

**WELFARE EFFECTS OF
BUENOS AIRES' WATER
AND SEWERAGE
SERVICES PRIVATIZATION**

Manuel Angel Abdala

*Expectativa -Economic Consultants-
Ituzaingó 1291 - 5000 - Córdoba, Argentina
Tel y fax: (51) 69-7751 -68-4735
Expenet@starnet.net.ar*

and

Universidad de San Andrés.

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Abstract

This study measures welfare flows accruing to those affected by the Buenos Aires' water and sewerage services privatization. The methodology follows the quantitative cost-benefit analysis developed by Jones, Tandon and Vogelsang (1990) to evaluate divestitures of public enterprises, adapted for the first time to a case study on water. One salient aspect of this case is that increased investment and improved service was accompanied by lower tariffs, which brought about important welfare gains for consumers. Government came out as a loser, mainly due to a takeover of existing liabilities. Post-privatization regulatory changes may alter some of these results.

Resumen

Este estudio mide cambios en el bienestar de aquellos afectados por la privatización de agua y cloacas en Buenos Aires. Se utilizó la metodología de análisis costo/beneficio desarrollada por Jones, Tandon y Vogelsang (1990) para evaluar traspasos de empresas públicas, adaptada por primera vez al caso de aguas. Un aspecto saliente es que el aumento en inversión y en calidad de servicio llegó acompañado de tarifas menores, lo que produjo ganancias de bienestar importantes para consumidores. El gobierno aparece como perdedor, principalmente debido a la absorción de pasivos empresarios. Los cambios regulatorios post privatización podrían alterar algunos resultados.

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WELFARE EFFECTS OF BUENOS AIRES' WATER AND SEWERAGE SERVICES PRIVATIZATION¹

I. Introduction

Prior to reform, water and sewerage services provided by *Obras Sanitarias de la Nación* in Buenos Aires suffered from: lack of investment and inadequate maintenance, overstaffing, unresponsive customer service, high levels of unaccounted-for water (UFW), and low collection rates. Privatization brought about positive changes, resulting in rapid improvements in the performance of the company now called *Aguas Argentinas*. The investment constraint was lifted, the labor force halved, cost-savings policies put in place, and new collection devices implemented. As a consequence, water interruptions diminished (for the first time in 15 years there were no water summer shortages); UFW was reduced from an estimated 45% to 30% in three years, water pressure increased substantially, appropriate repair and maintenance was reassumed, and service coverage expanded more rapidly.

The most salient aspect of the *Aguas Argentinas* case is that increased investment and improved service was accompanied by lower tariffs. In most privatization cases selling a public monopoly involves an economic trade-off between the efficiency gains from cost reductions and the potential allocative efficiency losses from increased exercise of market power. In fact, despite lower tariffs, *Aguas Argentinas* managed to increase profits, measured by both private and public conventions.

Aguas Argentinas' concession was part of an impressive privatization program initiated by the Menem administration in 1989. In five years (1990-1994), cumulative sales proceeds from key sectors like telecommunications, airlines, petrochemicals, gas, electricity, oil, shipping, defense, steel, water and sewerage, and ports represented 9% of average annual GDP for this period.

This study aims to measure welfare flows accruing to each of the groups affected by *Aguas Argentinas* privatization. The methodology follows the quantitative cost-benefit analysis developed by Jones, Tandon and Vogelsang (1990) for evaluating divestitures of public sector enterprises. The approach consists of comparing enterprise performance after privatization with what the expected performance would have been had *Aguas Argentinas* not been privatized. The analysis, which is restricted to a partial equilibrium framework, compares the surpluses accruing to each of the groups affected by reform with the surpluses that could have been expected if the reform had not occurred.

The paper contains the following sections: section II introduces the reader with the background of the current pricing regime. Section III shows and analyzes the performance of the firm under observed periods of public and private operation. In section IV, we draw the counterfactual scenario under the assumption of continued public operation. Section V discusses the assumptions used for projecting industry flows in the future, and section VI presents the final results on welfare effects, differentiated by each of the groups affected by privatization (consumers, buyers, government, employees, and oligopolistic competitors). Finally, in section VII some conclusions are presented.

II. Pricing Regime

Price regulation is a hybrid price-cap and cost-plus system. Water and sewerage prices are individually capped, but whenever a composite cost index exceeds a 7% variation, the company can file for a price change related to the magnitude of the cost variation. This is called an *extraordinary price revision due to*

cost changes². Therefore, the company has price-cap type of incentives only for annual cost variations lower than 7%³.

As well as the cost-plus adjustments, water and sewerage tariffs can be reassessed every five years (the first review is due in May 1998), based on the following five-year updated investment plan. This mechanism is known as an *ordinary price revision*. In the second five-year plan, Aguas Argentinas may request an ordinary revision only if it results in a tariff decrease.

Finally, *extraordinary revisions for other reasons* can be requested by either the company or ETOSS in the following cases:

- a. Regulatory request for variations in product quality standards.
- b. Regulatory request for variations in the works to be performed.
- c. Amendment of the Convertibility Law, creation of new taxes, or modification or elimination of existing taxes affecting the company.
- d. Creation of new environmental laws or changes in existing ones that directly affect the enterprise supply of services.

Aguas Argentinas inherited a strongly redistributive tariff structure system. The government chose to keep this structure because it was thought that the introduction of changes before privatization would introduce revenue uncertainty for the investor. Cross subsidies among customers are common, and they are linked to the size, location, and type of property⁴. Tariff subsidies (other than the cross-type ones inherited in the initial tariff structure) have to be explicit and the financing is the responsibility of the government⁵. For example, currently a discount is provided to all retired households.

The existing pricing structure for the main regulated services provided by Aguas Argentinas differentiates between customers with and without water meters. In 1995, metered customers represented around 8% of total water clients (75% of which are residential).

For metered customers usage tariffs are three-part, having a fixed component, an allotment of water consumption (bimonthly use of 30 m³) at zero marginal price, and a variable charge depending on consumption exceeding the 30 m³ threshold. Unmetered customers, on the other hand, pay a flat rate. Both the unmetered tariff and the fixed component of metered tariffs are multiplied by a so called *K* factor, which is the multiplier used as the awarding criteria for the competitive bidding process at the time of privatization. The bid with the lowest *K* won the concession contract (see point II.4). The *K* factor also serves as the parameter that adjusts tariffs whenever there are ordinary or extraordinary tariff revisions.

II.4.1. Unmetered Service

For a customer without a water meter the bimonthly price is defined by the following formula:

$$\text{Max} \{ \text{BBT}_{ij} = \text{GT}_{ij} * K * Z * (\text{SC} * E + \text{ST}/10), \text{BBT}_{ij}^{\text{min}} \} \quad (1) \text{ for } i = \text{type of service,} \\ j = \text{customer category}$$

where BBT is the basic bimonthly tariff; GT is the general tariff that can vary according to type of service (water or sewerage) and category of customer (residential, non-residential, and land property); *K* is a regulatory adjustment factor whose initial value was given by the winning bid at the time of privatization (*K*= 0.731); *Z* is a property location coefficient; SC is the total built area of the property measured in square meters; *E* is a coefficient that adjusts for type⁶ and age of property construction; and ST is the total property area.

There is also a regulated price floor on the bimonthly charge, named BBT^{min} that is currently set at \$ 4*K for residential water and sewerage services, and \$ 8*K for non-residential customers.

The BBT formula draws heavily on the location, size, age, and type of property, which determines a wide range of end prices faced by customers. The maximum tariff dispersion among customers who own a property of similar size (built and total area) yielded a ratio of 7:1 in 1996 and could reach a value of 9.5:1 by the end of the concession contract⁷.

II.4.2. Metered Service

For metered customers there is a three-part tariff, that consists of the following:

$$MT_{ij} = 0.5 * BBT_{ij} + P_i * K * (C - \tilde{A}) \quad (2) \text{ for } i = \text{type of service,} \\ j = \text{customer category}$$

where MT stands for metered tariff; P is a regulated price set at \$ 0.33 per m³ for water only and \$ 0.66 per m³ for customers that have both water and sewerage services; C is water consumption, and \tilde{A} represents the consumption for the first 30 m³ of the bimonthly water allowance. The first term of the MT formula is a fixed component, equivalent to half of what the unmetered bill for the same customer would be like, and is actually financing the consumption of the initial 30 m³.

II.4.3. Incentives of the Current Regime

We explored some of the incentives for the company and for the customers regarding the optional metering connection policy set by the concession contract. If the installation is enforced by Aguas Argentinas, then meter connection cost has to be afforded by the company. Conversely, if a customer is the one requesting the installation, the one-time connection cost has to be paid by the customer. Graph 1 compares the tariff level faced by metered and unmetered customers who hold a property of the same size⁸, but with the maximum possible dispersion for location, type and date of construction. Customer A, who lives in a well-located, modern, and luxurious unit can then be considered as a “high-income” customer; whereas customer B, who lives in an inexpensive and old unit can be classified as a “low-income” customer. Neither the company nor unmetered customers know the current level of their individual water consumption. By looking at Graph 1 and paying attention to the intersections (points A and B) of the unmetered and metered lines for each customer, three important implications arise:

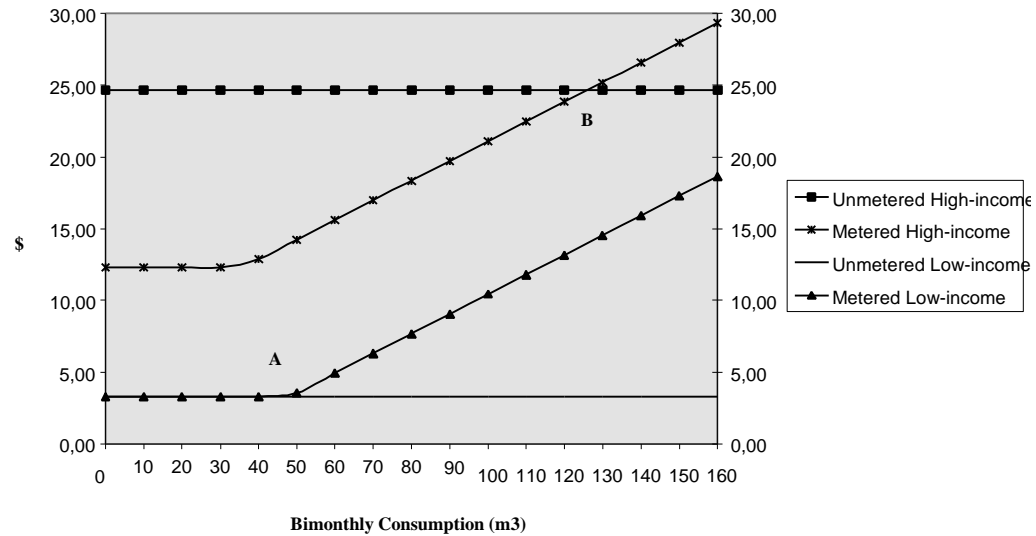
i. For a same level of water consumption that lies between the indifference points A and B, a “high-income” customer will be able to save money by switching to the metered tariff scheme. A “low-income” customer, on the other hand, may face an increase in his bill by virtue of the company having him switched to the metered regime.

ii. For any given level of water consumption, Aguas Argentinas has more incentive to install new meters in “low-income” households than in “high-income” customers⁹.

iii. The maximum tariff dispersion among customers who own a property of similar size (built and total area) decreases from 7:1 to 3.7:1.

The existing regime is currently providing a window towards a less disperse tariff regime (implication iii), but at the same time, there seems to be some dubious signals with respect to equity considerations and water conservation incentives (implications i. and ii.). There is also a problem of information asymmetries, since we would expect the average consumer to have less knowledge about its indifference curve than the company.

Graph 1
Aguas Argentinas: Metered vs. Unmetered Water Tariffs
(1995)



Source: Author's calculations.

The current regime does not provide an incentive for the company to extend metering to all customers. This leads to the broader question of water demand management, and whether the company and the consumers have incentives to exercise a rational use of water. Once a partial amount of customers get meters (assuming information asymmetries, only the portion that is convenient for Aguas Argentinas), and UFW is reduced to the standard technical levels, why would Aguas Argentinas want to induce any further reduction on water consumption? In this context, the government could have introduced, for instance, a water fee related to the amount of water produced or wasted as a bidding condition for privatization.

Competition for the concession contract could have also been done through the lowest bid in access charges, so as to address the problem of extended coverage to poorer areas.

Although all these incentive problems were known before privatization, the government of Argentina faced a trade off between keeping OSN's tariff structure (which was known with relatively certainty by investors) and attempting to reform, which meant imposing an additional risk on investors' perception about future revenues. The decision was also relevant in terms of the pace for privatization, since a deep change in the tariff structure prior to the sale might have required a fair amount of time. The government of Argentina is currently studying a reassessment of the current pricing regime.

III. The Actual Story

In this section we evaluate the actual performance of the firm during a six-year period before privatization (1987-1992) and during a three-year period of private operation (1993-1995). We begin with a description on the enterprise revenue breakdown, so as to best understand how we arrive to all calculations on the demand

side. It follows an analysis on various performance indicators related to profits, profitability, and productivity.

III.1. Enterprise Revenue Breakdown

The objective of this section is to identify prices, quantities, revenue, demand elasticities, excess demand, and rationing for the different services provided by the company, in order to calculate price and quantity indices for an aggregate output measure, and to compute changes in consumer surplus. The output measure is the basis for the calculation of performance indicators such as profits and profitability at constant prices and total factor productivity. A revenue breakdown of ten services was used in our analysis, the choice being driven by an economic definition of each relevant market, subject to data availability. The classification of services is:

1. Water Access Charges
2. Residential Unmetered Water Use
3. Non-Residential Unmetered Water Use
4. Residential Metered Water Use
5. Non-Residential Metered Water Use
6. Metering Installation Fees
7. Sewage Access Charges
8. Residential Sewage Collection
9. Non-Residential Sewage Collection
10. Miscellaneous

III.1.1. Water and Sewage Access

To have the service connected, customers have to pay access charges both for sewerage and water. Prices during the private period are regulated, and taken as the average price for the different customer categories. Access prices vary across customers according to the characteristics of the works needed to facilitate the connection. Access quantities were derived as a residual (revenue/average price). As for excess demand, rationing rules, and elasticities, we did not have to account for them directly, because the measure of consumer surplus has been aggregated with that of the demand for use. The rationale for doing this and its consequences is explained below.

To estimate changes in consumer surplus, we adopted a general approach that considers that the access decision taken by an individual is contingent to the consumer value derived from the demand for use (the consumption decision). A potential customer compares the net present value of his consumer surplus from usage, with the sum of the access fee, the net present value of rental charges (fixed component of the tariff), and the net present value of lost consumer surplus from his current alternative demand. If the net benefits from connecting to the service are positive, the potential customer decides to access. Therefore, to take into account the interdependence between the access and usage markets, the consumer surplus derived from the usage market is measured, net of the total amount paid for access charges¹⁰. This will be our target measure for aggregate consumer surplus from usage and access.

In Buenos Aires, the access decision is influenced by two other factors that are exogenous to the consumer: First, the investment constraint that restricts the supply of municipal services, and second, the institutional requirement imposed by the Water Law of 1949, which made connection mandatory to all customers where OSN was able to provide service. The access decision therefore is supply-constrained and is not optional for the customer¹¹.

Let us address the issue of the supply constraint first. We consider that all customers (those who had access to municipal services and those who do not), discriminated by service category, have similar demand curves¹². Within the demand

for municipal services in the usage market, customers who do not have access are therefore treated as rationed customers. We adopted this approach to account for coverage differentials (private vs. public) under the same demand curve. This approach does not take into account the fact that rationed customers are getting some consumer surplus from alternative services, which ought to be deducted from the overall consumer surplus calculation for each service category. Neither does it take in consideration that there are differentials in quality between municipal and alternative services. Consumer surplus from alternative services is therefore neglected in our study¹³. However, since the methodology looks for the differences between private and public; and since prices of alternative services remain the same in both scenarios, the changes in consumer surplus from alternative services will arise only from differences in quantities (the number of customers that are rationed out from the municipal service). Being coverage higher under private, by not deducting the consumer surplus from alternative services we could be slightly overestimating the change in overall consumer surplus. Nonetheless, given the magnitude of the positive results found for consumers, this will not alter the direction of final results.

Regarding mandatory access, we need to assess the water and sewerage alternatives available to those customers who are not connected to the municipal service. Alternative services for residential municipal water are mainly derived from pumped wells. The fixed installation cost of this alternative form of supply is estimated at US\$ 2,500 for a life-span of 5 to 10 years, whereas annual electricity costs are approximately US\$ 30.¹⁴ For sewerage services, the alternative form of supply is the construction of cesspools and septic tanks. Cesspools construction costs are estimated at US\$ 1,006, for a maximum life-span estimated at 20 years. Maintenance costs (evacuation) are calculated at US\$ 159 per year. Table 1 compares these values with residential municipal demand access and usage charges. Customers benefit from switching to the municipal service (in spite of the fact that this decision may not be voluntary), since quality-adjusted usage charges are considered to be lower in the municipal service¹⁵. The only exception to this inferred result may be given by low-income customers. In the case of very poor households, the costs of provision of the alternative services for water and sewerage is substantially lower than those reported in Table 1. Should the poor be forced to pay the municipal access charges, there would probably be a decrease in their surplus (at market prices)¹⁶. However, since the poor can not afford access to municipal demand, the decrease in surplus will never materialize¹⁷. Thus, once again, we expect that this issue will not affect the sign of our results in consumer surplus.

III.1.2. Water Services

Water services are differentiated into four categories: metered vs. unmetered customers and residential vs. non-residential. Metered water use refers to customers who have a meter and whose marginal price for consumption is higher than zero. Unmetered water use, on the other hand, refers to households who do not have a meter, pay a flat fee that is not related to the volume of water used, and therefore their marginal cost for water consumption is zero.

Residential water use comprises activities such as drinking, washing and cooking, bathing, toilet laundry, garden watering, and other personal uses. Non-residential water use consists of water uses in commercial and transportation sectors and to a lesser extent in light industrial activities like assembly operations, construction and demolition¹⁸. In the four categories, quantities and revenues are derived from the number of customers reported by the firm and prices are derived as a residual (average bill). Ideally, for metered customers the quantity variable should be the volume of water consumed, but this information was not available in any consistent manner during the actual period¹⁹.

Table 1:
Residential Demand: Comparative Access and Usage Charges
(in 1995 US dollars, without taxes)

	Municipal Service		Alternative Service
	<i>Min</i>	<i>Max</i>	
Water			
Connection Fee	208	297	-
Infrastructure Charge	43 ^a	340 ^a	-
Total Access Charges	251	637	2,500
<i>Annual Avg. Usage Cost</i>	61 ^b		30 ^c
Sewerage			
Connection Fee	284	319	-
Infrastructure Charge	572	572	-
Total Access Charges	856	891	1,006
<i>Annual Avg. Usage Cost</i>	48 ^b		159 ^c
TOTAL W&S			
<i>Access</i>	1,107	1,528	3,506
<i>Annual Usage</i>	109		189

Source: Own calculations based on Aguas Argentinas reports, ETOSS Resolution 83/93, and Revista Vivienda.

Notes: ^a The infrastructure charge for water (ICW) varies with total property area (ST), and with a common factor (R) that takes into account the type of soil under which the installation of the pipe must be placed and the level of repair to be done in streets and sidewalks. The formula is $ICW = ST * R * \$0.825/m^2$. We have used an average soil and repair coefficient of 1.03, and land areas of 50 m² and 400 m² for the minimum and maximum values respectively.

^b Annual average usage costs for municipal service is the annual bill paid for residential water and sewerage services, calculated as the division between revenue and the number of residential customers for water and sewerage respectively.

^c Annual average usage costs for alternative services is estimated by the electricity costs of running a pumping equipment in the case of water (based on an average bimonthly water consumption of 100 m³), and by the annual costs of cesspool evacuation in the case of sewerage.

Price elasticities in our study would then have to refer to the average bill paid by customers²⁰. To our knowledge, studies on demand elasticities for water and sewerage in Buenos Aires do not exist or have not been published. As a proxy for elasticities, we will resort to findings from international studies. Bhattia et al. (1995) summarized some evidence that shows price elasticities of residential demand in the range of -0.2 to -0.6. Gibbons (1986) report studies which gave a wider variance, though some of these studies include the non-residential category, as well as differentiation for summer and winter demand. We have adopted a price elasticity for residential water use of -0.35. In choosing this figure, we have put more weight on the cases that had characteristics (i.e., weather, size, and income level) that are closer to those prevailing in Buenos Aires²¹. The value used for price elasticities for non-residential water service is -0.85, an average of those cited in Bhattia et. al. (1995) for the US.²² We will conduct sensitivity analysis on elasticities, to test how welfare results may change with variations to our value choice of these parameters.

Excess demand on water usage applies for outputs 2-5 and is based on the information available on service coverage and also on water continuity. The percentage of people not served is translated into excess demand figures for water usage. At the beginning of the concession, rationing of municipal service due to lack of access accounted to 30% of total population. Since consumers who are denied

access to municipal services are those living in the suburbs (low income), we will presumably argue that these customers have the lowest demand. Rationing by willingness to pay (an extreme form of non-price rationing) is therefore used as an approximation in the calculations for consumer surplus.

Additionally, the number of hours of interrupted service are quantified and then translated into rationed quantity of demand. Since in Buenos Aires the use of water tanks is widespread, the number of hours of effective interruption is much lower than the one reported by the company. It is estimated that a tank of 500 liter capacity can stand a service interruption supplying basic water needs for a four-member family, for as much as 24 hours. For consumers, therefore, the duration of the effective interruption is what matters, more than the reported number of total hours of interrupted service. A complete histogram on interrupted hours was not available for this study, and as a proxy for rationed demand we have counted half of the hours reported, taking into account customers' self-store water ability. Rationing due to water interruptions reached values of 2.73%, 0.51% and 0.73% of demand for the 1993-1995 period respectively. Random rationing was assumed in this case.

III.1.3. Meter Installation

Metering installation charges are collected from customers that request the installation of a meter. The meter installation charge is interdependent with metered water use, similarly to the relation between water access charges and water use. Hence, for consumer surplus calculations, the revenue collected through meter installation charges is deducted from the consumer surplus derived from residential and non-residential metered demand.

III.1.4. Sewerage Services

Measuring the output of a sewerage service (collection system, sewage treatment, sludge treatment and disposal) is complex because it is usually estimated from the volume of water delivered. There are several water drains (water pipe leaks, pluvial drainage system, etc.) into the sewerage system that may distort this measure.

Instead of looking at a volume measure of sewage, we will consider as quantity the number of customers currently using the collection system. Sewage users pay an average price that is a function of BBT for those customers with unmetered water service or with access to sewerage services only. For sewerage customers with metered water, the sewage average price is a function of BBT and of his level of water consumption (see equation 2).

Elasticities for sewage only services are hard to find since this service is customarily provided as a complement to water supply. We use the same elasticities used for water demand, and run the corresponding sensitivity results.

As in the case of water, sewage excess demand figures are related to access to municipal sewerage services. As of 1993, 42% of total population lacked sewerage access. In addition, sewage excess demand due to sewer flooding could be accounted for, but lack of proper information impeded us to quantify it²³.

III.1.5. Miscellaneous Services

Miscellaneous services include a mix of water and sewerage services like effluent treatment, water block sales, sewage discharges, lab analysis, and other revenues. For an aggregated price we used SIGEP's OSN overall price index until 1991 and a Consumer Price Index for water, housing and sanitation for the rest of the period; and quantity was obtained as a residual. Since the most important components of this category are related to non-residential use (water block sales, water for construction uses, water for ships, trade effluent treatment, etc.) we used the

elasticity value for non-residential demand. Once again, sensitivity analysis is run for this elasticity parameter.

For this service category we adopted an initial percentage of 50% for the domestic market share, which reflects the portion of industrial customers currently served by alternative providers in trade effluent treatment.

III.2. Profits and Profitability

The bottom line of the company's reported profit and loss (P&L) statement, or retained earnings plus dividends - which we refer to as 'private' profits-, had mixed results throughout the actual period. Private profits were negative in the years 1988, 1992, and 1993, and slightly positive in the rest (see Graph 2). However, at least two ingredients distort the positive private profits in the 1990-91 sub-period: inflation accounting adjustments and revenue generated from non-operating sources. Should these two items be excluded, then private operating results would have been negative.²⁴ This leaves 1987 and 1989 as the only years under public operation with positive profits, privately measured. The negative 'private' profits in the last year of public performance is not surprising, and is similar to the experience of other privatized public services in Argentina: a near-collapse operating situation, with no "prop up" prior to privatization, ending in an expeditious transfer to private hands.

In the first year of private operation, negative private profits persisted, though an important turnabout was achieved in the following two years. A similar pattern was observed in the two main electricity distribution companies, Edenor and Edesur, privatized in late 1992.

The 'public' profit indicator, where the enterprise return to all society's resources is measured, looks different²⁵. At current prices, 'public' profits are negative for three years of public operation (1988-1990), whereas at constant prices 'public' profits are negative only in 1988 (see Graph 2). The negative results of 1989-90 at current prices are explained by the high level of the opportunity cost of working capital. This last component of public profits was high due to the hyper-inflation peaks experienced by Argentina in these two years, which skyrocketed average short-term deposit rates to annual values of 1,061% and 504% respectively.

Measured by either private or public profits, 1988 was a year of a bad performance - value added²⁶ at constant prices was negative! This is due to unusually high provisions and financial expenses within the intermediate inputs category.

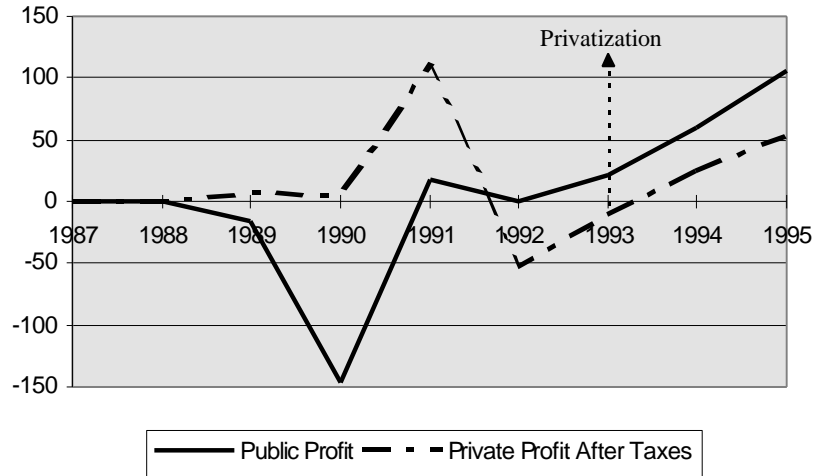
Profitability (profits over fixed assets), in turn, showed a low value in the years when profits were positive. Private profitability, measured as private profits over total assets at book value, reached a peak of only 6.5% in 1987. Since fixed assets were given under concession and Aguas Argentinas does not incorporate them in its balance sheets, an alternative measure on private profitability that is relevant after privatization is the return on equity (private profits over equity). This measure of profitability does not differ significantly from profitability over total assets during the public period, but is higher in the last two years of private operation (20% in 1994 and 28.8% in 1995).

Nominal public profitability (public profits over fixed assets at current cost), in turn, was never higher than 5% in the public period (4.4% in 1987), and reached a maximum of 5.1% in the last year of actual private operation. Real public profitability during public operation showed a better performance in the two years under hyperinflation (1989-90), though the 1995 figure is more than twice as large as the highest observed during the public period (12.2% in 1995 vs. 5.1% in 1990).

In sum, although OSN was not the typical money-loser SOE, profits, when positive, were very modest and often driven by returns from non-operating activities.

Privatization brought about a clear positive change in profits and profitability trends, though this change in the trend came with a one-year lag.

Graph 2
Aguas Argentinas: Public and Private Profits at current prices
1987-1995
(US\$ millions)



Source: Author's calculations based on OSN and Aguas Argentinas data.

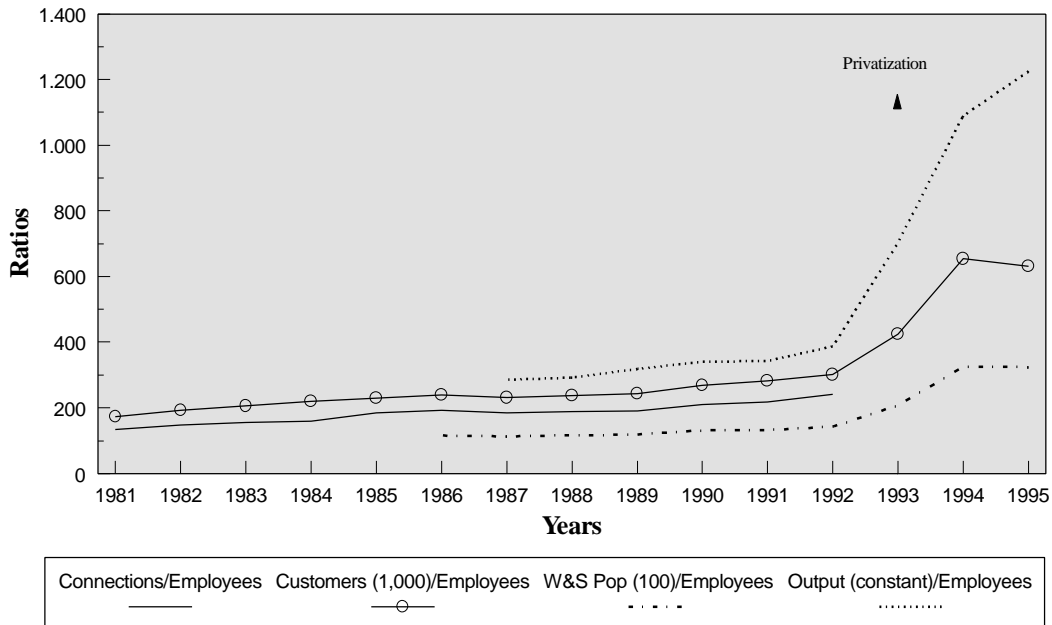
III.3. Productivity

Partial productivity indicators for labor indicate a steady improvement under both public and private operation. Nonetheless, the slope of the labor productivity curve is steeper during the first two years of private operation, where we observe large gains of 82% (1993) and 55% (1994). In the third year of private operation the gains in labor productivity were less dramatic (12.4%), but still almost twice the average gain observed under public operation (6.4% for the 1987-1992 period). The labor productivity gains of the first two years are heavily influenced by the massive voluntary retirement program, which resulted in a reduction of more than 50% of the number of employees transferred at privatization. Further productivity gains observed in 1995 are also the result of better management and the implementation of training programs²⁷.

Figures on the annual change of labor productivity can be compared with other measures of labor productivity. Graph 3 uses three alternative indicators for comparison: total W&S connections per employee, customers per employee, and W&S population coverage per employee. The comparison shows matching trends and a similar breaking point at the time of privatization. It is worth noticing, however, that when measured over total customers, labor productivity decreased slightly in 1995.

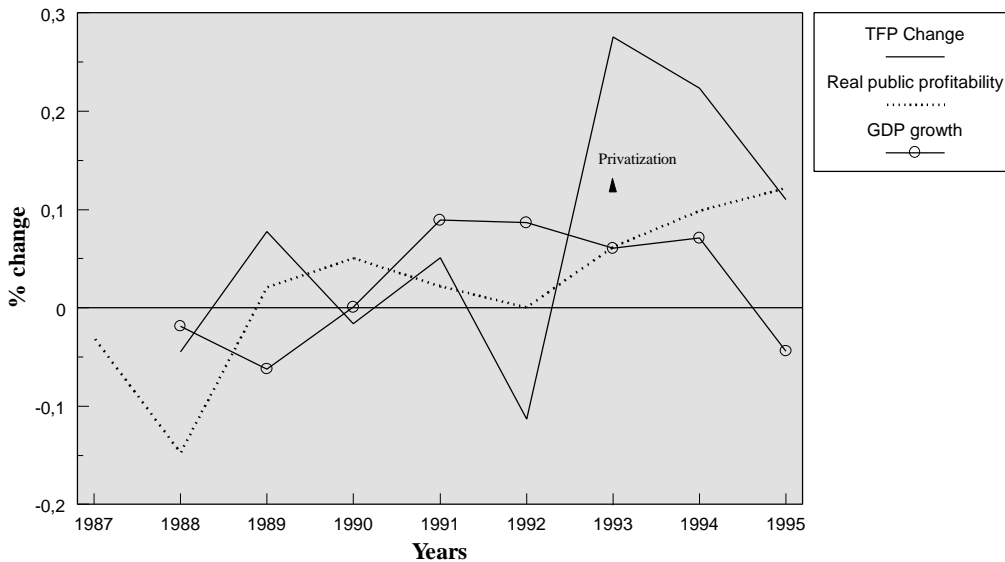
Partial productivity measured over intermediate inputs showed abrupt variations (-49% in 1988, +210% in 1989) under the first years of public operation, though a negative trend in the last two years of public (-33.8% in 1991, -12.3% in 1992). During private operation, productivity gains on intermediate inputs are important (24.8% in 1993, 16.7% in 1994, and 6.1% in 1995), especially in the first two years when the company reported an improvement in the use of chemical products for water treatment. After privatization, coverage was extended at similar water production levels as those observed under public operation (1.4 billions of m³ per year), because of the reduction in UFW, which dropped from 45% (1993) to nearly 30% (1995).

Graph 3
Agua Argentinas: Labor Productivity Indicators
1981-1995



Source: Author's calculations based on OSN and Agua Argentinas data.

Graph 4
Agua Argentinas: TFP, real Public Profitability, and GDP
1981-1995



Source: Author's calculation and Argentine Economics Ministry data .

The Total Factor Productivity (TFP) measure shows similar results to those observed in the intermediate inputs productivity indicator. Under public operation, 1988 looks again as a bad year (TFP went down 4.5%), and in 1989 the company recovered (7.7%). During 1991 TFP was also negative (-1.6%), contrasting with the

result found in real profitability, which was positive due to price effects on output. Under private operation the major TFP gain occurred in the first year (27.6%), although further improvements were observed in 1994/95. In spite of the slowdown on the pace of TFP gains under private operation, profitability kept on growing during this period. There is no correlation between GDP growth and TFP changes, and therefore we rule out the influence of external shocks attributable to the overall economy (see Graph 4).

III.4. Price Level and Structure

Prior to privatization the government adjusted the water tariff three times. In February 1991, a 25% increase was granted to compensate for the high inflation experienced in the first two months of that year. Later on, in April 1991, there was an additional 29% increase. A year later, residential consumers face a new rate increase through the addition of the value added tax (VAT) which at that time was 18%²⁸. An additional 8% tariff increase was granted before privatization. Consumer inflation, however was higher in the two years prior to privatization: 84% in 1991 and 17.5% in 1992.

At the time of privatization, the overall tariff rate was reduced by 26.9%, as a consequence of the competitive bid for the *K* factor.

After thirteen months of private operation, consumers faced the first tariff change. In mid 1994, ETOSS authorized a 13.5% increase in the *K* factor, that was partly attributed to the regulatory cost-plus clause (9.5%), and to an extraordinary revision explained by three factors:

- i. The Municipality of Buenos Aires requested an emergency plan for water and sewerage service coverage on some "shanty towns". This investment was estimated to be worth US\$ 9,800,000, of which US\$ 5,659,000 was to be effectively spent before 1996.
- ii. An advancement of regulatory targets on the original investment and coverage plan for the first five years. The works included upgrading the Belgrano water plant capacity by 300,000 m³/day and the extension of network distribution for 300,000 inhabitants, for a total estimated value of US\$ 80,440,000. As of the first quarter of 1996, nearly US\$ 24 million were already invested in the Belgrano plant. In works related to network distribution there were delays in the execution plan.
- iii. Lastly, there was an acceleration on the substitution program for nitrate-contaminated wells, whose value was estimated at \$31,845,000. As of March 1996, the company reported that almost 100 % of the estimated amount was already invested in this project, and that an additional US\$ 12 million was to be disbursed during the rest of 1996.

The *K* factor was not the only price adjustment in the 1994 tariff revision. Connection and infrastructure charges increased significantly, both for water and sewerage. The minimum water connection fee increased by 83.7%, whereas the one for sewerage increased by 42%. Infrastructure charges increased by 38.4% and 45.6% respectively.

In May 1995, access charges for water were modified. The minimum connection fee decreased by 16.1% and the maximum by 47.5%. The infrastructure charge for water was turned into a variable component depending mainly on total property area (see Table 1). On average, for a property size of 100 m², the water infrastructure charge decreased by 81%. In September 1995, there was a further reduction on the infrastructure charge (water and sewerage), this time a 14.59% decrease due to an extraordinary revision that passed through lower social security taxes. The 1994/95 changes in access charges implied that, in relative terms, water access was made less expensive than sewerage.

The relatively high level of access charges has already been denounced by Aguas Argentinas as a potential source of regulatory distress. A World Bank report

already warned that marginal customers may not be able to afford access fees. By adding indirect taxes to the access charges showed in Table 1, we found that the total access cost for both water and sewerage ranges between \$1,400 and \$1,600 for an average customer. Despite the latter reduction, these values are still higher than the above-poverty line income of \$ 1,224/cap/year²⁹. Getting the “right prices” in this case seems not to be beneficial for the company or for the consumer. Since the bulk of the upcoming expansion affects the urban poor, Aguas Argentinas fulfillment of service coverage targets may be impeded if it can not collect access bills. Low-income individuals will be blockaded from access to municipal service, even though they may be willing and able to pay for usage. The regulator is currently studying alternative solutions to the access affordability problem.

IV. The Counterfactual

What would have happened had OSN not been privatized? The general approach to build this counterfactual scenario is the following: observed changes are assumed exogenous, except for those that we deem to have been directly caused by privatization³⁰. Knowing that such action may involve a certain degree of non-objectivity, we rely on sensitivity analysis to establish robustness.

The crucial changes that we judged to be caused by Aguas Argentinas privatization are related to labor and intermediate inputs productivity, to the overall price level and structure, and to a lift on the investment constraint. Let us explore each of these changes.

IV.1. Investment Constraint and Output Growth

Capital expenditure levels in OSN were very low relative to the size of its assets (US\$ 1.6 billion) under the actual period. According to FIEL (1992), the average level of investment for 1981-1991 was only US\$ 34 million per year. For the 1987-1991 period, calculations reported by OSN Residual yield an even lower annual investment level (US\$ 11 million), and in our own estimates gross fixed capital formation at constant prices stands at an annual average of US\$ 33 million for the 1987-1992 period.

How do we derive counterfactual investment levels? We do not have any reason to assume that the trend in investment level would have changed under continued public ownership. On the contrary, during the Menem administration the government placed its central effort on privatization programs, and propping up investment in public enterprises which were not targeted for privatization was not in the administration’s agenda. Moreover, the adverse macroeconomic situation that began with the Mexican crisis of late 1994 prompted a cut on capital resources destined to ongoing public projects³¹. Therefore, we assume that if the company had not been privatized, the investment constraint would have not been removed and the pace of expansion would have been as low as the one observed during the actual period of public operation (about 1.5% per year for both water and sewerage, on average).

Combining the investment-constrained trend on service coverage with per capita investment costs for water and sewerage, we obtained the investment levels for the counterfactual period. We used COFAPYS’ (Federal Council for Potable Water and Sanitation) figures for unitary investment costs, estimated at US\$ 220 for water and US\$ 300 for sewerage³². We also assume that the counterfactual OSN would have not reduced UFW and would have not expanded metering. For other investment items we allocated 10% of the total capital expenditure on water and sewerage. Thus, the estimated investment level for the counterfactual period averages US\$ 50 million per year, which albeit exceeding the historic averages, is considered necessary to minimally maintain the existing network and plant infrastructure. This investment

level, in turn, would have allowed OSN to keep service coverage expansion at the 1.5% annual growth³³. In the private case, lifting the investment constraint allowed Aguas Argentinas to accelerate the pace of coverage growth and to improve product and service quality (namely water pressure, water continuity, and customer service). The counterfactual investment constraint would therefore have had a direct effect on the revenue side, since the pace at which the company would have increased its customer base is lower than that of the private. Collection rates would have also been lower, as the needed investment in information systems and improved organization would have not taken place.

Excess demand due to water interruptions would have also differed (being greater in the counterfactual) since lower investment levels translate into a poorer performance on water continuity. For water interruptions we have used the same water excess demand figures that prevailed at the year prior to privatization.

On the borrowing side, we have placed no restrictions on counterfactual indebtedness, since the initial debt/net worth ratio was relatively low. For the loan rate, we have used the average rate for long-term (greater than 90 days) dollar-denominated loans.

IV.2. Productivity

Changes in internal productivity were also caused by privatization. The labor retirement program would have been difficult to implement had the company not been privatized. Large public enterprises and administrative entities could not massively lay off workers in the absence of a credible reform. Financial support for severance payment would have not been available. Additionally, the number of labor training hours would have not risen as in the actual private case.

For the counterfactual labor productivity, we have used the historic productivity gains observed during the 1987-92 period, which averaged an annual rate of almost 6.5%, calculated over aggregate output. Notice that other labor productivity indicators showed similar trends (see Graph 3). This implies a declining number of workers from near 7,500 in 1993 to 6,750 in 1995. This reduction could have been achieved through natural attrition, without special layoff programs. Wages were kept constant at the pre-privatization level.

Changes in other labor rents may result from efficiency changes, labor compensation schemes, elimination of labor benefits (change in week working hours, extended vacations, social benefits, etc.) and other factors that may be specific to the case. Although with the new collective agreement some benefits were removed (i.e., increase in the number of week working hours which causes a decrease on welfare of employees), we can not count this change as a result of privatization because in other public enterprises that were not privatized there was a similar move towards the elimination of this type of labor rents³⁴.

On the intermediate inputs front, the average variable costs are assumed higher in the counterfactual scenario than in the private, since Aguas Argentinas achieved cost savings through the reduction of electricity prices due to its access as a "large consumer" into the wholesale electricity market, and through its improved purchase policy on chemical products. These two achievements would have been hard to materialize under public ownership, since public enterprises were precluded to sign electricity term contracts and barely optimized input purchases. Real prices of intermediate inputs and rentals are those observed right before privatization.

For the opportunity cost of working capital calculation we have used the same short-term deposit rates observed under the actual scenario, since we do not observe evidences of differential treatment for public enterprises in the domestic financial market.

IV.3. Price Effects

In the counterfactual scenario, we have kept pre-privatization prices, as the change prompted by the K factor ($K < 1$) was endogenous to privatization. Other public enterprises did not alter prices in the absence of privatization. Prices could have not been increased because of the Convertibility Law, which fixed the parity between the dollar and the peso, prohibiting indexation clauses³⁵. On the other hand, there is no reason to assume that OSN would have voluntarily reduced tariffs, since doing that would have automatically triggered the need for auxiliary Treasury funds to finance the operating deficit.

Would the structure of prices have differed? Recall that prices for each category of water and sewerage services are calculated as the ratio between revenue and the number of customers. Average prices would therefore differ between public counterfactual and private because of the following factors that are endogenous to privatization:

- i. The reallocation of customers from the residential to the non-residential category made by Aguas Argentinas, which allowed the company to regularize the situation of many non-residential clients that “under-reported” their category. Approximately 11% of residential customers were reclassified as non-residential and therefore charged a higher tariff.
- ii. The growing number of meters installed by the private company has the consequence of passing unmetered customers to the metered category, therefore altering the effective average price paid for both categories.
- iii. The update of the customer database done by Aguas Argentinas included the implementation of a geographical information system program which consisted of a photographic survey of all the area under concession, combined with physical in-site inspections. These inspections allowed the company to reassess the usage status of several properties that were reported as undeveloped land and had buildings standing on their sites, and to correct the size of almost 425,000 customers that had smaller declared built areas than their actual size.

Therefore, the counterfactual price structure is the same as under the pre-privatization period. In sum, our counterfactual scenario differs from the private actual period in four basic elements: investment expenditure, labor productivity, intermediate inputs productivity, and overall price level and structure.

V. The Projections

Although the contract extends for 30 years, we are projecting flows only until the year 2002 (10 years after privatization). This omits some “known” information regarding mandatory service coverage and investment growth projected beyond the year 2002. On the other hand, projecting prices and market conditions in the far future is difficult due to a higher degree of uncertainty, and the impact on welfare flows is usually small due to the effect of discounting. Nevertheless, at the end of the year 2002, to account for the value of the company beyond that date, we add the residual value of equity in the financial flows.

In projecting the private scenario we will consider the regulatory framework established in the concession contract. Besides this framework, private projections are based on information about the observed post-privatization enterprise performance, industry conditions, and exogenous parameters (i.e., GDP forecasted growth, interest rates, etc.). Public projections, in turn, are constructed from the same guidelines used in the counterfactual analysis.

Projections are expressed in constant currency, thus, for discounting we use a real rate of interest, which throughout the whole period was estimated at 12%. This figure is based on the stripped yield of Argentine Brady Bonds (15.5%)³⁶, and a

projected annual inflation rate of 3.5%. Sensitivity analysis will be conducted over the value of the discount rate.

V.1. Investment, Borrowing, and Output Growth

Regulatory targets set forth in the concession contract and its ensuing modifications determine the rate at which output could grow in the private case. Successfully fulfilling service coverage targets, however, requires high investment and demands external sources of funds. If Aguas Argentinas would not face borrowing constraints, projecting output growth (and investment levels) would be simple: in a conservative and safe scenario, the enterprise complies with the contract.

Unfortunately, the private projection story gets more complicated when there are binding borrowing constraints. If we follow the investment level declared by the company, which estimated an outflow of more than US\$ 1 billion for the first five-year plan and about US\$ 800 for the following five years, introduce no changes in the pricing regime, and assume that all profits are retained as internal sources of funds (i.e. no dividends are paid out), the required borrowing will exceed the limits imposed by the IFC loan conditions. Namely, the debt/net worth ratio will surpass the 1.9 target set for 1998 onwards.

Therefore, we estimate an alternative scenario that takes into account the IFC loan restrictions. This scenario, however, implies that Aguas Argentinas will fail to meet service coverage requirements in the 1996-1998 period due to lack of funds. Service coverage ratios eventually converge to the regulatory targets, but more slowly. For this scenario, using the highest possible level of borrowing allowed and per capita investment costs, we derive the implicit service coverage ratios. The unitary investment costs are the same as those applied in the counterfactual case, (per capital investment was US\$ 220 for water, and US\$ 300 for sewerage, and there is an allocation of 10% of total investment for other works).

There are no substantial differences between the two scenarios with respect to total welfare. However, the allocation of surplus between consumers and producers is different. The slower growth in coverage in the IFC-constrained scenario is compensated by a decreased borrowing requirement that improves the financial position of shareholders. The implied dividend pay-out ratio is zero for both scenarios until the year 1999. Any distribution of dividends before this date would translate into a lower growth on service coverage, because of the ceiling on indebtedness.

In selecting a scenario, there is an implicit trade off between complying with IFC loan restrictions or respecting service coverage targets set by the concession contract. We think that the IFC conditions will be stronger, especially since regulatory targets will eventually be met at the end of the second-year plan. For our base case, therefore, we choose the IFC-constrained scenario for private projections³⁷.

In projecting output, we allow growth to differ across categories (i.e., metered vs. unmetered). The growth rate of water metered customers is higher than that of unmetered as some of the latter will be turned into the metered category. This differential is expected to continue until the end of the projection period. Within the water and sewerage categories, the non-residential is projected to grow at a slightly higher rate than residential, due to the category reallocation program.

In the public projections, demand growth is induced by the investment constraint, as in the counterfactual case. Service coverage is expected to grow at its historic average growth (1.5% per year, on both water and sewerage).

V.2. Prices

Projected prices are assumed to remain constant both in the public and private scenarios. In the private case, the price level would not be altered as we assume that the domestic inflation conditions will determine that the 7%-cost-plus clause will not be

triggered. We also rule out other changes in the K factor related to any of the special provisions made for in the concession contract³⁸.

In the public case, no upward price changes could be expected from a SOE under the Convertibility law, and there are no reasons to expect downward movements either. The same assumptions used in the counterfactual back the public projection here.

With respect to the price structure, although the pricing regime is currently under review, attempting to forecast any rebalancing of water and sewerage prices would be pure guess work. For the generation of quasi-rents, projecting stable prices is equivalent to a price rebalancing exercise that is neutral with respect to average revenue. If the regulatory review introduces balanced changes in the price structure, we would be missing the potential effects on consumer surplus.

The structure of projected public prices is also assumed to remain unaltered. The differentials in the price level and structure between private and public will therefore be the same as those reported under the counterfactual.

V.3. Cost Side

Ideally, detailed cost information would allow us to estimate profits in each market. However, since the information needed to do this is not available (in fact, enterprises themselves are often unable to separate costs for different products), we treat the entire cost structure as a single activity, though differentiating among its main components: labor, intermediate inputs, rentals, and opportunity cost of working capital.

Aguas Argentinas labor productivity improved very quickly in the first two years after privatization. The work force was reduced by more than half in the first eight months of private operation. Labor productivity gains slowed down in the third year (around 12%), and the number of employees started to grow in September 1994³⁹. Therefore, for the projection period, we do not expect labor productivity gains to grow as fast they have been under actual private operation⁴⁰. We therefore forecast labor productivity improvements of 6.5% per year, in line with the historic changes observed in OSN (see also section on sensitivity analysis). We also assume that the severance payment compensates employees disutility laid off through the voluntary retirement programs.

For public projections, we maintained the historic productivity gains used for the counterfactual (6.5% per year), which is a sustainable figure over time, given the excessive number of employees observed under state-owned operation.

No productivity differentials were projected in the case of intermediate inputs, rentals, and the opportunity cost for working capital.

The deposit and the loan rate are assumed equal for public and private. The deposit rate is equal to 8% throughout the projection period, whereas the loan rate has been equated to the rate obtained by Aguas Argentinas on its latest lending arrangements (Libor plus 3.5% \cong 9.5%). We assume that OSN could have borrowed at the same rate, since there is no evidence on loan rate differentials between private and public enterprises.

VI. Welfare Impact

The change in welfare can be measured as the sum of four items: the change in consumer surplus; the change in enterprise profits (distributed to different types of shareholders, that is, foreign and domestic buyers, government, employees, etc.); the change in the rent of providers of inputs (which includes basically labor and intermediate goods); and the change in competitors' profits.

As a result of privatization the gain in worldwide welfare is estimated at US\$ 1,517 million, which is the total sum of flows accruing to each of the groups primarily

affected by the transaction. By deducting the flows that accrue to foreigners, we obtain a measure on the change in net welfare (domestic), which is worth US\$ 1,306 million. More than 80% of the total gains accrue to consumers, whereas the rest is distributed among employees and buyers (foreign and domestic). Competitors and government, in turn, appear as minor losers. Sensitivity tests, as it will be seen below, show that results are robust for all groups, with the sole exception of the government, which could easily reverse its sign if output prices for the privatized firm are higher (which translates into increased tax revenues).

VI.1. Winners and Losers

To measure the relative magnitude of welfare results -as used in Galal et. al (1994)- we look at the annual component of the perpetuity equivalent to the welfare change, expressed as a percentage of annual sales in the last pre-privatization year (1992)⁴¹. The results are as follows:

**Table 2:
Aguas Argentinas: Winners and Losers from Privatization**

<i>Domestic</i>	<i>Foreign Buyers</i>	<i>World Net Welfare Change</i>
<i>Government + Buyers + Workers + Consumers + Others = DW</i>		
-5.2% + 5.0% + 1.3% + 43.0% + -0.1% = 44.0%	+ 7.1%	= 51.1%

Source: Author's calculations.

VI.1.1. Buyers

The consortium that was awarded the concession contract comes out as a winner in the welfare results. Positive quasi-rents accrue to this group after the year 1994. The net impact on buyers is distributed between foreign groups, who gain US\$ 212 million, and domestic firms, who are better off by US\$ 147 million.

VI.1.2. Government

The government experienced mixed results as a consequence of privatization. As a recipient of taxes, the government is clearly better off. Increased tax collection comes from two sources: value added taxes and corporate taxes. The total differential from net taxes is worth US\$ 186 million.

As a shareholder, it receives quasi-rents both under the private and public operation. Under private, the government is treated as the owner of the syndicated Class B shares (10% of total shares) during the first five years after privatization⁴². During that initial period, net quasi-rents are almost zero due to the operating loss of 1993, and to the financial burden from the investment requirements. Under public operation the foregone quasi-rents are worth US\$ 69 million.

The privatization transaction did not provide the government with cash proceeds, but made government incur in a transaction cost estimated at US\$ 4 million for consulting fees. Government costs also include US\$ 76 million as the net present value of the costs of providing regulation (we assume that the entire revenue from regulatory fee collection is spent on ETOSS' budget). This cost is fully compensated through the levy of the regulatory tax paid by end consumers.

Financial restructuring for privatization required the government to take over existing OSN debt, whose net present value of amortization and interest payments meant a loss of US\$ 192 million. Adding up all three effects, the government came out with a negative amount, worth US\$ 155 million.

VI.1.3. Employees

Workers' positive results come from their gains as future shareholders, when the syndicated shares from the PPP program become available. The PPP program for Aguas Argentinas establishes that 10% of the shares will be transferred after five years of private operation or when the corresponding dividends paid out to the government cover its book value (US\$ 12 million). For the private case, the US\$ 40 million of employee gains is the sum of accrued quasi-rents from 1998 onwards. Workers who remained employed under private operation increased their productivity, and were compensated for this. The average monthly wage increased 24% in 1993 and 14% in 1994.

It is difficult to measure the welfare change for workers who were laid off because of privatization. Severance payments were generous (around US\$ 20,000 per capita, on average) but for some individuals the compensation may not be enough to offset disutility. Information on whether laid off workers were employed in alternative jobs, on the magnitude of searching costs, and on unemployment duration, is not known. Thus, the most reasonable and conservative assumption is that, on average, severance payments compensated their disutility from being laid off.

VI.1.4. Consumers

The welfare effect on consumers is reported as an aggregate effect over all customers. On the whole, consumers are the big winners of Aguas Argentinas privatization, with an estimated welfare value worth US\$ 1,277 million.

Our estimate for change in consumer surplus, although the largest, is still rather conservative for three main reasons: First, had we extended our analysis beyond the year 2002, there would have been additional gains despite the effect of discounting. Second, positive changes in quality including better water quality, higher water pressure, and the decreased number of flooded sewage, are not quantified. Finally, we do not quantify gains due to externalities such as public health, aesthetic pollution, and recreational and fishing activities.

Increased coverage under the private scenario meant that more customers than under continued public operation had access to the municipal water and sewerage system. These customers will be better off, although in our methodology we did not take into account any lost consumer surplus from their former alternative services. This, however, does not alter the main results on consumer welfare.

VI.1.5. Competitors

In the "miscellaneous" output, the market was assumed to be oligopolistic in trade effluent treatment, with Aguas Argentinas behavior affecting competitors. The Aguas Argentinas market share leads to an increase in quasi-rents, but to a decrease in competitors quasi-rents (which are calculated using Aguas Argentinas' information on average variable costs and unitary investment requirements). The total loss for competitors is nevertheless small, reaching US\$ 3 million.

It is important to recall that alternative water and sewerage services like vendors and self-provision are not treated as "competitors". These services, albeit different from the service provided through municipal water and sewerage supply, are considered as rationed demand within the same market.

VI.2. Sensitivity Analysis

As we are projecting variables into the future, and making judgment about the value of certain parameters, sensitivity analysis to examine the validity of our main assumptions is extremely relevant.

We have calculated the responsiveness of the main distributional results to small variations for 20 critical parameters. The impact of small changes in parameters was tested over the following distributional welfare results: total surplus, government, and consumers. We also looked at the difference between the social value of the firm under private operation and its social value under public, its individual components, and the market value under private operation.

Our first finding was that all distributional results were robust, that is, there was no reversal of the direction of results. By focusing on those parameters that make results sensitive in terms of their magnitude, we found price elasticities, the rationing rule, the dividend payout policy, and private investment projections to be the most relevant.

Let us start with the rationing policy. In our base scenario rationing for access was assumed to be by willingness-to-pay. Indeed, if rationing were random, consumer gains are reduced by US\$ 223 million, and if rationing were done by the reverse order of willingness-to-pay, the reduction on consumer welfare would be worth US\$ 446 million. Despite its magnitude, however, we feel very confident with our judgment about the rationing scenario since consumers who are denied access to municipal services are those living in the suburbs. Rationed consumers are therefore low-income individuals, with the lowest willingness-to-pay.

Testing the unconstrained investment scenario for Aguas Argentinas, when there is no cap to leverage, we found that the return to shareholders diminished, as the investment pace accelerates during the 1996-98 period. The gains on consumers are too small to offset quasi-rents, and total welfare decreases by a relatively low amount (US\$ 18 million). We also tested unitary investment costs used in both private and public projections. For small variations around the selected values (\$ 220 for water and \$ 300 for sewerage) sensitivity on welfare results is very small. Alternatively, for a discrete change, we used the implicit unitary investment costs reported by Aguas Argentinas in its original investment program, The resulting values were \$ 271 for sewerage and \$ 471 for sewerage. If investment is so more expensive, welfare decreases by US\$ 25.8 million.

For price elasticities of demand, we have tested the effect of discrete changes, which only alters the results on consumer welfare, since output growth is determined independently of the slope of the demand curves. For the residential categories, we used ± 0.25 changes to test the base value of -0.35 , and results proved to be very sensitive. A higher elasticity for residential (-0.6) decreases welfare by US\$ 136 million, whereas the lower value (-0.10) increases consumer surplus by US\$ 820 million. The latter effect should not be surprising, as we approach the perfectly inelastic zone of the demand curve. Likewise, for the non-residential categories, we tested changes of ± 0.25 over the base value of -0.85 . For the higher value of -1.1 welfare decreases by US\$ 183 million, whereas for the lower value (-0.6), welfare increases by US\$ 335 million.

The tests on the private value of the firm show that the most sensitive parameters are output prices and the dividend pay-out ratio. Should private prices escalate by 1% per year in real terms, the value of the firm increases from US\$ 399 million to US\$ 447 million. Alternatively, if 100% of the dividends were paid out, the value could reach US\$ 427 million, though in this scenario any dividends paid out before the year 1999 would mean a violation to the IFC borrowing terms.

Other parameters such as the discount rate, tax rates, depreciation policy, GDP growth, disposal ratios, and labor efficiency multipliers show low sensitivity on welfare results.

VII. Conclusions

Under public operation, OSN suffered from the inefficiencies common to public enterprises: lack of investment and inadequate maintenance, overstaffing, unresponsive customer service, and high levels (45%) of unaccounted-for water (UFW). Buenos Aires faced an important disparity in service coverage, since high-income areas like the Federal District had full coverage whereas in the suburbs only 55% out of 5.6 million inhabitants had access to municipal water services and only 35% to sewage collection.

Privatization brought about changes in the internal efficiency of the firm, released the investment constraint faced by OSN, and introduced important changes in regulation.

Regarding the privatization procedures, especially the selection of the lowest K factor as the awarding criteria, we identify two critical issues:

a. The government lost the chance to implement a system that provides stronger incentives for water conservation practices. For instance, it could have introduced, as a bidding condition for privatization, a water fee related to the amount of water produced or wasted. It seems that this is viewed as a long-term problem and not considered to be a priority in a city with such an abundant water resource as the *Rio de la Plata*.

b. Most importantly, competition for the concession contract could have been done through the lowest bid in **access** charges so as to address the core problem of the sector: extended coverage to poorer areas. In our opinion, there was no need to transfer lower **usage** rates to existing customers, especially since rates had lost more than half of their real value during the inflationary period of 1990. By lowering access rates as opposed to usage, the government could have avoided the problem of access affordability for the poor, which is currently demanding a renegotiation of the original contract. In our view, increasing usage tariffs to the pre-privatization level is politically more costly today as compared to maintaining (or even increasing) usage tariffs back in 1993. Of course, such solution would have meant allowing some degree of cross subsidization between existing and new users. But in this case the consumer welfare gains from extended coverage would have been greater than the costs of cross-subsidization⁴³.

The government did not foresee the provision of any special mechanism for the political and financial viability to extend coverage for the urban poor. Unlike the example of Chile, there were no targeted subsidies explicitly included in government budgets, despite of the fact that it was clear that access charges could not be afforded by the poorest population. Direct subsidies were granted in other privatization transactions, like the suburban train and subway transportation. The only instrument that the regulator imposed to make access more affordable, was to mandatory request that Aguas Argentinas finance access charges within a two-year period at a fixed annual interest rate of 16%.

On the pricing regime, Aguas Argentinas inherited the pre-privatization redistributive tariff structure system. Cross subsidies among customers are common, and they are linked to the size, location, and type of property. However, two changes are worth mentioning:

a. The price level for all usage charges dropped by 27%, as a direct result of the bid, which awarded the concession to the consortium offering the lowest K parameter.

b. We found that the metering policy does not provide the company with the incentive to extend metering to all customers. Moreover, we found that for certain levels of water consumption a high-income customer could save money by switching to the metered scheme, whereas a "low-income" customer could suffer from an increase in their bill when the company switched them to the metered

regime. In this way, metering provides an opportunity towards a less dispersed tariff regime, but at the same time there seems to be dubious signals with respect to equity and water conservation incentives. This leads to the broader question of water demand management, and whether the company and the consumers have incentives to exercise a rational use of water. Once a partial amount of customers get meters (assuming information asymmetries, only the portion that is convenient to the company), and UFW is reduced to the standard technical levels, why would Aguas Argentinas be interested in inducing any further reduction on water consumption?

The internal efficiency of the firm changed substantially after privatization. The company cut its labor force by half in less than a year, and labor productivity kept growing after the massive layoffs of 1993. We found this to be a consequence of privatization. The same is true for the decrease in variable unitary costs for intermediate inputs, given mainly by lower prices in chemicals and electricity. UFW decreased from 45% to 30% in 1995, which also helps to explain the reduction on variable unitary costs. These savings on costs, combined with the increase in collection rates (from 80% to 96%) and other related measures in the revenue side, allowed Aguas Argentinas to increase profits, especially since the second year of private operation.

But probably the most remarkable change from privatization is the removal of the investment constraint. OSN's level of investment during the eighties was not sufficient to maintain existing assets! Aguas Argentinas annual average investment for the 1993-95 period totaled more than US\$ 150 million, nearly 5 times what OSN had invested per year in the last six years of public operation. But according to our estimates, the requirement of Aguas Argentinas' debt-holders may slightly slow down the service coverage expansion program projected by the company for the 1996-98 period.

The main focus of the study was to estimate welfare flows accruing to each of the groups affected by Aguas Argentinas privatization. The government came out as loser. What triggered this negative outcome was the financial restructuring for which it took over OSN liabilities. It is important to note that the size of the government loss is almost equivalent to the amount of fiscal debt taken over by government, which could have eventually been consolidated within the government accounts, even if privatization had not happened. On the other hand, increased taxation added a positive impact on government.

Employees, in turn, became beneficiaries of privatization as they freely receive ownership of 10% of Aguas Argentinas shares. The result applies to those who remained employed, and dividends could not be expected sooner than 1999. For those workers who entered into the voluntary retirement programs, we assume that the severance payments that they received were enough to compensate their disutility from being laid off.

Buyers came out with welfare gains, as they produce positive quasi-rents that they can legitimately appropriate due to its role in the generation of internal efficiency gains. Oligopolistic competitors in the trade effluent business, on the other hand, are minor losers as Aguas Argentinas involvement in this segment is expected to be higher than a counterfactual OSN.

Consumers, in turn, are the big winners. Existing customers received the largest share of this pie, as there were important cuts in the average price for usage. New users also benefited, as privatization reduced rationing by increasing access, by releasing the investment constraint. Consumers also received benefits through improved quality effects and externalities (public health) that we were unable to quantify. On the quality side, this is clearly the case of improved water pressure levels, waiting time for repairs, and customer service.

Since our projections did not include the potential regulatory changes that may emerge as a consequence of the current talks between the firm and the Argentine government, it will be interesting to follow up on the evolution of these changes, to evaluate and quantify any major potential turn that could affect enterprise behavior and thus welfare estimates.

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² The composite cost index is formed by several intermediate input and financial components, each one having a fixed weigh for a five-year period. In addition to the threshold of the 7% cost variation level, the change in costs must lead to a change in tariff prices of at least 3% for the mechanism to trigger this extraordinary price revision.

³ For the 1993-1995 period, annual CPI changes in Argentina were 7.4%, 3.9% and 1.6% respectively.

⁴ Metering in OSN was rare, standing at less than 2% of total customers at the time of divestiture.

⁵ With the exception of gratis services that were included as mandatory in the concession service, like the provision of water for fire stations, religious organizations, and foreign embassies and delegations.

⁶ Type of property refers to the quality of construction, which is classified in six categories, ranging from luxury to low-budget type.

⁷ Recall that the newest the building, the higher the E coefficient. This explains that the maximum dispersion in the year 2023 be greater than in 1996.

⁸ 100 m² of built property and 130 m² of total area in this numerical example.

⁹ This statement has the implicit assumption that the net present value of expected benefits from metering to the company are larger than the costs of metering installation.

¹⁰ The approach was used in other welfare case studies related to telecommunications and electricity. See Galal et. al. (1994), and Abdala, M.A. (1992).

¹¹ Notice that the market interdependence holds despite of the fact that the connection decision is mandatory rather than optional in the area of concession. Should a customer whose self-evaluation on access is negative be obliged to connect (i.e., if present value of consumer surplus from alternative use is greater than consumer surplus from the municipal demand, net of access fees), then we would have to compute a negative effect on his consumer surplus, since he receives no compensation for his disutility.

¹² A similar approach is used in Walker et. al (1996) for a case study in Honduras.

¹³ Notice that this is equivalent to adopt a strict partial equilibrium analysis, where second-order effects in other markets are not taken into consideration.

¹⁴ Source: Revista Vivienda.

¹⁵ In sewerage, alternative usage charges are higher than municipal, even without adjusting by quality.

¹⁶ Of course, if we measure surplus from a social point of view, this result may be reversed if we account for public health externalities.

¹⁷ The access affordability problem is one of the most important issues on the ETOSS regulatory agenda. Obviously, low-income customers can not be compelled to pay for something that they can not afford. Neither can the regulator force the company to provide new connections at lower costs without any economic compensation.

¹⁸ Public sector use has been allocated between residential and non-residential demand, according to the customary classification made by OSN, and later followed by Aguas Argentinas.

¹⁹ Recall that metered customers represented only 7.3% of total customers in 1995.

²⁰ Aguas Argentinas undertook preliminary analysis on how customers changed their consumption level when passed from the unmetered to the metered category. A low response was found, possibly due to the time lag in changing consumption patterns. The international experience shows that important changes in consumption ought to be expected.

²¹ Bhattia, Cesty and Winpenny (1995) report studies on the cities of Jakarta (-0.37) , Bogor (-0.29 to -0.33), Mexico (-0.37), Denver (-0.34), Costa Rica's urban and rural households (-0.37 to -0.44), and Brazilian urban households (-0.597). A study in Malmö, Sweden, found that the price elasticity for municipal water demand was -0.15 (see Hanke and De Maré, in Kindler and Russel -1984-). In Gibbons (1986) humid urban areas in North America showed price elasticities varying among a wide range: -0.02 (Chicago), -0.05 (Massachusetts), -0.4 (Massachusetts), -0.43 (New England), and -0.93 (Toronto). In Lovei (1992), it is reported that Martin and Thomas (1986) found that the long-run price elasticity for residential water demand was -0.5 over a wide range of price changes and across several countries. Rivera (1996) states that for residential consumers price elasticities are in the order of -0.3 and -0.6.

²² Bhattia et. al (1995) reported a general study in the US (-0.72 to -0.98), and sectorial ones such as paper and chemical plants (-0.96 to -0.98), petroleum (-0.77), steel (-0.88). For India, the value for cotton, textile, paper, dairy product, ball bearing and distillery was -1.32, whereas for the steel industry was found to be -0.45. For industrial water demand, Lovei (1992) reports that Renzetti (1988) found the price elasticity varying from -0.1 to -0.6, while Rivera (1996) reports that Cestti (1996) found ranges from -0.5 to -1.2 for the manufacturing sector in Canada.

²³ A high proportion of sewer flooding incidents in Buenos Aires is the result of blockages in the sewer, though sometimes flooding is the direct result of the inability of the sewerage system to cope with the volume of waste water flowing through it. The number of reported cases of sewer flooding is an insufficient statistic to measure sewage excess demand since this figure does not provide an accurate information neither on the number of customers affected nor on the time duration of the flooding. According to OFWAT (1993), "...The most satisfactory way of assessing the number of properties at risk of sewer flooding is to carry out a full hydraulic analysis of the drainage system".

²⁴ In 1991 non-operating results reached 53% of revenue at factor cost.

²⁵ Public' profit includes returns to debt-holders (interest payments) and to government (net taxes), as well as depreciation to avoid use of accountant's rates. Besides, to correspond with the concept of quasi-rents, it deducts the opportunity cost of working capital and excludes non-operating returns.

²⁶ Value added is defined as the value of output at factor costs minus the value of intermediate inputs.

²⁷ The number of training hours increased from 34,882 in 1993, to 86,545 in 1994, and 114,728 in 1995.

²⁸ Since April 1995, the VAT rate for residential water and sewerage consumption is 21%.

²⁹ See also World Bank (1995).

³⁰ Because most of the changes are beneficial, this may be termed as a conservative approach that tends to underestimate welfare gains, as it forces some privatization-induced changes into the exogenous category.

³¹ For example, in 1995 the government reduced funds to the Yacyretá hydroelectrical project from US\$ 300 million to US\$ 66 million, and canceled all investment contributions for 1996. A similar policy was adopted for the case of the nuclear plant Atucha II.

³² A World Bank (1994) report indicates that a commonly quoted estimate for unitary investment costs in Argentina is US\$ 250 for water and US\$ 350 for sewerage and sewage disposal. This report also quoted COFAPYS' forecasts of US\$ 220 (water) and US\$ 300 (sewerage). FIEL (1992), in turn, argued that the per capita investment costs for OSN were US\$ 120 for water and US\$ 230 for sewerage. In constructing its estimates, FIEL considered that no new capacity was needed for water treatment plants, as long as the level of UFW could be diminished and metering implemented.

³³ The 1.5% rate of growth is different in 1996, since we included Quilmes under the service area of the counterfactual OSN, so as to make the analysis comparable to the actual case.

³⁴ See, for example, the case of Nucleoeléctrica Argentina SA, which eliminated some labor rents despite remaining under public hands.

³⁵ But even if we were to choose a higher counterfactual price level, counterfactual revenues would have nevertheless been lower than the actual, since both the collection rate and the customer base are lower. According to Rivera (1996), collection rates improved from 80% to 96% after privatization.

³⁶ Source: Rio Research, as of March, 6, 1996.

³⁷ In the section on sensitivity analysis we report the welfare results under the scenario that fulfills service coverage targets set by regulation.

³⁸ Even though projections are expressed in constant terms, we could have implemented changes in real output prices whenever the cost-plus clause exceeded the 7% threshold. However, we do not foresee any adjustment through this clause, as domestic inflation is currently very low (CPI increased by only 1.6% in 1995) and there is no evidence to forecast changes in relative prices between Aguas Argentinas' intermediate input prices and domestic inflation.

³⁹ By the end of 1995, the company had 500 more employees than in September 1994, representing an increase of almost 15% over total employment.

⁴⁰ This has been confirmed through interviews held with enterprise managers.

⁴¹ To allow comparisons with other cases, we adopted from Galal et. al (1994) the ratio of the welfare change to a measure of the size of the firm, represented by annual sales in the last year prior to privatization. Since the latter is a single year's flow, whereas net welfare change is a stock, we convert the stock to an equivalent flow -the annual component of a perpetuity with an equivalent present value-.

⁴² Recall that the government is entitled to earn dividends on Class B shares until the amount collected through dividends equals the book value of this share package, or until the end of the fifth year of the concession, whichever occur first. For our welfare calculations, this is equivalent as having the government being the owner of Class B shares for the first five years of private operation.

⁴³ In this sense, FIEL's report (1996) come to a similar conclusion on cross subsidies, but with a different argument. It is pointed out that existing consumers benefited in the past from investment and operating deficits that were financed by fiscal funds at no direct cost to them. Therefore, existing customers would have an "unregistered debt" with new customers who paid (through taxes) part of the expansion and the operating deficits but were rationed out due to a supply constraint. Based on this argument, allowing cross subsidies from usage to access is considered to be fair.