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**STAY PUBLIC OR GO PRIVATE?:
A COMPARATIVE ANALYSIS OF WATER SERVICES
BETWEEN QUITO AND GUAYAQUIL**

BY

PAUL CARRILLO*
ORAZIO BELLETTINI**
ELIZABETH COOMBS**

* THE GEORGE WASHINGTON UNIVERSITY

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Abstract¹

This paper computes several indicators of water coverage, quality, and prices in Ecuador's two largest cities: Quito and Guayaquil—both before and after the privatization of water services in Guayaquil. The type of data sources that are used make it possible to specifically control for income and, thus, to evaluate changes in water provision, particularly among the poor. These indicators provide useful information about how certain water-related services have changed over time and facilitate evaluating the performance of each company. It should be emphasized, however, that such estimates cannot be used to identify the causal effects of the privatization of water provision. In particular, differences in a) before-concession water-coverage trends, b) rural-to-urban migration patterns, and c) other idiosyncratic institutional characteristics between these two cities, suggest that Quito may not be a suitable control group for identifying the casual effects of privatization.

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1. Introduction

Many Latin American countries face similar water problems: deteriorating systems and networks, lack of access to water and sewage for many of the populations' poorest, and governments without the resources or expertise to invest in change. Unfortunately, there is little consensus on how to solve these problems. Many countries, including Ecuador, have embarked upon various forms of privatization to increase investment in infrastructure and improve service provision and water quality. Most of the time, however, the privatizations have generated substantial controversy.

In the hopes of clarifying the true impact of water privatization—an issue where ideology often overrides the facts—researchers have implemented numerous studies. Unfortunately, the results remain contradictory. On the one hand, the World Bank states that the number of water connections in Latin America has increased considerably since the days of privatization, and that the venture as a whole has had “no major adverse impacts on poverty and inequality” (Leipziger, 2004). A number of authors have reported large gains in productivity and profitability associated with privatization in other sectors (Megginson, Nash, and van Randenborgh, 1994; Barberis et al., 1996; Frydman et al., 1999; La Porta and López-de-Silanes, 1999), providing evidence that points to privatization’s achievements in increasing investment and productivity as well as improving the access of poorer communities. In addition, privatization is shown to have improved health indicators. For example, one study found that the expansion of water hook-ups as the result of water services privatization was associated with an 8 percent reduction in child mortality. Moreover, most of the reduction occurred in low-income areas (26 percent), where the network expansion was greatest (Galiani et al., 2005).

On the other hand, there have been many examples in both developed and developing countries where the privatization of water and sewage has faced serious challenges and has led to little, if any, net improvement in service provision. For example, structural adjustment reforms mandated by the International Monetary Fund (IMF) led to increases in water prices in Cochabamba, Bolivia’s third largest city, by as much as 200 percent, provoking widespread protests. In addition, international reviews in Europe and in the United States do not find clear cost savings associated with privatization (Boyne, 1998; Renzetti and Dupont, 2003; Hodge, 2000), and privatization rates among municipalities in the United States have actually fallen since 1997, according to the International City/County Management Association (Warner and

Hefetz, 2004). City officials cite problems with service quality and lack of cost savings; and statistical analysis of this reversal finds that problems with monitoring are key (Hefetz and Warner, 2004).²

Rather than finding new evidence for or against privatization, in this paper we document the water provision experiences in the two largest cities in Ecuador: Guayaquil and Quito. Guayaquil, the largest city in Ecuador, has struggled to provide adequate water and sewage services to its residents. In the early 1990s, when water companies were run by the municipality, coverage rates were dramatically low. In 1994, the municipal government set into motion a process of restructuring the public water and sewage companies and began to lay the groundwork for what would lead to the privatization of the sector. In 2001, the municipal water regulator signed a 30-year integrated concession with Interagua, a subsidiary of the International Water Group. This concession handed over commercial risk and responsibility for the operations, maintenance, and administration of all potable water and sewage services in Guayaquil. On the other hand, in Quito, water-service providers have always operated under the direct authority of the municipality. Although they have historically performed better than the public companies in Guayaquil, the municipal water and sewage companies in Quito also faced financial management difficulties in the early 1990s. Instead of pursuing privatization, however, reforms were introduced to create more business-oriented practices.

To evaluate the effects of the privatization of water services in Ecuador, it is tempting to compare changes in water performance indicators (before and after privatization) between these two cities. In fact, several civil groups have criticized the terms of the concession process by making merely subjective comparisons between the performance of the private water company in Guayaquil with that of the publicly owned water company in Quito.³ Such comparisons could only identify the effects of privatization if Quito and Guayaquil were identical cities and if the privatization of water services was randomly assigned to the latter city. This is, of course, not the case.

² For additional references that analyze the privatization of water services see Caplan et al. (2004), Clarke et al. (2004), Foster (2002), and Neu and Rahaman (2003). Other studies that analyze privatization processes more generally include Barberis et al. (1996), Bel and Warner (1996), Donahue (1989), Sclar (2000), and Shleifer (1998).

³ In the initial years of the concession there was very little negative public opinion about the process, but recently complaints about water quality have increased, and several civil groups have criticized the terms of the concession process. In some cases, arguments against the privatization of water services in Guayaquil have been made by comparing the performance of the private water company with the performance of a publicly owned water company in Quito. Most of the time, however, these comparisons have been merely subjective.

This paper has two main goals. First, we attempt to provide an objective comparison of several indicators of water coverage, quality, and prices in both cities—both before and after the privatization of water services in Guayaquil. The type of data sources that we use allows us to specifically control for income and, thus, to evaluate changes in water provision, particularly among the poor. These indicators provide useful information on how certain water-related features have changed over time and facilitate evaluating the performance of each company. Secondly, we thoroughly document why such an exercise cannot identify the causal effects of the privatization of water provision. In particular, we argue that before-concession water-coverage trends, rural-to-urban migration patterns, and other idiosyncratic institutional differences between these two companies may be driving a large portion of the quantitative results.

To assess how coverage levels have changed in Quito and Guayaquil, we gather data from two national income and expenditure surveys that were administered in both cities in 1995 (before concession of water services) and in 2004 (after concession). Then, we use a binary probit model and our database to identify the conditional probability that a household has access to water services. Our estimates provide evidence that, in Guayaquil, households in the lowest income quintile have a 7 percent less chance of receiving water services compared to 10 years ago (before the concession). In Quito, on the other hand, a household in the lowest income-quintile in 2004 had a 3.5 percent higher probability of receiving water services than in 1994. These findings may suggest that in Guayaquil, water coverage among the poor has decreased during the past 10 years, both within the city and also relative to Quito.

To explore whether there have been changes in the quality of water services in these cities, we use a detailed household employment survey that asks heads of households for their opinion about changes in water services (quality, pressure, and continuity) during the past six years. The survey was representative in both cities and included detailed information about household demographics, income, and employment. We analyze this data using both an ordered probit and a linear model. Our results suggest that, on average, perceptions of how water quality and water continuity have changed during the past six years in Guayaquil do not statistically differ from the same perceptions in Quito. Interestingly, the poorest quintile households in both cities consistently think that water quality has increased. This is not the case, however, with regard to water pressure. In all specifications, households systematically perceive that water pressure in Guayaquil has worsened relative to Quito.

Finally, we analyze the evolution of water prices in Quito and Guayaquil during a 10-year period from January 1996 to July 2005 and find that the average price of water in Guayaquil has been higher after concession and has increased at a faster rate than in Quito, both in nominal and real terms.

The previous quantitative results are useful to evaluate the individual performance of each water company over time. However, as discussed above, they cannot identify the casual effects of privatization. In both cities, there may have been several other factors not necessarily related to the concession that affected water performance. We document some of these factors in the rest of the paper.

First, we examine before-concession water-coverage trends and rural-to-urban migration patterns. We find that, from 1990 to 2000, Quito's coverage levels were increasing at a very high rate, while the opposite occurred in Guayaquil, particularly in its rural marginal areas. Furthermore, migration rates to Quito during the past six years have been higher than migration rates to Guayaquil for all consumption-level quintiles, with differences being higher for poorer families. Secondly, we provide evidence about the institutional differences between these companies. Through interviews and focus groups, we implemented an institutional analysis of costs, quality, and performance that helps explain why Quito and Guayaquil have had such different experiences in water performance. Thus, if we want to identify the effect of the privatization of water services on coverage levels in Guayaquil, Quito may not be a suitable control group. We conclude that while it is tempting to compare water indicators between Quito and Guayaquil, it is clear that, through this exercise, the causal effects of water privatization on performance cannot be identified.

The rest of the document is organized as follows. The second section provides background on the history of water companies in Guayaquil and Quito, emphasizing details about the concession of water services in Guayaquil. The third section presents changes in water services in these cities during the past 10 years. The fourth section explains why we cannot identify the effects of the privatization of water services. The last section concludes.

2. Background: Water Provision in Ecuador

2.1 Guayaquil

As the largest city in Ecuador, with a population of 2.5 million, Guayaquil has long struggled to provide adequate water and sewage services to its residents. In the early 1990s, its systems were in a state of near collapse. Financial mismanagement, inadequate maintenance and investment, and a history of overstaffing and political appointees all burdened its public utilities companies, which were heavily indebted and unable to provide basic services to the wave of unplanned communities that emerged with the construction of the *perimetral* (a highway that circles the city to alleviate vehicle congestion). Only 64 percent of the population had access to water service and only 46 percent had access to sewage in 2003 (Constance, 2003). With such low coverage rates, marginal communities were almost universally excluded from the official network and were left with no choice but to purchase water from *tanqueros* (private water-delivery trucks), which resulted in their paying 125 times more for water (sometimes up to 25 percent of their income) than those connected to the system (Ochoa and Prieto, 1995).

2.1.1 The First Steps toward Privatization

Recognizing a need for change, the municipal government initiated a restructuring process in 1994 that fundamentally changed the face of public utilities in Guayaquil. It merged the two previously separate public water and sewage companies under the auspices of the Empresa Cantonal de Agua Potable y Alcantarillado de Guayaquil (ECAPAG) and began to lay the groundwork for the privatization of the sector.

Upon the completion of the merger in 1996, ECAPAG set out to significantly reshape the provision of water and sewage services. By the late 1990s, it had streamlined staffing, created a division to respond to customer questions and complaints, and had improved efficiency in the operation of its services. The new ECAPAG began to expand distribution networks to marginalized areas of the city, rehabilitate treatment plants, purchase new, top-of-the-line equipment, and complete a process of extensive administrative and operational modernization.⁴

Although these public-system reforms were substantial, the level of indebtedness and the history of poor follow-through on loan obligations of the previous public utilities companies led international lenders to refuse access to credit for much-needed infrastructure construction

⁴ ECAPAG, undated document.

without significant involvement of the private sector.⁵ While it was understood from the outset that ECAPAG would work toward implementing the long-term goal of privatization, it was not until 1995 that the ECAPAG directory officially approved the implementation process. In October 1997, Ecuador signed a loan contract with the Inter-American Development Bank (IDB) to finance the improvement of water and sewage services in Guayaquil—a contract that was contingent upon opening the sector to private concession. The loan granted by the IDB covered three principal areas: 1) the concession process, 2) the transformation of ECAPAG into a regulatory body, and 3) the rehabilitation of the potable water and sewage systems.⁶

2.1.2 The Concession with Interagua

In 2001, ECAPAG signed a 30-year integrated concession with Interagua, a subsidiary of the International Water Group. This concession handed over commercial risk and responsibility for the operation, maintenance, and administration of all potable water and sewage services in Guayaquil, while maintaining ECAPAG as a regulator to ensure contract compliance. Key elements of the contract signed with Interagua include:⁷

- Operation and maintenance of potable water and sewage systems.
- Investment to improve quality of service.
- 5- and 10-year goals to improve minimum pressure, provision, and water quality.
- Investment to expand the system in the first five years.
- Obligation to install 55,238 new potable water connections and 55,238 new sewage connections in the marginalized sectors of the city.
- Obligation to invest \$520 million in infrastructure, in addition to investment in rehabilitation and new connections, by the end of the 30-year contract.
- Obligation to install the number of new potable water and sewage connections necessary to reach 95 percent coverage of potable water and 90 percent coverage of sewage by the end of the second fifth-year period.

⁵ Interview with ECAPAG General Manager Ing. Jose Luis Santos, conducted on August 16, 2005.

⁶ ECAPAG., undated document.

⁷ List of contract obligations taken from ECAPAG, undated document.

- Beginning in the second fifth-year period, obligation to implement the new treatment plants and a macrosystem of drainage as dictated by the Master Plan.
- Obligation to respect and apply the pricing structure established by ECAPAG for the first five years.
- The full investment during the 30 years of contract should reach approximately \$1 billion.

The terms of the concession were specifically designed to avoid some of the pitfalls that arose under privatization schemes in other countries and, comparatively, can be considered relatively “poor friendly” in terms of coverage, price, and quality. Recognizing that one of Guayaquil’s greatest problems has been the lack of inclusion of poor communities in the coverage of water and sewage networks, the concession contract specifically requires new connections to be provided to these communities at no cost. Emphasis in the first five years of the contract is placed on Interagua providing a minimum number of these new connections, and marginal communities are identified and incorporated according to an official expansion plan.

In order to avoid public backlash, as well as the burden of sudden price hikes, water tariffs are also strictly controlled for the initial years of the contract. The current tariff structure was designed and implemented by ECAPAG in the years prior to privatization to both more adequately cover the real costs of the system and to disassociate the changes in tariff structure from the privatization process so as to mitigate potential public backlash. For the first five years of the contract, the concessionaire is bound to uphold the pre-established pricing structure (barring any unforeseen changes on a national level that influence operational costs).

The concession contract also controls for water quality through the use of pressure and quality samples taken throughout the city and submitted to a number of laboratories for testing. Samples are taken by both Interagua and ECAPAG and must fall within the guidelines stipulated in the contract or else sanctions and monetary fines can be imposed.

2.1.3 Public Response to the Concession

While there appeared to be very limited negative public opinion regarding the process in the initial years of the concession, the tide has recently turned, and the debate has become much more polarized. An increasing number of complaints have been emerging from marginal

communities regarding poorer water quality and charges for services they do not receive. Despite the pressure and quality standards stipulated in the contract, residents of *Guasmo Sur*⁸ consistently complain of turbid, foul-smelling water that is not fit for consumption, while residents of *Suburbio Oeste*⁹ have struggled through both a hepatitis outbreak and periodic issues of decreased chlorine content/increased fecal content in the samples from their sector (Comisión de Control Cívico de la Corrupción 2005).

In early 2005, the Observatorio Ciudadano de Servicios Públicos, a citizens' watchdog group, was formed in an attempt to monitor the conduct and compliance of the concessionaire and regulator and to ensure a basic level of public and citizen accountability in the provision of the public good. Since its establishment, this group has issued numerous reports and forums analyzing and criticizing both Interagua's compliance with the contract and ECAPAG's capacity as a regulator (Observatorio Ciudadano de Servicios Públicos, 2005a, 2005b, 2005c, 2005d, 2005e, and 2005f) In an attempt to better measure public opinion on issues related to water provision and public participation, the Observatorio organized a survey in November 2005 that polled more than 40,000 citizens, primarily from marginal sectors. Although the poll was voluntary and administered only in certain sectors of the city, the results overwhelmingly demonstrated a desire for systemic change and increased citizen participation.¹⁰

Critiques of the services rendered by Interagua have also come from the governmental watchdog entities the *Defensoría del Pueblo* and the *Comisión de Control Cívico de la Corrupción* (CCCC), both of which investigated the issue of water quality in Suburbio Oeste. In addition, from May to October 2005 alone, more than 400 articles related to water appeared in the Guayaquil press. In many cases, these articles made an implicit comparison between water services in Guayaquil and Quito to argue against or in favor of the concession of water services. Moreover, in most cases, such comparisons were merely subjective.

As stated in the introduction, we worry that this type of comparisons is not appropriate to identify the causal effects of privatization, since there may have been several other factors not

⁸ Guasmo Sur is a low-income sector located in the southern part of the city.

⁹ Suburbio Oeste is a low-income sector located in the western part of the city.

¹⁰ According to this survey, more than 90 percent of respondents thought that Interagua and ECAPAG are not fulfilling their responsibilities to ensure quality water and sewerage services that are accessible to all citizens of Guayaquil. Furthermore, 95 percent believed that the concession contract should be revised to contain clauses that guarantee the rights of all citizens of Guayaquil. Notice that, because of sample selection, these results are not representative of the whole population.

necessarily related to the concession that affected water performance. We illustrate this point in the last section.

2.2 Quito

Water-service providers in Quito have always been under the direct authority of the public sector. EMAAP-Q, the municipal company that runs water and sewage services in Quito, was created in the mid-1990s by combining the former public water and sewage companies. EMAAP-Q encountered financial-management difficulties in the 1980s and early 1990s and was not able to meet citizen needs. However, reforms to create more business-oriented practices—such as cost savings and a stronger work ethic—increased efficiency and in turn, coverage. A detailed institutional analysis of Quito’s water company is presented in the fourth section of this document.

3. Measuring Changes in Water Services between Quito and Guayaquil

An objective comparison of water services in Quito and Guayaquil requires the construction of a set of indicators that allow such an evaluation. In this section, we construct and analyze the evolution of several indicators for water coverage, price, and quality in both cities during the past 10 years (1995-2005).

3.1 Coverage

To explore household water coverage, we used data from two national income and expenditure surveys. Each survey consists of one representative (cross-section) sample of the urban population (about 12 cities) in Ecuador and was conducted by the Ecuadorian Institute of Statistics (INEC).¹¹ The first survey took place from August 1994 to August 1995, and the second in 2004. The surveys provide detailed information about household sources of income and expenditures for each respondent.¹² Descriptive statistics of this database are presented in Table 1.

Our compiled database is a representative sample of the population of Quito and Guayaquil. The 1994 sample consists of 1,737 respondents (households) in Quito and 1,713 in

¹¹ In Spanish, INEC stands for “Instituto Nacional de Estadísticas y Censos.”

¹² The INEC analyzed the structure of the households’ expenditures to establish a representative basket of goods and services and to compute the Ecuadorian Consumer Price Index in both 1995 and 2004.

Guayaquil, while the sample size of the 2004 survey is more than 40 percent higher in both cities.

Because we were concerned with identifying changes in water-coverage levels among those located in the left tail of the income distribution, we collected several variables that provide information on household income level. For this, we measured households' real income in terms of the number of representative baskets of goods and services (BGS) that they could buy with their total earned income.¹³ According to the data shown in Table 1, mean household income (in real terms) decreased by about 4 percent in Quito and 20 percent in Guayaquil in the last decade.

We also collected other information that describes the household's socioeconomic status, such as the share of expenses allocated to food, the number of people living in the same household, the number of children below the age of five, and the education level of the head of the household. Household size and number of children under the age of five are important variables because they are generally negatively correlated to income.

We use a binary probit model and our survey data to identify the conditional probability that a household has access to water services in Quito and Guayaquil. The dependent variable equals one if the household is connected to the water network. The control variables include the household's income, the number of members in the family, and the head of the household's education. We also include an explanatory dummy variable that equals one if the survey was taken in 2004 (that is, the "privatization" dummy variable).¹⁴

To analyze the changes in water-service coverage before and after concession, the binary models are estimated with our sample data in Guayaquil and Quito in separate regressions. In addition, because we seek to identify changes in the coverage level among the poor, we divide our population by per-capita income quintiles, and estimate the probit equation for each of these quintiles. Results are presented in Tables 3 and 4. We show both the value of the coefficients as well as the marginal effects (evaluated at the sample mean of the independent variables in each income quintile).

¹³ The monetary value of the set of goods and services that a representative household spends money on to satisfy its basic needs is computed by the INEC on a monthly basis. The monetary cost of this set of goods and services was \$362 in 1994 and \$387 in 2004. We use the INEC's estimates to compute the real income of a household in our sample.

¹⁴ Although the actual concession occurred in 2001, we refer to the 1994 survey as the "before concession" data, because it was the year before ECAPAG started undertaking drastic public-sector reforms in preparation for the hand-over to a private company.

The results for Guayaquil are shown in Table 2. In all income groups, the education level of the head of the household has statistically significant effects on the probability of having access to water services. This variable is most likely capturing the unobserved location of the housing unit, since higher-educated households tend to be located in neighborhoods that have better public services. Our results also provide evidence that, with the exception of the richest quintile of the population, families with children under five years of age have had less chance of having access to water in Guayaquil after concession. This result is worrying considering that the health of young children is jeopardized by the lack of formal service.

The coefficients on the variable “privatization fixed effect” suggest that, on average, there are no significant changes in the probability of having access to water services before and after concession in Guayaquil. There is evidence, however, that households in the lowest income quintile have a lesser chance of receiving water services after concession. For example, the likelihood of these families obtaining water services decreased by approximately 7 percent in the past decade (Figure 1).

Coverage trends in Quito are quite different. In Table 3, we show evidence that, in 2004, the probability of having access to water services in Quito has increased during the past decade. While these effects are particularly large and statistically significant for the third and fourth income quintile, even first-income quintile households have notably increased the probability of being connected to the water network. For example, our results suggest that the likelihood of such low income families obtaining water services increased by about 3.5 percent.

It is tempting to compare changes in water coverage indicators (before and after privatization) between these two cities and associate them with the effects of privatization.¹⁵ However, such comparisons could only identify the effects of privatization if Quito and Guayaquil were identical cities and if the privatization of water services was a random event. This is not the case. In both cities, there may have been several other factors not necessarily related to the concession that affected water coverage, such as previous water-coverage trends and rural-to-urban migration rates. We document these factors below.

¹⁵ For example, one could use a “difference-in-difference” approach to explore the association between privatization and water coverage in these cities by estimating one binary model using data on both cities and adding “time,” “city,” and “private-owner” dummy variables to the set of other explanatory variables. A simpler and less rigorous comparison could consist of subtracting the marginal effects of the “privatization” dummy variable in Tables 3 and 4. For example, one may infer that, after privatization, a household in the first quintile in Guayaquil had a $(0.035 - (-0.066)) = 0.10$ lower probability of receiving water services than a similar household in Quito.

3.2 Quality

To measure whether the quality of water in Guayaquil has improved or worsened since the concession, the chemical and biological makeup of water samples taken before and after 2001 should be analyzed. Unfortunately, such data are not available (at least not to the researchers).

Information on water-quality samples in Guayaquil has been publicly available since October 2005, and we collected this data until January 2006 to determine whether poor neighborhoods have lower water quality. The data include details on the chemical composition of the water samples and the address of the properties where the samples were taken. We used the individual addresses to match the water-samples database with poverty data from the Ecuadorian 2000 Census. While this analysis does not assess whether there have been any changes in water quality during the past 10 years, it does help us understand whether there are systematic differences in the quality of the water provided to the poor.

We found 291 water-quality test records on the ECAPAG web page. Ten of those files would not open, 37 had missing information, and 44 locations could not be matched with a specific address. We then constructed a map of Guayaquil that divided the city into census zones and quintiles of poverty level as determined by a national poverty index in the Census (NBI for its initials in Spanish). Finally, the water records were matched with the Census poverty levels. Not surprisingly, water quality was tested at the highest rate by far in the richest areas, and the number of sites tested fell steadily as the poverty level of the location increased.

The water-sample tests contained information on many variables (such as chlorine, turbidity, fecal residuals, bacterial analysis, and ph-levels). We focus on chlorine and water-clarity indicators, because these are the only two available for most of the tested sites. Higher chlorine levels indicate larger amounts of disinfectant in the water. Lower turbidity indicates greater water clarity. As shown in Figure 2, wealthier areas generally had higher levels of chlorine and greater water clarity than poorer sectors. For example, poorer areas have an average of 20 percent less chlorine than other samples. However, those differences are not statistically significant.

In the remaining part of this section, we explore whether there have been changes in the quality of water services in Guayaquil relative to Quito after concession. For this, we used a

detailed household survey that contains information on individuals' perceptions of changes in various aspects of water quality during the past six years.¹⁶

We focus on three measures of water services that are available in the Ecuadorian Monthly Employment Survey: overall water quality (purity, odor), water pressure, and water continuity. In the April 2006 survey, heads of households were asked: "In your housing unit, has the quality/pressure/continuity of water improved, remained constant, or decreased over the past six years?" We use the responses to these questions and a simple regression analysis to identify if there are any systematic differences in these variables in Guayaquil relative to Quito.

We use two types of regression models. The first is a traditional linear model and the second is an ordered probit model. The dependent variable is an integer that represents five different categories: 1) notably decreased, 2) decreased, 3) remained the same, 4) improved, and 5) notably improved. We also include several independent variables that may explain the way individuals express their opinions about water issues. For example, it is possible that less-educated people are more optimistic about the future and perceive that water quality changes have been higher than in reality. For this reason, we include several independent variables such as the number of children (age five and younger) in the housing unit and head of household's age, gender, education, marital status, and employment status. Because we are interested in identifying effects among the poor, we also control for income by adding a set of dummy variables that describe the per-capita income quintile to which the household belongs.

For both the linear and the ordered probit models we estimate three different specifications. In the first and second specification, we control for income and city effects only; the third adds several other independent variables to control for household demographics. The results are presented in Tables 4, 5, and 6.

Our results suggest that, on average, perceptions in Guayaquil about how water quality and water continuity has changed during the past six years do not statistically differ from the same perceptions in Quito. However, the poorest quintile households consistently think quality has increased. This is not the case, however, with perceptions of water pressure. In all specifications, there is evidence that households think that water pressure in Guayaquil has worsened relative to Quito. In particular, this effect seems to be stronger among those

¹⁶ This survey is known as the Ecuadorian Employment Survey and is carried out by the Facultad Latinoamericana de Ciencias Sociales (Flacso)–Ecuador on monthly basis in the three largest urban areas in the country. The survey is used by the Central Bank of Ecuador to compute employment statistics and consumer confidence indices.

households in the second income quintile. These results are consistent with the fact that Interagua has made an effort to increase the number of water connections. Without increasing the production of water, water pressure inevitably worsens.

These results provide useful information about how households' perceptions of water quality in Quito and Guayaquil have changed over time. We emphasize, however, that these do not identify any causal effect of the privatization of water services.

3.3 Price

To analyze the price of water in Guayaquil before and after the concession, we compare monthly average water prices in Guayaquil and Quito during a 10-year period (January 1996 to July 2005). This highly reliable information comes from monthly surveys undertaken by INEC with the objective of calculating the Consumer Price Index.¹⁷

Through these surveys, we analyze the evolution of the average cost of 30 cubic meters of water in Quito and Guayaquil. Figure 3 presents the amounts in current US dollars. From the beginning of 1996 until October 1999, water was on average 66 percent more expensive in Guayaquil than in Quito. On the other hand, from November 1999 to May 2000, water was 25 percent more expensive in Quito than in Guayaquil. However, a few months after the concession, this tendency reversed, and the price of water in Guayaquil again surpassed the price of water in Quito. Thus, there exists evidence that after the concession, the average price of water in Guayaquil has increased in comparison to Quito. The price gap jumped to \$3 (per-unit) immediately after concession and climbed steadily to more than \$4 by 2005.

To calculate the evolution of the price of water in real terms, we divided the nominal price of water in Quito and Guayaquil by the Price Index in each city. Then, we standardized the index so that the price of water in Quito in January 1996 is equal to 100. The corrected evolution of prices is represented in Figure 4. As in the last graph, the difference between the relative price of water in Guayaquil and the price in Quito is positive at the beginning of 1996 and decreases until a few months before privatization. Approximately six months before the concession, the difference becomes positive again and remains higher than Quito for the following years.

¹⁷ Pricing information taken from the water companies may be biased, since they may have incentives to provide misleading information. On the other hand, information collected by the INEC should be reliable.

It should be acknowledged that changes in nominal water prices in Guayaquil have been limited so far by the concession contract. Once the first five years of the concession are over, Interagua will be able to change tariffs without ECAPAG approval.

4. Identifying the Effects of the Privatization of Water Services

If Quito and Guayaquil were identical cities and the privatization of water services were randomly assigned to the latter city, some of the estimates in the previous section would measure the effects of privatization on water coverage, quality, and prices. This is, of course, not the case. Quito and Guayaquil are quite different cities, especially in terms of water provision.

In this section, we first describe how differences in previous coverage trends and migration patterns between Quito and Guayaquil can bias our quantitative results. Then, we provide a detailed comparative institutional analysis of both water companies, which leads us to conclude that they face radically different environments and that Quito is not a suitable control group for identifying the effects of water concession in Guayaquil.

4.1 Previous Trends in Water Coverage

Figure 5 presents data on water-coverage levels in Quito and Guayaquil from three National Population and Housing Censuses. Unfortunately, the Census data do not allow us to analyze water-coverage levels by income quintile. We can only determine whether residences are located in rural or urban areas within the borders of these cities. However, because rural areas in both cities are primarily populated by poor families, it is reasonable to assume that coverage levels in rural areas are somewhat similar to the coverage levels of families that belong to the first income quintile.

Using a simple linear extrapolation of the Census data, we estimate that by 2004 (the year of the income and expenditure survey), water-coverage rates in the rural areas of Guayaquil would have been 6.1 percent lower than corresponding coverage levels in 1994.¹⁸ In the previous section, we provided evidence that, after concession, poor households (first income quintile) in Guayaquil decreased their likelihood of obtaining water services by approximately 7 percent.

¹⁸ According to the Census, water-coverage levels in rural Guayaquil were 18 percent in 1990 and 9.8 percent in 2001, that is, they decreased at an average annual rate of 5.68 percent. Using this average annual decrease rate, we estimate that the corresponding water-coverage rates in 1994 and 2004 may have been 14.2 percent and 8.3 percent, respectively. The difference between the two is 6.1 percent.

Thus, previous trends in water-coverage levels may be explaining a large portion of the decreased access to water among the poor.

Coverage levels in Quito's rural areas, on the other hand, show an opposite trend. Quito made significant improvements, particularly, during the 1990s. In 1990, water coverage levels reached 32 percent; by 2001, they increased to 56 percent, and by 2004 they may have climbed to 65 percent.¹⁹

Before the concession of water services, Quito and Guayaquil showed completely different trends in their water-coverage levels, especially in the cities' rural areas. Thus, Quito may not be a suitable control group to identify the effects of privatization of water services, particularly among those at the low end of the income distribution.

4.2 Migration Trends and Urban Planning

To understand changes in coverage levels between Quito and Guayaquil, it is also important to analyze the two cities' migration trends. For example, higher rates of migration to Guayaquil may explain why water coverage decreased relative to Quito.

Data from the 2004 Demographic Survey on Mother and Infant Health Survey (ENDEMAIN)²⁰ were used to identify migration rates. In this survey, heads of households in Quito and Guayaquil were asked if they had resided in the same city in 1999.²¹ Furthermore, the survey contains information on households' consumption is available and, therefore, we were able to rank households by their per capita consumption level. This information is displayed in Table 7.

Clearly, migration rates to Quito are higher than migration rates to Guayaquil for all consumption-level quintiles, and these differences are higher for poorer families. Whereas only 8

¹⁹ Using a similar linear extrapolation, we may infer that water coverage levels in rural Quito increased from 39 percent in 1994 to 65 percent in 2004.

²⁰ Since 1987, the Center for Population Studies and Social Development in Ecuador (CEPAR, for its initials in Spanish) has periodically published its "Demographic Survey on Mother and Infant Health," the ENDEMAIN. The last survey was taken in 2004. Through the compilation of numerous statistics related to health care, infant and child mortality, reproductive health, fertility, domestic violence, sexually transmitted diseases, household demography, migration, and other topics, CEPAR attempts not only to describe, but also to identify any patterns or problems in terms of access to and usage of health services. Socioeconomic status (based on consumption), for example, is one of the household statistics collected to ascertain if persons of lower socioeconomic status have less access to health care or have to spend more to obtain it than persons of greater socioeconomic status. The information is collected through household and individual surveys, with responses solicited from 17 different sections of the country. Of the 10,966 observations in the 2004 ENDEMAIN, 1,151 come from Quito and 957 come from Guayaquil. For more details on the ENDEMAIN, see Angeles, Trujillo and Lastra (2005).

²¹ Optimally, we would have liked to observe migration trends during the past 10 years to make our previous results comparable with our migration trends. However, we were not able to find such information.

percent of the poorest families in Guayaquil lived in another city five years earlier, 22 percent of the poorest families in Quito had recently migrated.

The table provides evidence that the decrease in coverage in Guayaquil after concession relative to Quito could not be explained by migration trends to these cities. This provides additional evidence that Quito is not a suitable control group for identifying the effects of privatization of water services in Guayaquil.

4.3 Other Institutional Factors

In this section, we analyze the institutional environments of both companies. To understand the institutional contexts of these entities, we interviewed employees of EMAAP-Q, ECAPAG, Interagua, the University of San Francisco at Quito, the Inter-American Development Bank, and the Observatorio Ciudadano de Servicios Públicos. In addition, we conducted focus groups with residents of various marginal communities throughout Guayaquil to obtain first-hand accounts of their experiences with water services.²²

Throughout this section, we provide evidence that these two companies are radically different in many ways and provide additional reasons why comparing changes in Quito's and Guayaquil's water services in the last decade may not be a useful exercise for identifying the effects of water service privatization.

4.3.1 External Factors that Contribute to Performance

Geographic characteristics. Both cities have geographic advantages and disadvantages in terms of capturing, cleaning, and distributing water. Quito, for example, has a more complicated system of carrying water from its sources to the city and its suburbs. Hundreds of kilometers of piping are used to transport water from seven water-capture sites to 22 treatment plants. Guayaquil, on the other hand, has only one source, the River Daule, and three treatment plants, which are relatively close in proximity. One could argue that Quito's many capture and treatment sites complicate coordination and raise the cost of water production.

However, the mountains surrounding Quito provide it with an advantage in terms of water pressure. The majority of the 172 water tanks are located above the valley that the city of Quito occupies, and therefore, EMAAP-Q has to restrain water pressure, not create it. On the other hand, the relatively flat topography of Guayaquil, combined with the fact that its treatment

²² Details about the interviews and focus groups can be found in Appendix 1.

plants are located above the river, means that money has to be invested not only in pumping water to the plant, but also in distributing it throughout the system.

Probably the most important geographic characteristic that contributes to water entity performance is the quality of the water *before* it arrives at the treatment plants. Quito is proud that its water tests well below the water-turbidity requirement of 5 units, reaching the treatment plants at around 1 or 2 units. The water consumed by Quiteños comes from melted snow and glaciers from the various volcanoes surrounding the municipality, which is a great advantage not shared by Guayaquileños. To get the water to a point at which it is potable, Guayaquil's treatment plants have to subject it to fairly extensive sedimentation and filtration processes in order to reduce the organic material and contamination caused by nearby factories, boats, and communities. Unfortunately, heavily treated water does not always guarantee lasting quality because the effects of the chlorine used in the treatment dissipate over time and as the water moves through the water mains.

4.3.2 Water Companies and Political Influence

According to several interviewees, Guayaquil's political environment has been one of the primary causes of the poor historical performance of its public water providers. According to them, past (pre-privatization) water-service providers in Guayaquil did not operate as independent and technical entities, but as mechanisms by which to mobilize political power, damaging their institutional capacity and the provision of services.

It was not until the establishment of ECAPAG in 1995 that the issues of overstaffing and political influence began to come under control. The national law establishing ECAPAG's creation removed it from the influence of the local political scene and gave it the autonomy to carry out the provision of water and sewage services in an apolitical, technical manner. In preparation for the privatization process, ECAPAG began to streamline staffing as well as implement numerous administrative and organizational reforms. To this day, the municipality plays a very limited official role in water provision; the mayor simply has a representative who sits on the ECAPAG board.

In contrast, interviewees in Quito emphasized the technical—not political—nature of, EMAAP-Q. Although low turnover rates are positive, Quito may also be suffering from overstaffing (see Table 8), indicating that it is not as efficient and apolitical as it would like to

appear. Although EMAAP-Q has not been heavily politicized, the mayor plays an active role in the company's decisions.

4.3.3 Measures of Efficiency and Current Performance

We have chosen several indicators to measure the current institutional efficiency and performance of both water companies: 1) response to consumer complaints, 2) payment rate, 3) ratio of employees per 1,000 connections, 4) percentage of water lost, 5) general finances and 6) management and technical innovations. These indicators may provide a better sense of how efficiently and effectively the public and private institutions are working.

Response to consumer complaints. Water-providing entities in both Quito and Guayaquil have mechanisms for receiving, processing, and addressing consumer complaints, but Quito's appear to be more responsive and user-friendly. In Quito, there are two main systems by which to make a complaint—via telephone or via an EMAAP-Q office. There are 12 client services centers throughout the municipality, where 83 percent of the complaints are made. These offices are only open on business days from 7 a.m. to 7 p.m., but a call center additionally takes complaints 24 hours a day. Both methods are connected to the AS400 system, which processes and distributes the complaints to the appropriate areas. According to the director of Client Services (Guaman, 2005) there has never been a complaint related to the quality of water. Most have to do with billing problems, which are addressed by a home visit on the next working day. New connections are addressed within 20 days and reconnections within 48 hours after payment. Pipe breaks and technical complaints have response rates of 24 hours within the city of Quito and 48 hours in the parishes. In 2002, EMAAP-Q set a goal to keep the annual complaint rate below 1 percent of the number of consumers, a goal it surpassed in 2005 with a complaint rate of 0.35 percent.

In Guayaquil, both Interagua and ECAPAG have established fairly thorough mechanisms for accepting and processing complaints, and the absolute number of complaints has actually gone down since the concession. Under ECAPAG, prior to privatization, the total number of complaints received per month averaged approximately two thousand, while Interagua now averages roughly 800. Complaints related specifically to billing have also decreased. In 2001-2002 there were approximately 0.6 complaints related to billing per account, a number that has now decreased to 0.4.²³

²³ According to an interview with ECAPAG's Director de Control y Regulación Económica, Espinoza (2006).

Processes for receiving and attending to customer complaints have also expanded since the concession. Similar to EMAAP-Q, Interagua accepts complaints either through its call center, which is open from 7 a.m. to 8 p.m. Monday to Friday and with limited hours on Saturday, or through its two customer service centers in the northern and southern parts of the city, which are open from 8:30 a.m. to 4 p.m. Unfortunately, neither the Interagua nor ECAPAG call centers offer a toll-free number.²⁴

Interagua responds to first-instance billing complaints within 30 days and second-instance complaints within 10 days. Technical complaints have a much faster response time, which varies according to their gravity. Reconnections are made within 48 hours of payment.

As the operator and provider of water services, Interagua has the primary responsibility for addressing consumer complaints and concerns. However, as the regulating entity, ECAPAG monitors the database of complaints received and responded to by Interagua and also acts as a third-instance appeal. When a consumer makes a complaint, the first two instances go through Interagua. However, if the consumer remains unsatisfied with the decision, he or she may file an appeal with ECAPAG, which then conducts its own investigation, reviews the prior decisions, and makes its own decision. Like Interagua, ECAPAG has initiated a call center to receive customer complaints and concerns and responds to such complaints within 30 days.

While mechanisms for accepting and responding to complaints exist, focus groups conducted in marginal areas of the city reported high levels of frustration with Interagua's responses to user complaints and requests.²⁵ Participants reported poor treatment by Interagua employees working in both the customer-service centers and in the field. Others felt that they were "given the run-around" when they attempted to get a response to the complaints they had filed.

Payment rates. In Quito, the payment rate has increased substantially in the past 10 years, from 42 percent in 1996 to 80 percent in 2004 (Table 8). Although the 20 percent still outstanding is high, it only represents what is owed by 3 percent of total customers.

In Guayaquil, payment rates have also increased substantially—both since ECAPAG assumed control of water provision operations and in the four years of Interagua's control. In the

²⁴ Interagua has a regular phone number and ECAPAG a 1 700 number. In both instances, users must personally assume the cost of the calls.

²⁵ Specific dates and location of the focus groups are presented in Appendix 1.

years prior to the creation of ECAPAG, payment rates averaged 50 percent, not enough to cover even the basic costs of water provision. Just before the concession, ECAPAG had reached a payment rate of approximately 76 percent. According to one of ECAPAG's directors, since the concession, payment rates have continued to rise to 84 percent, with additional increases each year. In addition to accepting payments in Interagua offices, the company has worked to expand the methods through which monthly bills can be paid.²⁶

Ratio of employees per 1,000 connections. An indicator commonly used to determine efficiency and management performance is the number of employees per 1,000 connections.²⁷ As shown in Table 8, Quito has approximately 6 employees per connection, down from 7.1 in 1996. Interagua, on the other hand, is right on the efficiency target with a ratio of 3 to 1,000. In this area, privatization has definitely had an impact on efficiency, considering that the pre-privatization water providers in Guayaquil had extremely high employee per connection ratios.²⁸

Physical and commercial losses. Another common measure of efficiency is the level of physical and commercial losses suffered by the water-provision companies, such as the amount of water unaccounted for either due to illegal connections, breaks in the system, or non-payment. In 2005, EMAAP-Q lost about 30 percent of its water (Table 8).

Heavy losses in both of these areas have been one of the most serious problems in Guayaquil's water provision system. Under the provincial water provision entity EPAP-G, which existed prior to ECAPAG, water losses reached 75 percent—one of the highest rates in Latin America (IDB, 1996). Since Interagua has assumed operations and begun to invest more heavily in system infrastructure and new connections, the level of loss, although still high, has begun to decline. It is now at approximately 67 percent. Losses also originate from clandestine connections to the official water network. At this point in time, there is no truly accurate estimate of the number of clandestine connections in Guayaquil. However, many have been created by low-income residents who have water mains near their house but who have never been provided with formal connections to the system. Interagua currently has a program to regularize such users

²⁶ Espinoza (2006).

²⁷ Based on technical criteria, experts typically recommend a ratio of approximately 2 to 3 employees per 1,000 connections in this type of industry.

²⁸ In 1982, EMAP-G (one of the previous municipal water providers) had a ratio of 15 to 1,000 and at the end of 1994, before control was turned over to ECAPAG, EPAP-G (the provincial water company that followed EMAP-G) had a ratio of 9.4 to 1,000 (Swyngedouw, 2004).

once their connections are discovered. As Interagua expands the number of new connections to the more marginal sectors of the city, the number of clandestine connections and concomitant losses is expected to decrease.

General finances. As of 2005, EMAAP-Q has an annual budget of \$200 million. The budget has grown by approximately \$80 million in the past five years. Expenditures are divided as follows: 60 percent project investment, 10 percent debt repayment, 20 percent operations and maintenance, and 10 percent administrative costs. EMAAP-Q earns its income from various sources: 60 percent service sales, 25 percent telecommunications taxes, 10 percent international loans, and 5 percent sales of electricity. The last item is perhaps the most interesting and innovative. Due to the fact that EMAAP-Q works with rushing water sources, it developed a system to generate electricity, earning almost 5 million dollars in 2004. Originally, the electricity created was used within EMAAP-Q. However, with increased production, it is now sold for additional income.

In terms of loan history, EMAAP-Q has worked with several international creditors for more than 15 years. EMAAP-Q is proud to have a direct loan relationship with these creditors, which is not common in Ecuadorian public agencies, most of which must work through the Central Government.

Unfortunately, information on Interagua's general finances was not publicly available. According to ECAPAG, Interagua's annual budget is \$80 million, with approximately \$40 million going to general operating expenses and \$25 million to investments. How Interagua allocates funds within these general categories and how it makes use of the \$15 million unaccounted for remains unexplained.

One possible explanation for performance differences between EMAAP-Q and Interagua may be related to their budgets. In the past 10 years EMAAP-Q has had a substantially higher budget than that of ECAPAG and Interagua. In particular, the telecommunications tax is said to give EMAAP-Q extra resources that allow it to afford higher employment levels.

Management innovations. In addition to selling electricity, other important technological innovations have been undertaken. One was the implementation of a digital mapping system in Quito in 1998. Now that 100 percent of the commercial area of Quito has been mapped, technicians can more easily identify breaks or problems in the system. With these technological

improvements, technicians in charge of water production can measure the amount of water being produced at each capture site to divert it more effectively to processing plants. Another innovation has involved equipping treatment plants with a system to automatically and constantly test and treat the water.

In regard to administrative innovations, EMAAP-Q had to develop an effective communications system to allow all 22 water plants to coordinate activities. Furthermore, EMAAP-Q uses its long-term strategic plan to calculate tariffs. Instead of basing the price of water on current costs, EMAAP-Q includes costs of future projects. Additionally, EMAAP-Q is aware of the advantages of using private companies to implement some activities, such as meter reading and the printing of bills. Finally, 97 percent of customers now have meters, allowing EMAAP-Q to charge consumers more fairly. The meters are changed every five years to avoid mistakes.

While Interagua has implemented numerous reforms and innovations since assuming control of operations in 2001, the modernization of Guayaquil's water services first began under the direction of ECAPAG in the late 1990s in preparation for opening the sector to private concession. In the years leading up to the concession, ECAPAG expanded the network, incorporating 43,000 new users from marginal areas in Guayaquil, conducting numerous projects to rehabilitate and optimize the functioning of the water and sewage system, and designing a plan for providing potable water to Isla Trinitaria, a marginal suburb of Guayaquil. ECAPAG also implemented various reforms to modernize its administrative and operational systems; among many other things, this included automating the billing system and undertaking significant improvements in customer service.

As a subsidiary of a multinational company with access to the latest technological developments and innovations, Interagua has continued to build upon the modernization projects first begun under ECAPAG. However, because the relevant information is not available to the public, the number of innovations implemented by Interagua since 2001 has not been quantified in this paper.

4.3.4 Other Factors Contributing to Institutional Strength

Civil society participation. There are various indicators that can be used to measure civil society participation in water provision: 1) newspaper articles critiquing or exposing water company performance, 2) civil society movements or organizations that diffuse information to citizens and

press for reforms, 3) mechanisms provided by the water companies to receive feedback from citizens, and 4) programs promoted by the water companies to involve citizens in project activities.

In Quito, general participation is low in the first three areas. In terms of citizen participation in program activities, the Department for Public Works for Social Development of EMAAP-Q provides the materials and technical support to make free connections to water and sewage systems if the community provides the manual labor.

During 2005, the issue of citizen participation in the provision of Guayaquil's water services began to gain attention. In part due to a number of scandals regarding water quality, as well as media attention generated by a newly formed watchdog group, the number of newspaper articles focusing on water company performance skyrocketed. From just May to October 2005, more than 400 water-related articles were printed in the local press.²⁹ In addition to this increased media attention, and perhaps a cause of some of it, a citizen watchdog group (the *Observatorio Ciudadano de Servicios Públicos*) was formed to publicly monitor Interagua and ECAPAG and hold them accountable for the services they provide.

The *Observatorio* says it does not necessarily oppose the privatization of public services, but believes that adequate citizen oversight and accountability need to accompany such processes. Although the *Observatorio* is a relatively new organization and a fairly unique one in Ecuador, it hit the ground running, publishing numerous reports analyzing and critiquing the terms of the concession contract, the structure of ECAPAG, and the master plan for water and sewage development that was recently presented by Interagua.

While the *Observatorio's* efforts have definitely created a public dialogue around the quality of services being provided by Interagua and the responsibilities that ECAPAG holds as a regulator, official channels for citizen participation within both Interagua and ECAPAG remain severely limited.

Regulatory bodies. In Ecuador, water provision has virtually no regulation at the national level.³⁰ There exist, however several forms of self-regulation at the municipality level. For example, various members of EMAAP-Q mentioned that the entity is "self-regulated." EMAAP-Q tests the quality of water in a laboratory that works independently from the Department of Water

²⁹ Articles compiled by the Observatorio Ciudadano de Servicios Públicos.

³⁰ For example, a new code of water-quality norms, which raised national standards, was passed in October 2005. However, no national body exists to hold municipalities accountable.

Production. However, it is located on the same site, if not in the same building, and the laboratory receives almost 100 percent of its funding from EMAAP-Q. Nonetheless, according to the director, the independence of his laboratory is respected.

Guayaquil, on the other hand, has a much more elaborate and established regulatory system, as is essential under privatization. Specific areas of regulation include the following:

- a) *Client Attention*—ECAPAG monitors billing, consumer complaints, and Interagua’s response to said complaints. Monthly reports as well as Interagua’s databases are submitted to ECAPAG for review. Goals in this area focus on follow-through and response time in addressing complaints, not on the total number of complaints made.
- b) *Water Quality*—ECAPAG conducts monthly/weekly regulation of water quality throughout the city by subcontracting a number of laboratories to do four counter samples in various sectors. In addition, ECAPAG is immediately informed of any complaint made to Interagua regarding water quality and sends its own team out to take counter samples.
- c) *Investments*—ECAPAG specifically regulates Interagua’s completion of the required number of water/sewage connections stipulated in the concession contract. Because additional infrastructure investments are not required to go through any specific regulation or approval process, Interagua’s follow-through in this area is indirectly regulated through its ability to meet service goals (such as pressure and continuity).
- d) *Finances*—ECAPAG conducts regular reviews of Interagua’s financial statements to ensure that it is in good financial standing for the projects it seeks to undertake. The contract does not stipulate any further regulatory influence over company finances.

5. Conclusions

Through a comparative study of Ecuador’s two largest cities, Quito and Guayaquil, we have analyzed the coverage, quality, and pricing of their water-provision systems during the past 10 years. This study provides two important contributions. First, we provide a battery of quantitative indicators of water performance in these two cities. We find evidence that, during this period,

water-coverage levels in Guayaquil have decreased, particularly among those in the first quintile of the income distribution. The opposite is true in Quito. Furthermore, our findings suggest that households systematically perceive that water pressure in Guayaquil has worsened relative to Quito. Finally, we find that both in nominal and real terms, the average price of water in Guayaquil is higher and has increased at a faster rate than in Quito.

These indicators provide useful information to evaluate the performance of the water companies over time. However, they cannot be used to assess the effects of privatization. The second contribution of our paper consists of documenting several differences between these two companies that should be considered when interpreting any of the quantitative findings. First, we show that before-concession water-coverage trends and rural-to-urban migration patterns are radically different in both cities. Thus, relative changes in coverage levels between Quito and Guayaquil cannot be attributed to privatization. In addition, we have conducted an exhaustive institutional analysis of the two entities to measure both the external as well as internal management factors and show that these two entities face significantly different environments. These institutional differences alone may explain a large portion of the results obtained in the statistical analysis.

While it is tempting to compare water indicators between Quito and Guayaquil, it is clear that, through this exercise, the causal effects of water privatization on performance cannot be identified. To evaluate these causal effects further research is needed.

Table 1.
Ecuador, Income-Expenditure Surveys by Year and City, Descriptive Statistics³¹

	Year: 1994							
	Quito				Guayaquil			
	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max
Water services	0.94	0.24	0	1.00	0.82	0.39	0	1.00
Income	1.94	2.77	0	38.88	1.94	2.67	0	31.75
Share of expenses in alimentation	0.24	0.19	0	0.99	0.29	0.20	0	1.00
# household members	4.21	1.78	1	15.00	4.84	2.03	1	16.00
# members below age 5	0.53	0.75	0	4.00	0.61	0.81	0	5.00
Years of education head household	10.12	4.96	0	22.00	9.01	4.89	0	22.00
Observations	1737				1713			
	Year: 2004							
	Quito				Guayaquil			
	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max
Water services	0.97	0.16	0	1.00	0.80	0.40	0	1.00
Income	1.87	1.31	0	10.94	1.55	1.08	0	7.30
Share of expenses in alimentation	0.32	0.18	0	0.84	0.45	0.22	0	0.91
# household members	3.78	1.71	1	14.00	4.36	2.21	1	26.00
# members below age 5	0.43	0.68	0	3.00	0.59	0.85	0	6.00
Years of education head household	10.51	4.89	0	20.00	9.32	4.65	0	20.00
Observations	2460				2819			

³¹ *Water services* refers to the percentage of households that have access to a public water network; *income* is measured in terms of the number of representative baskets of goods and services (BGS) that a household could buy with its total earned income; *share of expenses in alimentation* is the percentage of total expenditure that a household spends toward alimentation; the *number of household members* and the *number of children below age five* are measured in units; and finally, the number of years of education of the head of the household includes all primary, secondary, and higher education.

Table 2.
Guayaquil: Before and after Privatization:
Probit Estimates of Access to Water Services
(Dependent variable equals 1 if household is covered)

Household's Percapita Income Quintile

	1		2		3		4		5	
	Coef.	Marginal Effect	Coef.	Marginal Effect	Coef.	Marginal Effect	Coef.	Marginal Effect	Coef.	Marginal Effect
Constant	0.047 (0.151)		-0.121 (0.170)		0.335 . (0.180)		-0.062 (0.207)		1.039 *** (0.265)	
Privatization fixed effect	-0.188 ** (0.083)	-0.066 ** (0.029)	-0.071 (0.090)	-0.023 (0.029)	-0.079 (0.106)	-0.019 (0.026)	0.115 (0.136)	0.018 (0.022)	-0.335 (0.212)	-0.022 . (0.012)
Number of household members	0.081 *** (0.021)	0.029 *** (0.007)	0.085 *** (0.025)	0.027 *** (0.008)	0.048 (0.030)	0.012 . (0.007)	0.176 *** (0.049)	0.027 *** (0.007)	0.032 (0.059)	0.002 (0.004)
Number of household members < age 5	-0.18 *** (0.045)	-0.064 *** (0.016)	-0.151 *** (0.055)	-0.049 *** (0.018)	-0.229 *** (0.074)	-0.057 *** (0.018)	-0.233 ** (0.113)	-0.036 ** (0.017)	-0.089 (0.177)	-0.006 (0.012)
Years of education head of household	0.038 *** (0.012)	0.013 *** (0.004)	0.066 *** (0.012)	0.021 *** (0.004)	0.065 *** (0.012)	0.016 *** (0.003)	0.074 *** (0.013)	0.012 *** (0.002)	0.071 *** (0.017)	0.005 *** (0.001)
Number of observations	1043		1006		913		851		719	

Standard errors in parenthesis

The covariance matrix was calculated using White Heteroskedasticity-Consistent Method

* significant at the 10% level

** significant at the 5% level

*** significant at the 1% level

Table 3.
Quito: Before and after Privatization:
Probit Estimates of Access to Water Services
(Dependent variable equals 1 if household is covered)

Household's Percapita Income Quintile

	1		2		3		4		5	
	Coef.	Marginal Effect								
Constant	0.42564 *		1.01087 ***		0.75649 ***		1.38973 ***		1.30379 **	
	(0.229)		(0.268)		(0.251)		(0.372)		(0.555)	
Privatization fixed effect	0.23372	0.03538 *	0.18475	0.01731	0.60336 ***	0.05366 ***	0.54841 **	0.02162 **	0.45211	0.0047
	(0.146)	(0.021)	(0.156)	(0.015)	(0.160)	(0.016)	(0.227)	(0.010)	(0.354)	(0.004)
Number of household members	0.04547	0.00719	-0.0546	-0.005	0.03193	0.00241	0.00501	0.00015	-0.0015	-1E-05
	(0.036)	(0.006)	(0.042)	(0.004)	(0.049)	(0.004)	(0.059)	(0.002)	(0.124)	(0.001)
Number of household members < age 5	-0.0998	-0.0158	-0.0211	-0.002	-0.2666 **	-0.0201 **	0.11061	0.00339	0.03342	0.00026
	(0.082)	(0.013)	(0.105)	(0.010)	(0.135)	(0.010)	(0.206)	(0.006)	(0.274)	(0.002)
Years of education head of household	0.10021 ***	0.01585 ***	0.10613 ***	0.00982 ***	0.07288 ***	0.0055 ***	0.04024	0.00123 *	0.08332 ***	0.00066 *
	(0.020)	(0.003)	(0.024)	(0.002)	(0.017)	(0.001)	(0.025)	(0.001)	(0.032)	(0.000)
Number of observations	704		740		834		893		1026	

Standard errors in parenthesis

The covariance matrix was calculated using White Heteroskedasticity-Consistent Method

* significant at the 10% level

** significant at the 5% level

*** significant at the 1% level

Table 4.
Changes in Water Quality during the Past Six Years
(Dependent variable: Has the quality of water improved, remained constant,
or decreased during the past six years?)

	LinearRegression			Ordered probit		
	(1)	(2)	(3)	(1)	(2)	(3)
Constant	2.838 *** (0.039)	2.846 *** (0.046)	2.959 *** (0.145)			
Guayaquil fixed effect	0.046 (0.035)	0.021 (0.077)	0.021 (0.079)	0.091 (0.070)	0.04 (0.151)	0.041 (0.155)
Household belongs to income quintile No 1	0.118 ** (0.059)	0.072 (0.093)	0.068 (0.098)	0.233 ** (0.117)	0.142 (0.185)	0.135 (0.193)
Household belongs to income quintile No 2	0.082 (0.057)	0.043 (0.079)	0.04 (0.086)	0.161 (0.113)	0.085 (0.154)	0.082 (0.167)
Household belongs to income quintile No 3	-0.012 (0.050)	-0.056 (0.069)	-0.054 (0.073)	-0.03 (0.099)	-0.12 (0.137)	-0.116 (0.143)
Household belongs to income quintile No 4	-0.045 (0.052)	-0.005 (0.068)	-0.005 (0.070)	-0.092 (0.103)	-0.013 (0.135)	-0.014 (0.138)
Guayaquil and household income quintile No 1		0.078 (0.124)	0.083 (0.124)		0.157 (0.245)	0.166 (0.246)
Guayaquil and household income quintile No 2		0.082 (0.116)	0.096 (0.119)		0.161 (0.229)	0.189 (0.234)
Guayaquil and household income quintile No 3		0.091 (0.102)	0.092 (0.103)		0.187 (0.202)	0.189 (0.203)
Guayaquil and household income quintile No 4		-0.09 (0.106)	-0.089 (0.107)		-0.178 (0.209)	-0.176 (0.210)
Household demographic variables ^a	No	No	Yes	No	No	Yes
Number of observations	1131	1131	1131	1131	1131	1131
R2	0.01	0.02	0.02			

Standard errors in parenthesis

The covariance matrix was calculated using White Heteroskedasticity-Consistent Method

^a Demographic variables include: the number of children (age 5 and younger) in housing unit,
head of household's age, gender, education, marital status, and employmet status.

* significant at the 10% level

** significant at the 5% level

*** significant at the 1% level

Table 5.
Changes in Water Continuity during the Past Six Years
 (Dependent variable: Has the amount of time when water services are available increased, remained constant, or decreased during the past six years?)

	Linear Regression			Ordered probit		
	(1)	(2)	(3)	(1)	(2)	(3)
Constant	2.839 *** (0.035)	2.852 *** (0.039)	2.889 *** (0.145)			
Guayaquil fixed effect	0.054 (0.037)	0.015 (0.075)	0.026 (0.079)	0.101 (0.071)	0.039 (0.145)	0.06 (0.152)
Household belongs to income quintile No 1	0.081 (0.063)	-0.076 (0.097)	-0.089 (0.098)	0.155 (0.121)	-0.139 (0.187)	-0.168 (0.190)
Household belongs to income quintile No 2	0.114 ** (0.057)	0.108 (0.075)	0.1 (0.079)	0.225 ** (0.110)	0.221 (0.147)	0.206 (0.154)
Household belongs to income quintile No 3	0.066 (0.051)	0.015 (0.064)	0.012 (0.069)	0.13 (0.100)	0.037 (0.127)	0.032 (0.135)
Household belongs to income quintile No 4	-0.025 (0.049)	0.017 (0.061)	0.011 (0.062)	-0.049 (0.095)	0.038 (0.118)	0.027 (0.120)
Guayaquil and household income quintile No 1		0.244 * (0.132)	0.245 * (0.133)		0.451 * (0.253)	0.456 * (0.255)
Guayaquil and household income quintile No 2		0.025 (0.117)	0.025 (0.120)		0.034 (0.225)	0.036 (0.230)
Guayaquil and household income quintile No 3		0.11 (0.106)	0.106 (0.109)		0.196 (0.206)	0.189 (0.211)
Guayaquil and household income quintile No 4		-0.094 (0.104)	-0.098 (0.106)		-0.195 (0.201)	-0.205 (0.205)
Household demographic variables ^a	No	No	Yes	No	No	Yes
Number of observations	1131	1131	1131	1131	1131	1131
R2	0.01	0.02	0.02			

Standard errors in parenthesis

The covariance matrix was calculated using White Heteroskedasticity-Consistent Method

^a Demographic variables include: the number of children (age 5 and younger) in housing unit, head of household's age, gender, education, marital status, and employment status.

* significant at the 10% level

** significant at the 5% level

*** significant at the 1% level

Table 6.
Changes in Water Pressure during the Past Six Years
 (Dependent variable: Has the pressure of water improved, remained constant,
 or decreased during the past six years?)

	Linear Regression			Ordered probit		
	(1)	(2)	(3)	(1)	(2)	(3)
Constant	3.018 *** (0.039)	3.044 *** (0.045)	3.01 *** (0.176)			
Guayaquil fixed effect	-0.1 ** (0.039)	-0.177 ** (0.082)	-0.166 . (0.085)	-0.171 ** (0.067)	-0.305 ** (0.142)	-0.287 ** (0.145)
Household belongs to income quintile No 1	0.022 (0.069)	-0.105 (0.095)	-0.105 (0.099)	0.038 (0.117)	-0.182 (0.164)	-0.182 (0.170)
Household belongs to income quintile No 2	-0.039 (0.060)	-0.135 . (0.077)	-0.134 . (0.081)	-0.068 (0.102)	-0.233 . (0.132)	-0.233 . (0.139)
Household belongs to income quintile No 3	-0.074 (0.056)	-0.101 (0.073)	-0.1 (0.076)	-0.127 (0.096)	-0.175 (0.125)	-0.173 (0.131)
Household belongs to income quintile No 4	-0.124 ** (0.056)	-0.099 (0.070)	-0.097 (0.071)	-0.214 ** (0.096)	-0.171 (0.120)	-0.168 (0.121)
Guayaquil and household income quintile No 1		0.221 (0.138)	0.21 (0.140)		0.382 (0.237)	0.363 (0.241)
Guayaquil and household income quintile No 2		0.208 . (0.123)	0.208 . (0.125)		0.357 . (0.211)	0.358 . (0.214)
Guayaquil and household income quintile No 3		0.08 (0.116)	0.069 (0.117)		0.138 (0.199)	0.12 (0.201)
Guayaquil and household income quintile No 4		-0.044 (0.117)	-0.056 (0.117)		-0.075 (0.200)	-0.096 (0.200)
Household demographic variables ^a	No	No	Yes	No	No	Yes
Number of observations	1131	1131	1131	1131	1131	1131
R2	0.01	0.02	0.02			

Standard errors in parenthesis

The covariance matrix was calculated using White Heteroskedasticity-Consistent Method

^a Demographic variables include: the number of children (age 5 and younger) in housing unit,
 head of household's age, gender, education, marital status, and employment status.

* significant at the 10% level

** significant at the 5% level

*** significant at the 1% level

Table 7.
Migration Patterns in Quito and Guayaquil
Answer to the question: Where did you live in January 1999?
(ENDEMAIN 2004)

		Consumption quintile					
		1	2	3	4	5	Overall
Quito	Number of Respondents	290	389	416	580	580	2,255
	% Lived in same city	78%	86%	86%	90%	95%	88%
	% Lived somewhere else	22%	14%	14%	10%	5%	12%
Guayaquil	Number of Respondents	203	433	541	500	375	2,052
	% Lived in same city	92%	92%	98%	97%	93%	95%
	% Lived somewhere else	8%	8%	2%	3%	7%	5%
Difference in migration rates between Quito and Guayaquil		0.145 (0.031)	0.058 (0.022)	0.121 (0.018)	0.074 (0.014)	-0.013 (0.016)	0.070 (0.008)

Source: ENDEMAIN 2004
Standard errors in parenthesis

Table 8.
Management Indicators from Guayaquil's and Quito's Water Companies

Indicator	Guayaquil		Quito	
	Before concession	Actual	1996	Actual
Number of employees / 1,000 connections	9.4	3	7.1	6.1
Percent of water lost due to leaks in the system or non-payment	79%	68%	Not Available	30%
Payment rate	50% (1996) 76% (2001)	84%	62%	79%
Percent connections with meters	24%	49%	67%	97%

Source: EMAAP-Q and Interagua.

Figure 1.
Likelihood of Having Access to Water Services in Guayaquil in 2004 Relative to 1994
(Before and after privatization)
(90% confidence interval)

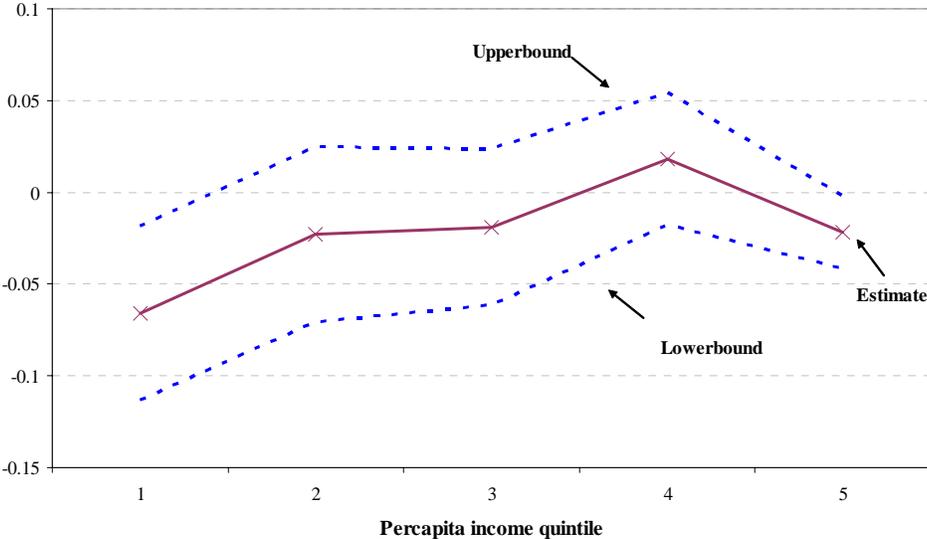
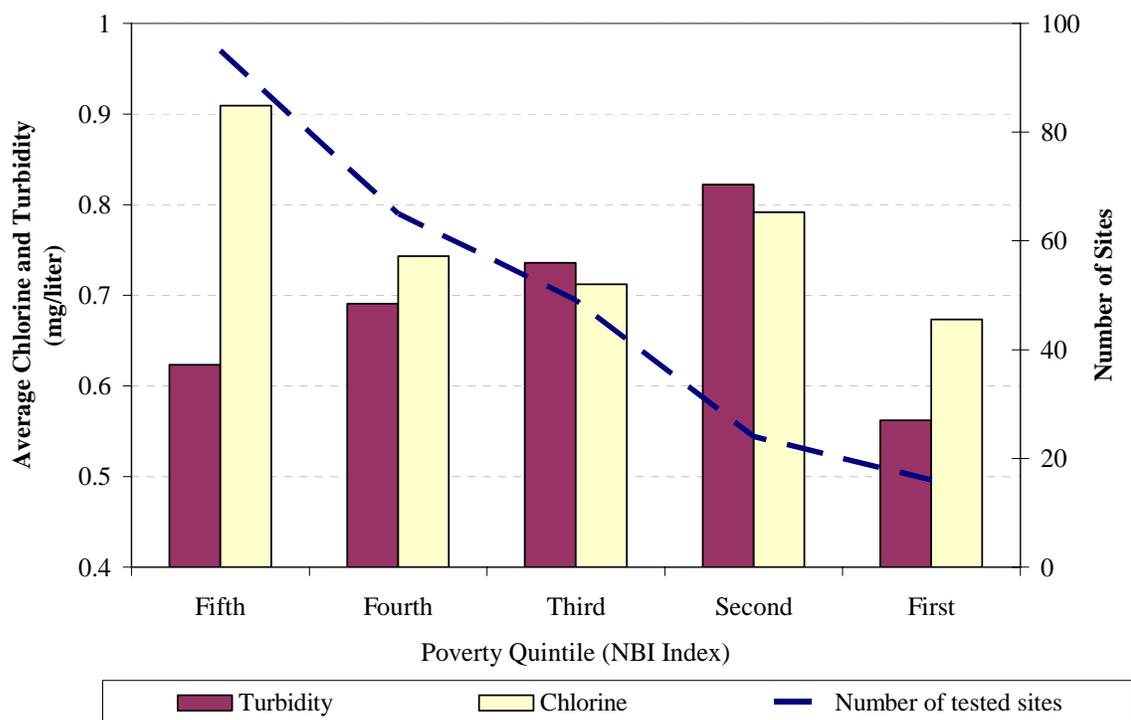


Figure 2.

Average Chlorine and Turbidity by Poverty Level and Number of Tested Sites



Source: Chemical composition of water was drawn from ECAPAG water samples. Poverty data come from the 2000 Census. Poverty was measured using a poverty index based on the infrastructure of the household dwellings. The index is called NBI (“Necesidades Básicas Insatisfechas”).

Figure 3.
Price of Water Services in Quito and Guayaquil
(US dollars)

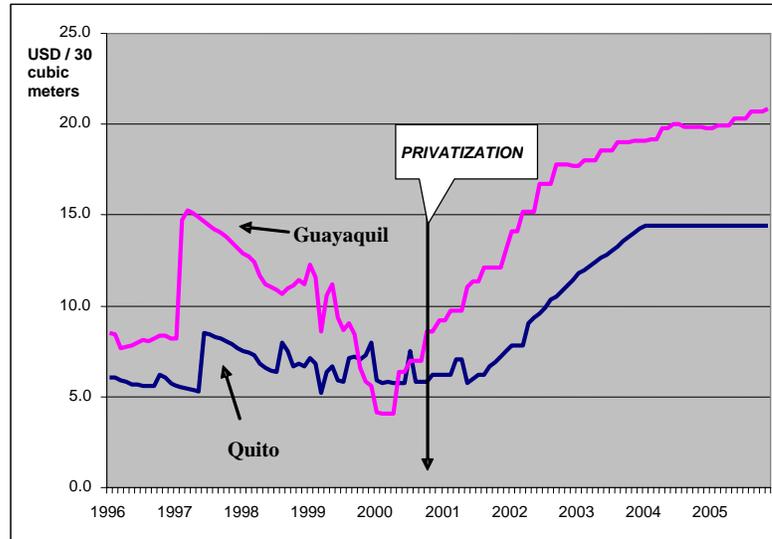


Figure 4.
Index of the Price of Water Services in Quito and Guayaquil in Real Terms
(Consumer Price Index Adjusted)

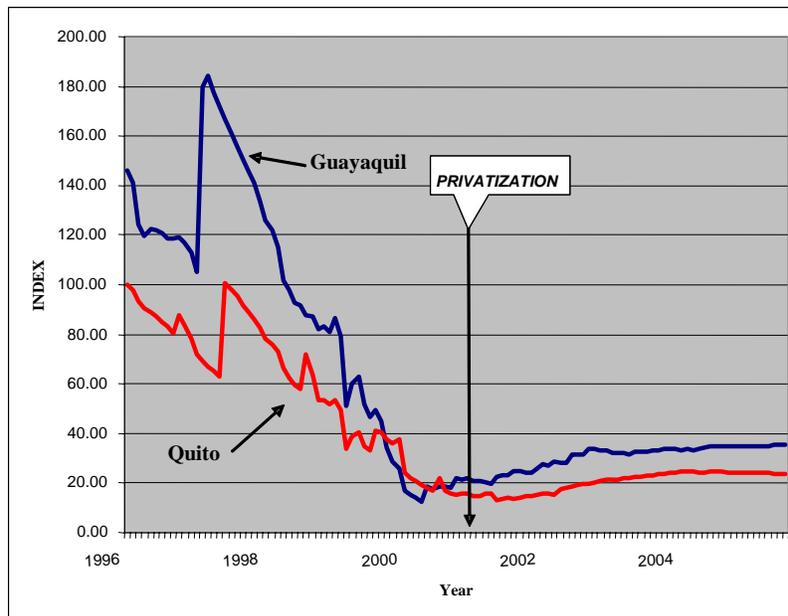
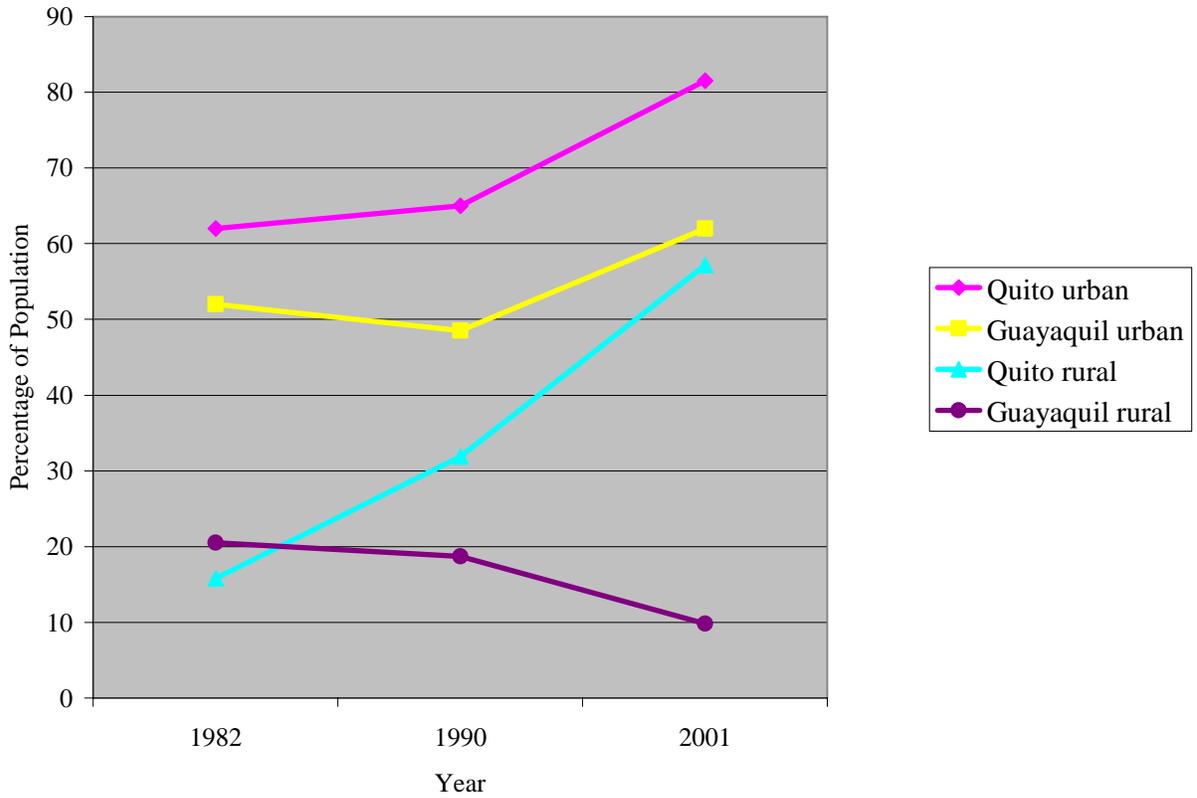


Figure 5.
Water Source from a Public Network and Inside the Household, 1982-2001



Source: Population and Housing Census. Rural and Urban definitions are according to the Ecuadorian Census.

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Appendix 1: Interviews and Focus Groups

Interviews:

Andrade, E. Gerente Financiero, EMAAP-Q. Interview conducted on November 8, 2005.

Cardenas, C. Director, Observatorio Ciudadano de Servicios Públicos. Interview conducted on December 14, 2005.

Carpio, M. Director de Planificación and Gerente de Desarrollo Institucional, EMAAP-Q. Interview conducted on October 26, 2005.

Cevallos, J. Jefe de Producción, EMAAP-Q. Interview conducted on November 9, 2005.

Espinoza, C. Director de Control y Regulación Económica, ECAPAG. Interviews conducted on November 17, 2005, and on March 17, 2006.

Guamán, F. Jefe de Departamento de Servicio al Cliente, EMAAP-Q. Interview conducted on November 11, 2005.

Ojeda, F. and V. Parreno. Jefe del Departamento de Producción y Director del Laboratorio Central de Calidad, EMAAP-Q. Interview conducted on November 25, 2005.

Quelal, E. Jefe del Departamento de Cartera y Cobranzas, EMAAP-Q. Interview conducted on November 10, 2005.

Rodriguez, M. Jefe Administrativo y Financiero, ECAPAG. Interview conducted on November 18, 2005.

Rodríguez, O. Jefe del Departamento de Obras de Desarrollo Solidario, EMAAP-Q. Interview conducted on November 10, 2005.

Santos, J.L. Gerente General, ECAPAG. Interview conducted on August 16, 2005.

Suardi, M. and F. Chang. Interagua. Interview conducted on November 18, 2005.

Vera, H. Analista Superior de Inversiones y Obras, ECAPAG. Interview Conducted on December 28, 2005.

Focus Groups Conducted in Guayaquil:

- *Mapasingue* *November 26, 2005*
- *Cooperativa 5 de Diciembre/Pascuales* *November 26, 2005*
- *Guasmo Sur—Cooperativa Marioxi Febres Cordero* *December 3, 2005*
- *Batallón de Suburbio* *December 4, 2005*