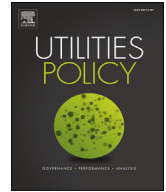




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Technical efficiency in Chile's water and sanitation providers

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ABSTRACT

Chile achieved universal levels of coverage in water, sewerage and wastewater treatment in urban areas. The providers show complete cost recovery, universal metering and diminishing consumption. But investments in Non-Revenue Water control have been deemed insufficient. We explore the sector's comparative technical efficiency, in recent years, and address new challenges related to Non-Revenue Water reduction. We find that a 10 percent reduction in Non-Revenue Water implies a 2.6 percent increase in the input vector. Regulators can induce providers to invest more by recognizing the increased costs, and influence efficiency gains sharing with clients, including automatic coefficients in the rate formula.

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1. Introduction

Chile's water and sanitation (W&S) sector has made a significant effort in both investments and institutionalization over the last four decades, attaining universal levels of water and sewerage coverage for the urban population, and nearly universal wastewater treatment levels. The sector achieved a full cost recovery, universal micro-metering and the progressive control of volumes consumed.¹ It represents a very interesting case study regarding the objectives of service universalization, cost recovery, the rationalization of consumption and environmental improvement, occurring together with major changes in the political regime. A critical view of the regulatory mechanism used (model or referential company) shows that it does not solve the asymmetry of information in favor of the regulated company. Additionally, the sector's observers have highlighted the relatively low investments in network maintenance, the stagnation in Non-Revenue Water (NRW) control, and the concentration of company ownership in a few groups, who have achieved cost synergies and economies of scale, which have not

been transferred to consumers in the form of lower rates.

In this paper we intend firstly to determine the comparative technical efficiency of the providers and its drivers; secondly, to analyze the evolution of technical efficiency over time, exploring the possibility of transferring efficiency gains to consumers (through an X-Factor); and thirdly to determine a possible path to increase maintenance investments with the aim of reducing NRW (through a K-Factor).

Based on a sample of 18 Chilean providers of water and sewerage for the period 2005–13, we computed an input distance function through a stochastic frontier analysis (SFA). We performed a True Random Effects (TRE) model to control for possible unobserved heterogeneity between providers. We use the results to measure the phenomena under study, and to give support to policy suggestions.

In so doing, we have organized the paper in seven sections. After this Introduction, Section 2 reviews the literature and establishes some facts about the sector's history and evolution. Section 3 discusses the method of analysis and the model to be estimated. Section 4 presents our database. Section 5 discusses the results. Section 6 presents some policy considerations and Section 7 concludes.

2. Evolution of the Chilean water and sanitation sector

2.1. A recent history of the Chilean water and sanitation sector

In 1931 the General Directorate of Drinking Water and Sewerage in the Ministry of the Interior was created to promote the

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¹ Coverage went from 77% to 99% in water, from 43% to 96% in sanitation and from 0% to 100% in sewerage treatment, comparing the years 1975 and 2013 (Alé Yarad, 2013). Cost recovering with tariffs went from 10% in 1973 to 100% in 2000 (Gómez-Lobo, 2001). Between 2000 and 2012, the sector invested on average US\$ 270 million per year (Espinosa Sarría, 2014; Ebensperger, 2012).

institutional development of the country's sanitation sector (Salazar, 2000). In 1953 the Directorate of Waterworks (DOS) was established to carry out the study, planning, construction, repair, administration and provision of facilities for potable water and sewerage, implying a partial unification of the supervision of the sector (Ebensperger, 2012). The DOS joined the Department of Hydraulics of the Ministry of Public Works and the Directorate General of Drinking Water of the Ministry of the Interior (Salazar, 2000). In 1973, 74 percent of the financing came from fiscal resources, 16 percent was external and only the remaining 10 percent was derived from rates. Most of the spending targeted investments to expand coverage, whereas expenditure on maintenance fell below 15 percent. Between 1968 and 1973, the personnel increased from 3800 to 13,500 (Fischer and Serra, 2007).

In 1977 SENDOS² was created as the single state agency (rural and urban) for the operation and maintenance of sanitation systems, also acting as the regulatory and supervisory body under the Ministry of Public Works. The State funded investments and there was a system of tariffs based on cross-subsidization between regions without considering the costs of providing the service. This system operated centrally in the area of investment planning, resource allocation and pricing, the regional SENDOS providing only operational services (Sistema de Empresas, 2006). Its headquarters operated in 11 of the 13 regions and there were two autonomous state-owned companies in the remaining regions: EMOS³ (today Aguas Andinas, in the Metropolitan Region) and Esva (in the Valparaíso Region), all under the Ministry of Public Works (Ebensperger, 2012; Sistema de Empresas, 2006; Alfaro, 2009). By 1979 SENDOS's personnel had been reduced to approximately 3000 employees (Fischer and Serra, 2007).

In 1988 a law for Sanitation Services (Decree with the force of Law 382) was passed, giving autonomy to the providers. With this, the two regional companies became subsidiaries of CORFO,⁴ which is the governmental agency for economic and industrial development, acting as a holding company of public enterprises (Fischer and Serra, 2007). They also began to implement efficient rates and self-financing criteria. The Law sets the rules for the operation of the sanitation providers, the conditions in which they must provide the services and the regime of concessions that they operate, Supreme Decree 121 in 1992 (Alegria Calvo and Celedón Cariola, 2006).

In 1989 the new institutional framework for the sector was established with the separation of the roles of producer (in charge of the companies) and regulators (in charge of the SISS⁵). The SISS was created by Law 18,902 in 1990 (Gómez-Lobo, 2001) and constituted an essentially technical, regulatory and supervisory body (Alegria Calvo and Celedón Cariola, 2006). In 1998 the SISS was granted greater authority and a higher budget (Espinosa Sarría, 2014). The SISS is responsible for setting rates, conducting studies and overseeing the sector. The SISS is intended to be autonomous of the political power, although its chairman is appointed and can be removed at any time by the president, and its budget is voted by the congress. Hierarchically, the Superintendent depends on the Ministry of Public Works. Funding comes from the national budget (Gómez-Lobo, 2001). The Decree with the force of Law 70 of the Ministry of Public Works (General Law on Rates) sets down the

procedures and standards to determine tariffs (Alegria Calvo and Celedón Cariola, 2006). Until January 1990, the Ministry of Economy determined the tariffs, which then fell under the responsibility of the SISS. Law 18,778 in 1989 established a direct subsidy for consumption, awarded by the State through the municipalities, allowing the tariffs to reflect private supply costs. In practice, the subsidy covers discounts on the invoice for 15 percent of the users.

In the 1990s EMOS (today Aguas Andinas), Esva, Essal and Esva were privatized, although the State retained a minority stake in the property. In the mid-1990s the former SENDOS regional companies were transformed into eleven corporations, all subsidiaries of CORFO (Sistema de Empresas, 2006). Initially, three state-owned companies sold strategic participations to private consortia with experience in the water industry. After that, from 1998 to 2000, a significant part of the capital of the main Chilean water and sanitation providers was privatized. In 2001, the Chilean Government decided to transfer to the private sector, for a fixed term, the remaining companies (Molinos-Senante et al., 2015). In 2011, the State sold the shares it held in all of the privatized enterprises, except for a 5-percent participation in the hands of CORFO, allowing it to choose a director and wield veto rights for some decisions (Golden Share). In 1998 Law 19,549 amended the legislation and regulatory framework of the sector, introducing limits on the ownership structure to prevent an excessive concentration in the sector both at the horizontal and sectoral levels (Gómez-Lobo, 2001).

Privatization was motivated by the need to count with private financing for investment projects in wastewater treatment. In 1995, and owing to the country's decision to open up to the world economy through free trade agreements, which demanded health and environmental obligations that Chile did not meet in export products, a policy priority was given to wastewater treatment (Alegria Calvo and Celedón Cariola, 2006). For its part, the change in the privatization model – moving away from perpetual concessions to 30-year agreements, opening 10 percent of the capital in the stock market and up to 10 percent of the shares for purchase by the employees – was partly influenced by the view that the regulatory framework was still too precarious to regulate these companies successfully (Gómez-Lobo and Vargas, 2002). The privatizations implied the collection of US\$ 2500 million and between 2000 and 2012 the industry invested US\$ 3561 million in various infrastructure works, mainly for wastewater treatment (Espinosa Sarría, 2014; Ebensperger, 2012).

Table 1 shows the evolution of the water coverage that 50 years before had reached just half of the population and of sewerage coverage that had reached only a quarter. It is currently universal in both services. In addition, the universalization of wastewater treatment was achieved.

Rural providers covering 11 percent of the population are organized into cooperatives and do not require concessions granted by the SISS, while urban areas are covered by concessions granted

Table 1
Coverage evolution (in percent of the population).

Year	Drinking water	Sewerage	Wastewater treatment
1965	53.5	25.4	0
1970	66.5	31.1	0
1975	77.4	43.5	0
1980	91.4	67.4	0
1985	95.2	75.1	0
1990	97.4	81.8	8.0
1995	98.6	89.4	14.0
2000	99.6	93.1	20.9
2013	99.8	96.1	100.0

(Source: Alé Yarad, 2013.)

² Servicio Nacional de Obras Sanitarias (National Service of Water Works).

³ Empresa Metropolitana de Obras Sanitarias (Metropolitan Water Works Company).

⁴ Corporación de Fomento de la Producción (Corporation for Production Development).

⁵ Superintendencia de Servicios Sanitarios (Sanitation Services Superintendency).

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