Privatization and Renationalization: What went Wrong in Bolivia's Water Sector?[1]

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Abstract

This paper investigates the concentration of access to safe water across income levels in Bolivia. In particular, it focuses on how privatization has changed coverage, affordability and concentration of access to water to the poor. We compare the performance of two privatized cities (La Paz and El Alto) with a cooperative managed (Santa Cruz de la Sierra) and a publicly provided one (Cochabamba). We examine the pre- and post-privatization periods. Close inspection of the household surveys reveals that access to water by low-income consumers increased during the periods of provision under private concessions. Coverage has expanded significantly in the bottom quintiles of the population in the privatized cities, translating into a more equitable access to water. The state, however, renationalized the water utility. What went wrong then in Bolivia's water sector? The answer is that the private concessionaire failed to meet the consensual targets stipulated in the contract. The tariff increases required for full cost-recovery has eventually led to public outrage and forced the government to terminate the contract.

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1 Introduction

According to UNDP's *Human Development Report 2006,* over 1 billion people in the world live in extreme water deprivation. The report also stated that "not having access to water and sanitation is a polite euphemism for a form of deprivation that threatens life, destroys opportunity and undermines human dignity" (UNDP, 2006, p. 5). International concerns about access to water have long been acknowledged. The Millennium Development Goals (MDGs) have targeted halving the proportion of people without access to safe drinking water until 2015.[2]

While a right by itself, access to water contributes to the achievement of the remaining seven MDGs. It reduces child mortality and combats diseases. It empowers women by freeing them from the burden and dangers of carrying water, and enables higher schooling rates -

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[2] At the UN Water Conference at Mar del Plata, in 1977, governments agreed on including the target of providing safe drinking water and basic sanitation to all by 1990. At the World Summit for Children, in 1990, the target for universal access was set to year 2000.

children frequently skip classes due to illness or for helping their mothers on fetching water. Moreover, in rural areas access to water can help to eradicate hunger by improving crop irrigation.

Safe access to water is defined as "the availability of at least 20 litres per person per day from an improved source within 1km of the user's dwelling" (WHO and UNICEF, 1990). This is the minimum amount required to cover drinking and hygiene needs. When including bathing and laundry, the consumption threshold reaches 50 litres a day.

Not only quantity of water consumption is important, but also the distance from the water source. It is women and children who are mostly hurt by the long distances combined with the heavy weights of fetching water (Costa et al., 2009). For instance, a household with five members, living strictly on the water poverty line and one kilometre away from the water source, require 100 litres to be carried daily. The several trips and hours of this hard physical work often force households to consume below the water poverty line, apart from constraining adults to dedicate such time to income generating activities. As a consequence, the vicious circle of diseases, poor education, and low human development remains unbroken.

From a human development perspective, having access to improved water sources is the most favourable objective. Improved means water in enough quantity, of reasonable quality and as close to the dwelling as possible. Piped water, through in-house connections, is the sort of access which better fulfils the improved water requirements. The quality of the water from a utility provider is the most reliable and *per unit* price from utility companies is cheaper than that of alternative sources (UNDP, 2006; Israel, 2007; Komives, 1999). For the water utility, the marginal cost of delivering water to an additional (already connected) household is minimal. Usually, where a water grid exists, the largest barrier for the poor is the connection fee.

Water privatization has been a polemic topic in Latin America, leading to a series of political debates, protests, and even riots.[3] This paper aims to contribute to the growing literature through evaluating the performance of the water sector under private concession in Bolivia. We chose Bolivia because of the early termination of privatization contracts and the renationalization of the water sector in La Paz and El Alto cities. Other large Bolivian cities operate their water utilities in different schemes: cooperative (Santa Cruz) or public provision (Cochabamba).

The research in this paper is guided by three questions: *Did privatization increase access to safe water for the poor in Bolivia? How affordable was water during privatization?* And *what was the reason for the early termination of the private contracts?*

Close inspection of the household surveys reveals that, under private concessions, access to water by low-income consumers increased. Coverage has significantly expanded, particularly for the bottom quintiles of the population. We certainly see an improvement and equitable access to water. These findings would imply a successful privatization. But there is more to the story. When the concession contracts were drafted, the government and the private company agreed on consensual targets for increasing coverage. The targets were installing 71,752 new water connections in La Paz and El Alto by December 2001, being 25

[3] The term *privatization* refers, in this paper, to any involvement of the private sector in the provision of basic utilities.

per cent of the target to be reached annually. This target translates into universal access in the city of La Paz and 82 per cent coverage in El Alto.

The private company was successful in increasing coverage in the poorest areas, mainly because high-income areas already have high coverage rates. It made sense to expand services in the poorest areas for meeting the targets set in the contract. But the company has failed to achieve the agreed targets. The cost recovery limits have been reached. Those who could afford the tariffs and connection fees have already been covered and the opportunity no longer existed to exploit further provision on cost recovery basis. When the company pressed the limits, public outrage was the result. Eventually, the failure to meet legally binding targets and public anger prompted the government to terminate the contract and renationalize the utilities.

The rest of the paper is structured as follows: Section 2 introduces the general debate on water sector privatization and discusses water pricing. It also presents facts on the water sector in Bolivia. Section 3 describes the methodology and data used in the empirical analysis. The results in Section 4 are split into three parts: the analysis of coverage expansion along the income distribution curve, the concentration of access to water, and the evolution of water expenditure after privatization. The renationalization of the Bolivian water sector is discussed in the concluding remarks (Section 5).

2 Water Sector Privatization: The Debate

There are several forms of private participation in the provision of basic utilities (Table 1). In the water sector, the most popular are the concession contracts. Governments maintain ownership of infrastructure and, through a public bidding process, transfer to the private sector responsibilities for management, service provision and investments during a concession period. When the contracts expire, provision duties return to the public sector, ideally with improved management and infrastructure.

Table 1: Modalities of Private Participation in the Water Sector

Contract modality	Term length	Private companies' responsibility[b]	Asset ownership	Investment duty
Service	1-2 years	SS	public	public
Management	3-5 years	M,O	public	public
Build-Operate-Transfer (BOT)	by product[a]	SC	public	private
Build-Operate-Own (BOO)	by product[a]	SC	private	private
Lease	10-20 years	M, O	public	public
Concession	20-30 years	M, O, I	public	private
Partial divestiture	unlimited	M, I, R	mixed	mixed
Full divestiture	unlimited	M, O, I, R	private	private

Notes: [a] The contract does not follow a specific deadline but, instead, it is finished upon the successful delivery of the product. [b] SS: specific service; M: maintenance; O: operations; SC: infrastructure specific construction; I: investment; R: revenue collection.
Source: Elaborated by the authors.

Private participation in the water sector involves risks and uncertainties. Exceeding expected costs enhance construction risks, uncertainty on demand raises commercial risks, high interest rates and exchange volatility generate financial risks, an uncertain regulatory environment creates regulatory risks, and, finally, political instability and assets expropriation compose political risks (see Bayliss, 2009). Risks and uncertainties increase costs of capital in poor developing countries compared to rich ones. Thus, advocates of privatization argue that, to achieve the desired rates of return, the private sector requires higher average tariffs in order to participate in the market (Estache, 2006).[4] Nevertheless, if the public sector operated well in the pre-privatization period, few structural adjustments are needed and the transaction costs and risks are minimized. Transparency before the concession is also said to lessen expectations and risks, and helps gather political support and confidence of final consumers. But the rule of thumb should be: if the utility is operating well, there is no need for privatization, given the aforementioned risks.

As Estache (2006) observes, Latin America's experience has shown that building up support, as opposed to just reforming by decree, is a key component to the effectiveness of reforms: without popular support, privatization might lead to conflicts. Protests against water privatization already happened in Cochabamba, Bolivia, in 2000; led to Uruguay's Water Referendum and Constitutional amendment in 2004; and protests were evident during the World Social Forum held in Caracas in 2006.

Regulation has been advocated as a necessary bargaining process which strikes a "balance between providing private companies with the incentives to invest and operate efficiently, and protecting the interests of other social and economic actors" (Rees 1998, p. 8). A strong regulator is seen as desirable to reduce risks for private investors, at the same time that it defends the interests of the final consumers regarding the concession commitments on coverage expansion, investment targets and price levels. A solid regulation also makes the concession bid more competitive by attracting more private candidates.

Supporters of privatization defend that the private sector participation improves water provision through large investments in maintenance, network expansion and excellence on delivery. Managerial efficiency comes from higher billing collection, reduced personnel per production, and lower rates of unaccounted-for-water (the water lost between production and delivery). They blame the public sector as naturally inefficient: (i) utility monopolies ignore competitive market incentives; (ii) public companies are subject to short run political interventions; and (iii) they are accountable to their own (government) interests and not to final consumers, who are left with limited channels to express their demands. Moreover, supporters believe that if investments target low-income and under-supplied areas, privatization is expected to foster development and to have a positive distributional impact (Kikeri and Nellis, 2004).

But there is scepticism on whether profit oriented concessionaires really invest on

[4] Urban water provision is regarded as a natural monopoly: it has significant infrastructure sunk costs, high fixed costs and large economies of scale. The utility supply chain comprises several activities, where only infrastructure building and plumbing services are competitive ones – that is, activities for which there can be a market, and where many companies can participate in grid construction and maintenance.

coverage expansion. Apart from operational efficiency, there is no reason to believe that private monopolies will better serve the users than public monopolies. In fact, the opposite may happen if regulation is not enforced, which is the case in most developing countries. When facing an inelastic demand, private monopolies have higher incentives than a public monopoly (with a social planner) to undersupply, to increase prices, under invest and provide low quality services.

Sceptics argue that due to lack of market incentives, concessionaires will not expand the water grid to low-income areas (Bayliss and Kessler, 2006). Serving the poor is hardly profitable for the utility: the high incidence of illegal connections and the low purchasing power of households in slum neighbourhoods hinder cost recovery and discourage private investment. Thus, companies tend to withdraw from non-profitable geographical markets. Moreover, when governments assume the new role of regulator, this might be poorly performed particularly if privatization is a new experience. For instance, the enforcement mechanisms devised can be insufficient to make the private utility comply with contractual obligations. In addition, private companies might capture the regulatory agency, preventing governments from fulfilling their regulatory role.

Another possible negative effect of privatization concerns inequality. Reducing companies' personnel results in job cuts, which affect mostly the poor and the middle classes (Birdsall and Nellis, 2003). In addition, privatized utilities often remove "illegal connections" and force poor households off "free" piped supply. The search for profits requires full cost recovery, which tends to increase water tariffs affecting the poor harshly and directly (Dagdeviren and Hailu, 2008).

2.1 Water pricing and the poor

There are three main reasons why poor households lack access to piped water: the network utility does not reach their neighbourhood[5]; they cannot afford the initial investment in the network connection; or they do not have enough income to monthly pay for the services.

Poor households without access or connection to the water grid have to rely on alternative sources of water such as pipe trucks, private wells, kiosks and bottled water. Paradoxically, the private alternative market overcharges. Their *per unit* price of water is five to ten times higher than the price charged to households provided with in-house piped water (UNDP, 2006; Israel, 2007). For the poor, water bills can easily surpass the affordability threshold of 3 per cent of their total income.

The supply chain of water in the private alternative market consists of several stages: collecting water in the source (usually a tap connected to the utility network), packing bottles or containers, and distributing it to a water vendor or "reseller". This will eventually bring water to the final consumers into suburbs and slums, using pipe trucks, donkey-drawn carts or even bicycles. Not to mention that the quality of water is not guaranteed.

[5] Or households may not meet the legal requirements for having piped water installed, such as proof of land ownership and legal property right over the dwelling (Dagdeviren and Robertson, 2009).

There are various mechanisms to connect poor households to safe water connections. Progressive *block tariffs* can be set according to geographical regions, consumer category, or quantity consumed. Each consumer pays according to their own characteristics, in contrast to the *flat rate* where all users face the same tariff. In a geographical block tariff scheme, households living in rich areas subsidize the consumption of the ones in poorer neighbourhoods. High-income consumers pay tariffs higher than the cost of providing water, whereas their low-income counterparts pay less than this cost.[6] Another method is the consumer category scheme, which differentiates tariff blocks between household consumers, industrial consumers and others. The quantity scheme sets progressive tariffs according to the volume of water consumed (Whittington, 1992).

Progressive block tariffs are only efficient if the poor households are in fact connected to the utility network. If they are not, progressive block tariffs can harm the poor even deeper. Vendors usually resell tapped water collected from the utility network. In a quantity block scheme, vendors take large amounts of water from the utility to pack and resell. The poor re-buying this water will end up paying the upper block tariffs. The high initial cost of water is directly forwarded to the poor, together with the value added in the supply chain between the water source and the final consumer. Hence, the price of water in the utility determines the benchmark prices for vendors and has an important impact on poor households – even if those are not connected to the utility network.

Another issue is the sustainability of cost recovery. The poor are harmed by full cost-recovery schemes, particularly related to connection fees or higher tariffs, thus hindering universal access to water. Full cost recovery ends up compromising the expansion of network provision to low-income areas. Insufficient demand among low-income groups will not often cover the fixed costs. Providing water only to the households who can afford it is unprofitable for firms and therefore the low-income neighbourhood tends to be unsupplied (Brown, 2009). If the water utility is not obliged to expand the water grid, or if legal enforcement fails, poor households will remain excluded from access to piped water.[7]

Lower tariffs from a higher operational efficiency of utilities are unlikely to benefit the poor. Evidences of decreasing water prices after privatization are seldom found. Obligations with shareholders and the taste for profit make it difficult to decrease tariffs. It is also common that governments adjust prices upward before privatization in order to make the utilities more attractive for the private sector. A way of trying to minimize tariffs to the final consumers is setting a low-tariff bid modality in the bid competition for the utility. The concession is granted to the company willing to provide the services at the lowest cost.

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[6] Geographic cross-subsidies based on broader regions, such as inter-cities, are very sensitive to privatization processes. Private companies are mostly interested in profitable areas making the cities which are the source of revenues surpluses more likely to be privatized. As a consequence, the amount destined to subsidies declines, having a negative impact on the tariff structure of all other connected cities.

[7] Yepes (1999) supports cost-sharing and criticizes cross subsidies on the grounds that welfare losses may be caused by different elasticities of high and low income consumers. He argues that prices should be uniform across consumers, except in case provision costs vary. But still, he admits that full cost recovery could exclude the provision to the poor and discusses alternative subsidy schemes, not through tariffs.

2.2 The water sector in Bolivia: privatization and renationalization

During the 1990's, supported by the World Bank and foreign donors, privatization was regarded as a convenient solution for both deteriorated infrastructure and unbalanced public finance. Privatization of the water sector was attempted in La Paz, El Alto and Cochabamba, the three large cities.[8] The first private sector participation contract in the water sector was signed in 1997. The world's largest water consortium, the Lyonnaise des Eaux, won the concession bid for water and sewerage provision in the cities of La Paz and El Alto, through the company Aguas del Illimani (AISA). According to the concession contract, the ownership of assets remained public. The modality of private participation was the "concession contract" for 30 years.[9] The concession bid was based on the higher number of new connections to be installed.

La Paz, the country's capital, and its rapid growing neighbour El Alto compose the largest metropolitan centre in Bolivia, with over 1.4 million people. The wealthiest households live in the valley region of southern La Paz, while lower income households inhabit El Alto and the "laderas" (steep slopes) of La Paz. The landscape and the residential segregation by income determine the provision of basic utilities. Poor neighbourhoods, often located in hills or close to other geographical barriers, are harder to reach, implying higher costs of installation and maintenance.

The private concession contract in La Paz and El Alto defined the provision of in-house connections as the only accepted type of water provision. This excluded any obligation of the concessionary toward alternative water provision (such as community stands, pipe trucks, etc.). In fact, the concessionaire was required to close all public taps while substituting water supply by metered piped water. The government tried to maximize the network expansion to the lower income areas of La Paz and El Alto as stipulated in the concession agreement. The contract included expansion goals for every 5 years (expansion mandates), which were monitored at the end of each term. The Bolivian regulator was responsible for monitoring the targets, allowing tariff revisions, and setting up the maximum connection fees at the end of each 5-year term (Komives and Cowen, 1999).[10]

In 2005, public discontent led to the termination of the concession contract. The water (and sewerage) utility was renationalized and Aguas del Illimani was replaced by

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[8] The water utility in Bolivia has traditionally been state provided. The 1906 legislation (*Ley de Aguas*) established water as a property of the state. The water provision was under the central government until 1966, when the system started to decentralize and a municipal water company was created in La Paz. The semi autonomous public company SAMAPA (Servicio Autónomo Municipal de Agua Potable y Acantarillado) became responsible for providing water and sewerage to La Paz and El Alto. The 1994 law (*Ley 1600*) introduced a national regulatory reform in several infrastructure sectors and created a sectoral system of regulation, SIRESE (Sistema de Regulación Sectorial).

[9] The Bolivian law on the water sector regulation mandates that any public provision of water must operate under concession (either public or private), according to Article 14 of the 1997 Regulation of Concessions (*Reglamento de la Organizacion Institucional y de las Concessiones del Sector Aguas*).

[10] The regulatory body, Superintendencia de Saneamiento Basico (SISAB), was created in 1999, together with the legal framework for water and sewerage provision. According to Law 2029 (Ley de Servicios de Agua Potable y Acantarillado Sanitário) and Law 2066 (Ley Modificadora a la Ley 2029).

Empresa Publica Social de Agua y Saneamiento (EPSAS), a municipal public provider. The expansion requirements of the private concession involved targets such as absolute number of connections, overall percentage coverage and coverage according to neighbourhood criteria (e.g. demographic density). The consensual targets stipulated in the concession contract for the period 1997-2001 included installing 71,752 new water connections in La Paz and El Alto by December 2001, which is estimated to achieve 100 per cent water coverage in La Paz, and 82 per cent coverage in El Alto (where 50 per cent should have been new connections).[11] The underperformance of the private utilities and failure to fully reach the targets, together with public outrage concerning water tariffs, has led to the early termination of the contract.

Premature termination of water concession contracts have also happened in other countries. Table 2 provides examples of renationalization in Latin America.

Table 2: Water private concessions prematurely renationalized in Latin America

Country	City	Concession date	Contract length	End date
Argentina	Buenos Aires	1993	30 years	2005
Argentina	Santa Fe	1998	30 years	2006
Argentina	Tucuman	1995	30 years	1998
Bolivia	La Paz and El Alto	1997	30 years	2005
Bolivia	Cochabamba	1999	40 years	2000
Uruguay	Maldonado	2000	-	2004
Uruguay	Maldonado*	1993	-	2004

Note: * Balneario de Manantiales.
Source: Elaborated by the authors.

What was the situation of water provision in the other cities where utilities were not privatized? Santa Cruz de la Sierra is the largest Bolivian city, with 1,196,100 inhabitants. Its water utility was operated as a consumer cooperative all along the period. The institutional structure of the water company is composed of a general delegate assembly, a management board and a supervisory board. This latter body has veto power over the management board. The cooperative has a good reputation of transparency and efficiency in service delivery (World Bank, 2002).

We also analyze Cochabamba, the third largest city in Bolivia, with a population of 834,900. Its water sector was privatized in 1999, but the concession contract was cancelled after about completing one year, under popular riots (known as the Water War) protesting against the high tariffs (35 per cent increase on average) and bad service provision[12]. Water provision returned to Cochabamba's municipal water company in 2000 and prices were adjusted downward under the public provision.

[11] See Komives (1999) and IADB (1998) for reference to the contract targets.

[12] An early attempt to privatize water provision in Cochabamba occurred in 1997. For legal reasons the bid was suspended. A new bid for exploring another aquifer was launched, but no proposals were received. In 1999, Aguas de Tunari (from the multinationals Biwater and Bechtel) submitted an unsolicited bid and was granted the concession.

3 Methods and Data

To gauge performance of the various water provision modalities, we analyze access to water from three perspectives: *delivery* (coverage rate), *equity* (concentration), and *affordability* (expenditure). We use data from national household surveys (see Table 3) carried out by the Bolivian *Instituto Nacional de Estadistica* (INE). Water privatization occurred in 1997 and there are two periods of interest in our analysis: before and after the sector reform. To investigate whether changes in delivery were more than proportional in cities which adopted private provision, we compare La Paz and El Alto to Santa Cruz de La Sierra (where the water utility was never privatized) and to Cochabamba (where provision is public, except for a brief period of less than a year under private concession). We chose those cities because, in many aspects, Santa Cruz de La Sierra and Cochabamba are closer to La Paz and El Alto than any other Bolivian cities for which there is available data (see Table 4).

Table 3: Data sources

Dataset	Year	Non-weighted total hh sample size	Household sample size by city			
			La Paz	El Alto	Cocha-bamba	Santa Cruz
Encuesta Integrada de Hogares	1992	3169	855	652	664	998
Encuesta Nacional de Empleo I	1996	2138	611	316	515	696
Encuesta Continua de Hogares	2001	1197	579	56	225	337
Encuesta Continua de Hogares	2005	807	214	197	174	222

Source: Datasets from INE Bolivia.

Table 4: Household average characteristics before privatization (year 1996)

	Cochabamba & Santa Cruz	La Paz & El Alto
Number of rooms in the dwelling	2.77	2.61
Hard material walls	0.95	1.00
Electricity provision	0.97	0.96
Household income per capita*	488.65	478.63
Hh income per capita (20%poorest)*	99.13	90.72

Note: * Bolivian pesos.
Source: Authors' calculations based on INE.

Herein, “having access to water” is defined as the access to piped water for drinking, cooking and hygiene purposes through a connection in-house or within the land property. Since the scope of this study is addressing the water utility privatization and, thus, access to piped water, alternative sources (such as public taps, private boreholes, wells, rivers, lakes) were not considered as proper access to water. Neither were considered the water sources located outside the household's property, for it is an inferior type of access which does not comply with the proximity requirement; or with the contractual agreements for private provision.

3.1 Delivery

Water *delivery* is measured by the total coverage rate and by income quintiles of population. This is the most fundamental performance indicator and is easily calculated from most household surveys that bear information on characteristics of dwellings. The quintiles are calculated by ranking individuals according to per capita household income, in a way that all five quintiles have 20 per cent of each city's population.

As point estimates calculated from survey data are subject to sampling errors, we deployed a Welch t-test to evaluate the statistical significance of the changes in coverage rates across time. Due to poor documentation, it was not possible to incorporate the sample design, and the test was made as though the data had come from a random sample.

We also analyse the change in the coverage rate taking initial conditions into account, that is, the fact that each city departed from different levels of coverage. This is better understood by considering a hypothetical scenario. Imagine two cities, A and B who have roughly similar landscapes and urbanization patterns. City A has 50 per cent of its population with access to the water grid, and city B 95 per cent. In city B, the unsupplied population lives in slums situated on hills where the underground is solid rock. Some years later, City A has seen its coverage rate increase to 75 per cent and city B to 98 per cent. Considering the absolute or relative advance in coverage rates, city A would be judged a better performer than city B. However, although the water utility in City A required a higher overall investment to increase the coverage rate, the *per capita* cost of the expansion was much smaller than in city B, where many obstacles had to be surpassed in order to deliver water to a hard to reach neighbourhood. In this sense, the water utility in city B was the best performer, because it has put more effort in the network expansion.

Therefore, a measure of performance that account for initial coverage rates would foster a better comparison of the performance of the water utilities of each city. Kakwani (1993) proposed a performance indicator that takes the departure level into account and allows the specification of the degree of effort appreciation. This indicator is based on what he called an "achievement function" which is a non-linear transformation of the original indicators. Kakwani's performance indicator is calculated as follows:

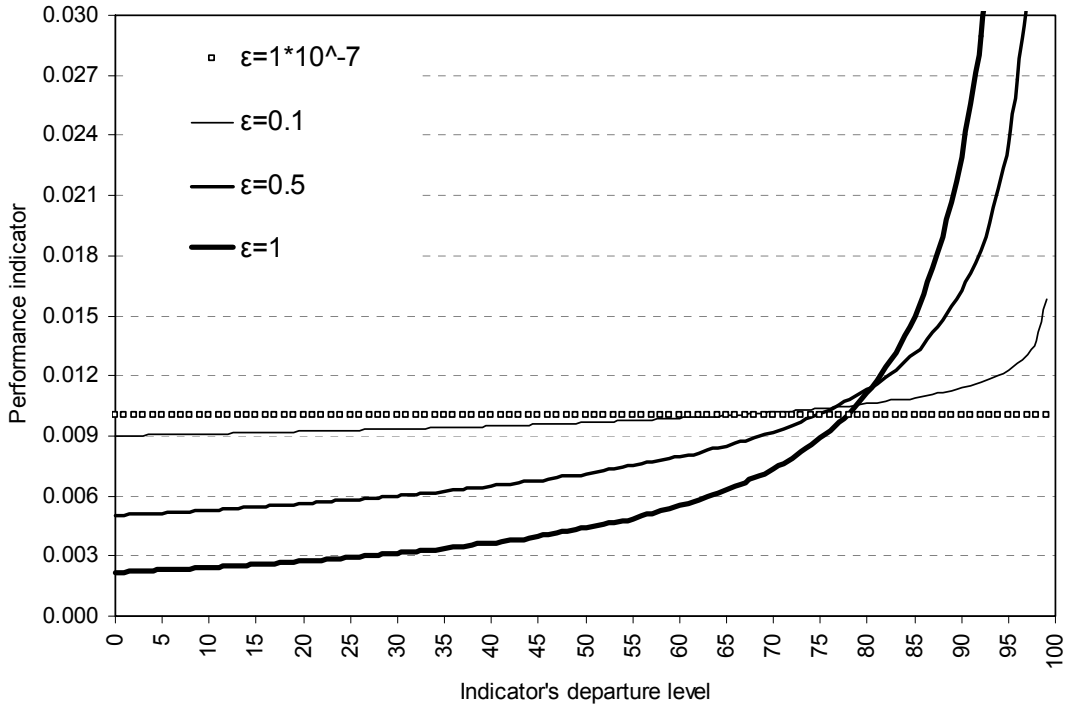
$$A = \begin{cases} \dfrac{(W - x_1)^{1-\varepsilon} - (W - x_2)^{1-\varepsilon}}{(W - W_0)^{1-\varepsilon}}, \forall\ 0 < \varepsilon < 1 \\ \dfrac{\ln(W - x_1) - \ln(W - x_2)}{\ln(W - W_0)}, \forall\ \varepsilon = 1 \end{cases}$$

Where W_0 and W are the lower and upper bounds of the original indicators; x_1 is the departure level of the indicator; x_2 is the final level; and ε is the parameter that sets the degree of effort appreciation. An interesting and handy property of the performance indicator is that of being additively decomposable, allowing the calculation of the

performance by period, simply by dividing its value by the number of periods between each observation. As lower and upper bounds, we used the logical limits of the coverage rate, zero and 100 per cent.

The parameter ε is similar to the parameter of inequality aversion in Atkinson's social welfare function (Atkinson, 1970). The choice of values for it is arbitrary, and for that reason we use different degrees of effort appreciation in the analysis: 0.1, 0.5 and 1. When ε approaches zero, the performance indicator gives more importance to the absolute change than to the departure level. When ε values increase, more weight is attached to the departure level.

Figure 1: Behaviour of the performance indicator for distinct degrees of effort appreciation



Source: Authors' elaboration.

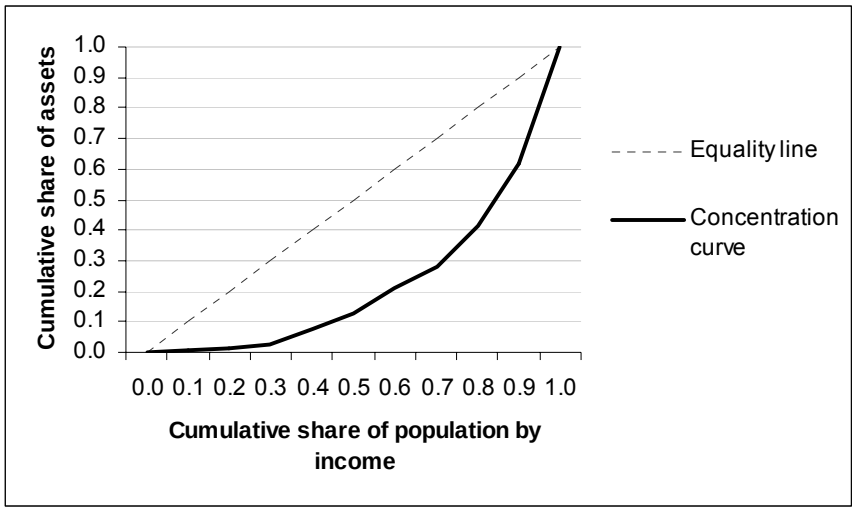
Figure 1 shows the behaviour of the performance indicator for different degrees of effort appreciation and for one percentage point changes from the departure levels 0, 1, 2, 3, …, 99. Considering our previous example, with a low degree of effort appreciation, 0.1, the performance indicator of city A was 0.25 and of city B was 0.04, whilst for a high degree of effort appreciation, 1, performance of city A was 0.15 and of city B was 0.20.

3.2 Equity

As far as *equity* is concerned, access to water refers to providing all households

with the same level of utilities despite their income status. A social planner could perform distribution by either transferring assets from rich to poor households or by increasing, more than proportionally, the provision to the poor (a pro-poor approach). The second approach seems more reasonable in the case of utility infrastructure. Equity is measured both by concentration curves and concentration indexes. A concentration curve graphs the cumulative share of population by the cumulative share of total assets (in this case, access to water) in a given community. A 45-degree line starting from the origin depicts a perfectly equal society, where the proportion of individuals holds equal proportion of access. The overall distance between the concentration curve and the equality line measures the level of inequality in the society. The larger this distance, the higher is the inequality in access to water.

Figure 2: Standard concentration curve



The concentration index assumes a value of zero when there is no inequality, and a value one in case there is only one individual holding all the assets in the society - perfect inequality. The coefficient is usually positive, and the most positive the highest is the concentration towards rich households. As depicted in Figure 2, the concentration index is a ratio of the area between the 45-degree line and the concentration curve, to the total area of the triangle below the 45-degree line. In other words, it is twice the area between the equality line and the concentration curve. In a few cases, the concentration curve lies above the 45-degree line and the coefficient assumes negative values. This occurs when poor individuals have proportionally more access to the asset than richer individuals.

3.3 Affordability

Finally, *affordability* is assessed through households' per capita monthly expenditure. If households spend more than 3 per cent of their per capita income on water, water is considered non-affordable to them. Data on expenditure is available for 1992, 2001 and 2005. A comparison before/after privatization is not possible given the lack of data for

1996. Thus, households' expenditure on water is analyzed in the four cities at two points in time: four and eight years after the concession in La Paz and El Alto.[13]

Household surveys usually lack information on the quantity of water consumed. In Bolivia, the household survey questionnaires ask households the monetary amount spent on water in the month previous to the interview, but not the volume consumed. Given the complex block tariff structures in every city, it is not possible to reconstruct the amount of water consumed from the expenditure reported in the surveys. It is also recognized that expenditure analysis cannot fully capture the welfare impact on the poor (demand curves are required for this purpose), nevertheless we are able to reveal the direction and magnitudes of welfare changes by analyzing expenditure data (see Foster et al. (2004) for a similar approach).

3.4 Further analysis – Econometric approach

We use a probit regression model to further investigate the relationship between the expanded access to piped water and the privatization of the water utility. In a difference-in-difference (DID) approach, and controlling for households living standards and city specific characteristics, we compare two groups: households living in the privatized cities, and those living in the non-privatized ones. The data reflects two points in time, before and after the privatization reform, and models are run for the years 1996 and 2001 as well as 1996 and 2005.[14]

In a difference-in-difference approach the difference in the tendency of outcomes is captured, having controlled for fixed effects. Two groups are said to be initially similar and they differ in the second period only because one group has received a policy shock. In our study, the water utility privatization is the policy shock. In an ideal experiment, the group of households in the non-privatized city would represent a counterfactual to the group within the reformed city: how would the group in the privatized city perform if it had not been subjected to the policy shock. The first difference in this double difference method refers to the difference in the outcomes between the two groups prior and after the policy shock. The second difference in DID is the difference between these two first differences, and it highlights the true difference between the groups which can be attributed to the policy intervention. The difference-in-difference estimation is given by:

$$\delta = (\overline{w}ater_{a,p} - \overline{w}ater_{a,np}) - (\overline{w}ater_{b,p} - \overline{w}ater_{b,np}) \qquad (1)$$

where *water* refers to access to piped water, while the time subscripts refer to *b* (before) or *a (*after) privatization, and the policy shock *p* (privatized) or *np* (non-privatized), respectively.

Finding a perfect counterfactual for carrying out an impact analysis is usually

[13] It is worth to notice that prices have been adjusted in La Paz and El Alto right before privatization (Israel, 2007). This effect is not captured in our analyses.

[14] The regressions were run in separate pairs before/after privatization (1996/2001 and 1996/2005 or 4 years and 8 years after privatization).

tricky. In the case of cities it is even harder since there are no two places with complete similar demographic characteristics and economic dynamics. The state of a privatized city, if it had not been privatized, simply cannot be observed. We are aware of another caveat in selecting the cities to be analyzed: given that privatization is not a casual event, the comparison cities were not randomly chosen and are not expected to have identical characteristics, although they are the most similar cities available in terms of demographic dimension and household characteristics (refer to Table 4). Thus, we note caution concerning the econometric results, in an attempt to infer a *causal* relationship between the expansion of water access and the utility reform.

Our model tests whether there is a variation more than proportional in the access to water for the group of households living within cities where water was privatized, relative to their counterparts living where water reforms did not take place. This would be indicated by a positive coefficient for *effect*, $\delta > 0$, in the reduced form the equation is estimated as:

$$water = \beta_0 + \beta_1 wealth + \beta_2 dcity + \beta_3 post + \beta_4 privatized + \delta effect + \mu \qquad (2)$$

Where *water* is a dummy for household access to piped water; *post* is a year dummy assuming value one for the period after privatization, and *privatized* is a dummy indicating the privatized cities of La Paz and El Alto. *wealth* is a vector of household' characteristics to control for the wealth (electricity provision, number of rooms in the dwelling, and wall material). The choice of only these three variables for capturing living standards is based on the low compatibility of survey questionnaires regarding the dwelling characteristics across the four years. One limitation is that other household characteristics may not be captured in this simple model. We include dummy variables for each city, the vector *dcity*, in order to capture place specific characteristics and also to minimize the lack of other household characteristics.[15]

Our parameter of interest is δ, where *effect* is built from the interaction term between *post* and *privatized*. *Effect* captures the relationship between privatization and access to piped water, having controlled for the influence of other characteristics apart from the reform.

4 Results

4.1 Delivering water

Descriptive statistics of water coverage rates just before privatization allow us to identify two pairs of cities: El Alto and Cochabamba had access as low as 76 per cent, whereas La Paz and Santa Cruz had better coverage rates. Delivery was especially deficient within the poor. Only 55.6 per cent and 63.3 per cent of households in the lowest quintile of El Alto and Cochabamba, respectively, had access to water in 1996. The lowest quintile in La Paz

[15] We also use the household per capita income for robustness checks, although this could be subject to criticism whether endogeneity would be introduced in the model.

had also poorer access than the one in Santa Cruz. The post-privatization period is characterised by an expansion of access to piped water for all quintiles in both La Paz and El Alto, benefiting particularly the poor. In 1996, the coverage rate difference between the poorest 20 per cent and the richest 20 per cent was around 30 percentage points in El Alto (Table 5). In 2005 this difference was reduced to about 5 percentage points, similar to the distance found in La Paz (see next subsection for the concentration analysis).

Table 5: Water coverage rate: lower and upper quintiles

year	1996			2001			2005		
	total	QI	QV	total	QI	QV	total	QI	QV
La Paz	87.9	83.4	97.9	88.6	79.2	98.2	96.6	96.2	100.0
El Alto	76.2	55.6	85.6	69.4	78.1	87.4	87.8	86.0	90.8
Cochabamba	76.5	63.3	84.7	78.6	58.5	93.1	61.8	25.9	74.2
Santa Cruz	95.5	90.2	98.6	95.8	92.2	100.0	95.6	90.1	100.0

Source: Authors' calculations based on INE.

In the non-privatized cities, overall access to water remained constant over the period. Access to water was already higher in 1996, but it did not improve significantly. In Santa Cruz the estimated changes were not statistically significant, except for an increase of 2 percentage points in the upper quintile, leading the rich toward universal access.

Table 6 shows the expansion of access to water in the four cities, by quintile of population during the privatization period (see Appendix for detailed data). There was significant expansion of water coverage in the privatized cities, especially in the lowest quintiles of El Alto. Also, the poor have benefited proportionally more than rich households, as shown by the magnitude of coefficients. The lowest quintile in El Alto increased coverage by about 30 percentage points, expanding access to piped water from about 55 per cent to 86 per cent of households in El Alto. In La Paz, the expansion of 13 percentage points in the lowest quintile increased coverage rate from 83 per cent to almost universal access among the poorest. The delivery analysis indicates that access to water has increased under the private concession, while non-significant increases were found in the non-privatized cities. Cochabamba, in fact, has deteriorated sharply its access to water.

Table 6: Percentage change in water coverage rate (1996-2005)

quintile	La Paz	El Alto	Cochabamba	Santa Cruz
1	0.128 **	0.303 **	-0.374 **	0.000
2	0.168 **	0.104 **	-0.466 **	-0.007
3	0.051 **	0.111 **	-0.078 **	0.000
4	0.067 **	0.008	-0.017	-0.001
5	0.021 **	0.052 **	-0.105 **	0.012 **

Note: ** Welch t test, significant at 5 per cent level.

The expansion of access to water was larger in the initially less provided areas in El Alto, and it targeted significantly the bottom quintiles of the population. This result possibly brings us to the achievement problem described by Kakwani (1993). It is likely

that expanding access in El Alto, given its low initial level, would be easier than increasing it in La Paz or Santa Cruz. Table 7 analyses the expansion of access to water in the lowest quintile of population, showing Kakwani's Achievement Index (AI) at different levels of effort appreciation, ε.

Table 7: Coverage rate variation and Achievement Index in the lowest quintile

Year/ city	initial coverage	change (X_2-X_1)	(%)change	Achievement Index ε=0.1	ε=0.5	ε=1
1992-1996						
La Paz	61.1	22.3	36.5	0.057	0.054	0.046
El Alto	53.4	2.2	4.2	0.005	0.004	0.003
Cochabamba	58.2	5.1	8.7	0.013	0.010	0.007
Santa Cruz	74.3	15.9	21.4	0.043	0.048	0.052
1996-2001						
La Paz	83.4	-4.3	-5.1	-0.009	-0.010	-0.010
El Alto	55.7	22.4	40.3	0.045	0.040	0.031
Cochabamba	63.3	-4.8	-7.6	-0.009	-0.008	-0.005
Santa Cruz	90.2	2	2.3	0.005	0.007	0.010
2001-2005						
La Paz	79.2	17.1	21.6	0.048	0.065	0.093
El Alto	78.1	7.9	10.1	0.021	0.023	0.024
Cochabamba	58.5	-32.6	-55.8	-0.078	-0.054	-0.031
Santa Cruz	92.2	-2.1	-2.25	-0.006	-0.009	-0.013

Source: Authors' calculations based on INE.

Prior to the reform (1992-1996), water coverage was growing faster in the lowest quintile of La Paz and Santa Cruz. Both percentage change and achievement index points toward their good performance. While their percentage changes were different, the achievements of these utilities were similar, given their initial water access levels and the consequent required efforts. El Alto and Cochabamba, on the other hand, were improving coverage very slowly.

Within the first period of privatization (1996-2001), El Alto increased water access significantly in the lowest quintile. La Paz and Cochabamba decreased coverage rate, while Santa Cruz slightly expanded it. One may note, however, that small changes may result from statistical fluctuations. In the period 2001-2005, the privatized cities continued to expand coverage while the non-privatized cities decreased it. The deterioration of access was most striking in Cochabamba, mainly because the concession contract turned out to be against the interest of the poor, where tariffs became exorbitant (Hailu and Hunt, 2008).

As an overall result, the privatized La Paz reached close to universal access like the non-privatized Santa Cruz. The privatized El Alto ended up better off than Cochabamba, even though they started at the same initial coverage level (see Table 5). From these, it emerges that access to piped water improved under the period of privatization.

An interesting question is: What would be the water coverage rates at the non-privatized cities if they had performed as the privatized ones (and vice versa)? The

exercise below estimates two counterfactual scenarios where the performances of La Paz and Santa Cruz are applied to all four cities. The coverage rates by the end of the period are calculated considering the different initial coverage levels, and thus accounting for the degree of "difficulty" in expanding access at each individual city.

Table 8: Counterfactual Performance according to Kakwani's performance index at different effort intensities

City	Actual coverage by end of the period	Counterfactual 1: Performance of La Paz			Counterfactual 2: Performance of Santa Cruz		
		0.1	0.5	1	0.1	0.5	1
1996-2001							
La Paz	**88.6**	**88.6**	**88.6**	**88.6**	88.2	88.4	88.7
El Alto	69.4	76.9	77.2	77.5	76.6	76.9	77.8
Cochabamba	78.6	77.2	77.4	77.8	76.8	77.2	78.0
Santa Cruz	**95.8**	96.1	95.9	95.7	**95.8**	**95.8**	**95.8**
2001-2005							
La Paz	**96.6**	**96.6**	**96.6**	**96.6**	88.3	88.2	88.0
El Alto	87.8	78.6	84.1	91.0	69.2	68.9	67.9
Cochabamba	61.9	87.4	90.5	93.7	78.3	78.1	77.5
Santa Cruz	**95.6**	100.0	99.7	98.8	**95.6**	**95.6**	**95.6**
1996-2005							
La Paz	**96.6**	**96.6**	**96.6**	**96.6**	88.0	88.0	88.1
El Alto	87.8	85.8	89.6	93.4	76.3	76.4	76.7
Cochabamba	61.9	86.1	89.7	93.5	76.6	76.7	77.0
Santa Cruz	**95.6**	100.0	100.0	98.7	**95.6**	**95.6**	**95.6**

Source: Authors' calculations.

Counterfactual 1 shows all cities performing at the La Paz performance index in each period. Comparing the actual figures (Table 8, second column) with the estimated ones, we observe that both in the second term (2001-2005) and in the overall period (1996-2005), the non-privatized cities - Cochabamba and Santa Cruz - would have achieved higher water coverage rates if they had performed the same as La Paz. On the other hand, counterfactual 2 shows that if the privatized cities had performed like the non-privatized Santa Cruz, coverage rates would have been lower than they actually were by the end of each period. The exception is El Alto during 1996-2001, where coverage rate would have been slightly better.

4.2 Distributing access to water

Just before privatization, El Alto and Cochabamba had clearly the most unequal societies in terms of water provision (Table 9). Five years after, the privatized El Alto and La Paz turned out to be the most equal cities in terms of water access. Between 1996 and 2005, concentration indexes have decreased from 0.044 to 0.01 in La Paz, lower than the initial level of concentration in the other non-privatized cities. El Alto also moved towards

equitable water access. Its negative concentration index shows that, in 2001, the poor had proportionally better access to water than richer households. Moreover, El Alto and La Paz had the same low concentration index in 2005 despite the high and very different indexes in 1996.

Table 9: Concentration index

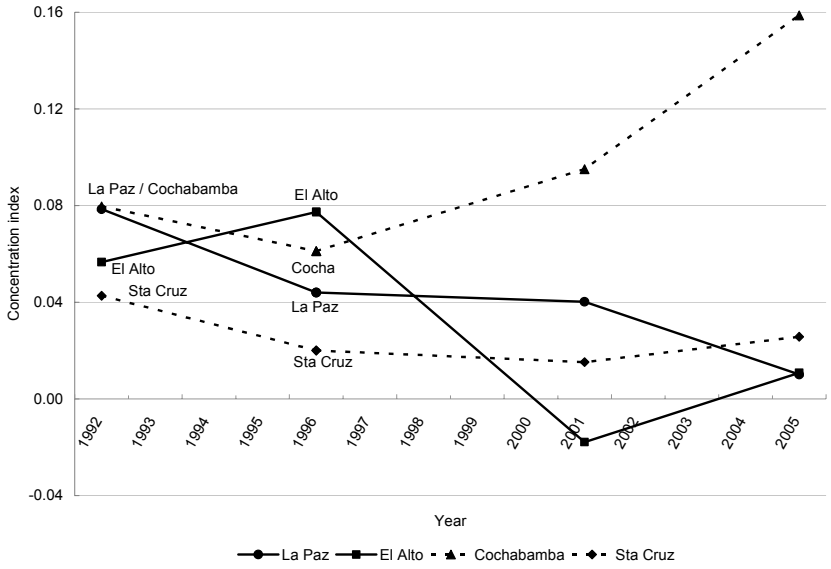
year	La Paz	El Alto	Cochabamba	Sta Cruz
1992	0.076	0.056	0.078	0.040
1996	0.044	0.077	0.061	0.020
2001	0.040	-0.018	0.095	0.015
2005	0.010	0.011	0.159	0.026

Source: Authors' calculations based on INE.

The period 1992-1996 shows that before privatization there was already a tendency of deconcentration of water provision in all cities, except El Alto. On projecting this trend to future years, one could expect that, *ceteris paribus*, deconcentration would continue, though at decreasing rates. After the reform, however, we observe different deconcentration tendencies. El Alto suffered a sharp deconcentration, while La Paz and Santa Cruz accompanied each other in a less intense but still deconcentration trend. The period 1996-2001 was turbulent for Cochabamba and we observe a steep concentration path from 1996 onwards. Figure 3 shows the concentration tendencies between 1992 and 2005.

After privatization, La Paz and El Alto converged to a lower level of concentration, ending up with the lowest index among the four cities. It is also interesting to focus on La Paz. The city started with the same concentration level as Cochabamba, but ended up in an extreme opposite. La Paz followed the deconcentration pace of Santa Cruz from 1992 to 2001, though in the last period the paths have diverged: La Paz steeply deconcentrated while Santa Cruz slightly concentrated access to water.

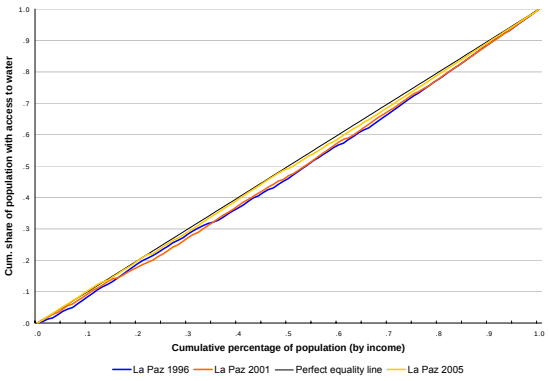
Figure 3: Concentration index - Tendency (1992-2005)



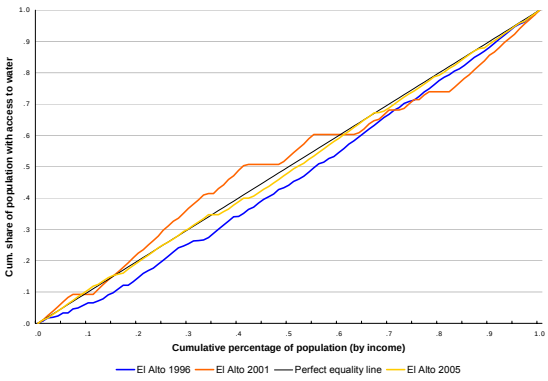
Source: Authors' elaboration based on INE.

The concentration curves in Figure 4 depict the distribution of access to water in each city. The curves have moved inward (toward the equality line) along the years in both La Paz and El Alto, denoting a more equal distribution of the access to water. Once curves do not cross each other over time, the interpretation is straight forward: concentration has decreased along the time. The lowest quintile (the poorer 20 per cent) of population in El Alto, who had in 1996 14.6 per cent of all water connections before privatization, increased its share to 19.5 per cent in the end of the concession period. In the perfect equality world, the bottom 20 per cent of population should hold 20 per cent of the total water access.

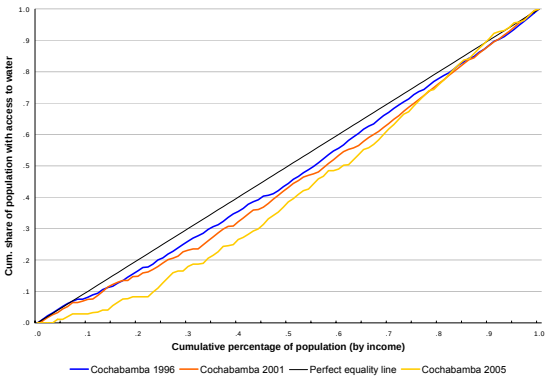
Figure 4. Evolution of concentration of access to water



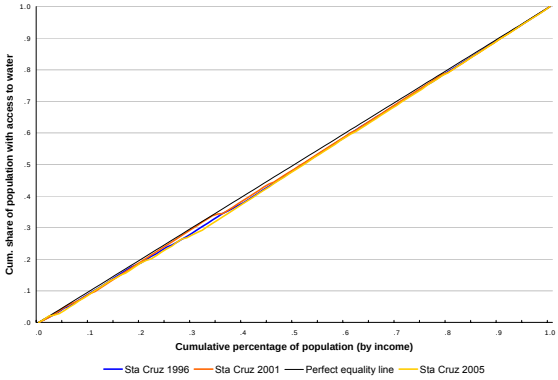
(a) La Paz



(b) El Alto



(c) Cochabamba



(d) Santa Cruz

Source: Authors' elaboration based on INE.

4.3 Affording water

A given level of water expenditure can be achieved by a combination of different price levels and consumption patterns. Thus, if tariffs are set in a block scheme, it is not possible to build household consumption from reversing the expenditure data.[16] With some caveats, household income is usually used as a proxy for consumption level: households with higher per capita income are on average expected to have a higher consumption pattern. This includes water consumption. Water expenditure, however, may vary widely across cities pushed by prices, despite households having similar income and consumption levels. In a temporal analysis, however, assuming that water is an inelastic good, the quantity demanded should remain constant for households within a same income level over the years.[17] If income increases, it is expected that water expenditure will also increase, though less than proportionally given the decreasing marginal utility at high levels of consumption. Thus, if water expenditure for households – within a given city and already connected to the utility – increases more than proportionally to their income increase, this suggests that prices may have risen. It is also true that a sharp increase in prices may force consumption down despite an increase in income (see Yepes, 1999), but still it would be unlikely to find households decreasing their overall water expenditure in such case – they would decrease consumption up to maintaining the same expenditure level.

Table 10 shows that water expenditure has been persistently higher along the years in the cities of Santa Cruz and Cochabamba for both the richest and the poorest households. Comparing Santa Cruz and La Paz, for instance, despite the poorest in the first city have an average lower income than in La Paz ($89.5 against $101.8 in 2001); they spent more on water than the later. The burden of water expenditure seems to be the hardest on the poor households of Santa Cruz, who spend on average 8.8 per cent of their income on water in 2001, and 5.9 in 2005. The poor in La Paz and Cochabamba also bear a high burden,

[16] Even though tariffs are available (Barja and Urquiola, 2001; Komives, 1999), the block schemes do not allow us to rebuild the individual household demand.

[17] Unless the overall consumption pattern have changed substantially due to behavioural adjustments.

spending 4.7 and 4.6 per cent of their income on average in 2001 – which is higher than the accepted affordability measure of 3 per cent of income.

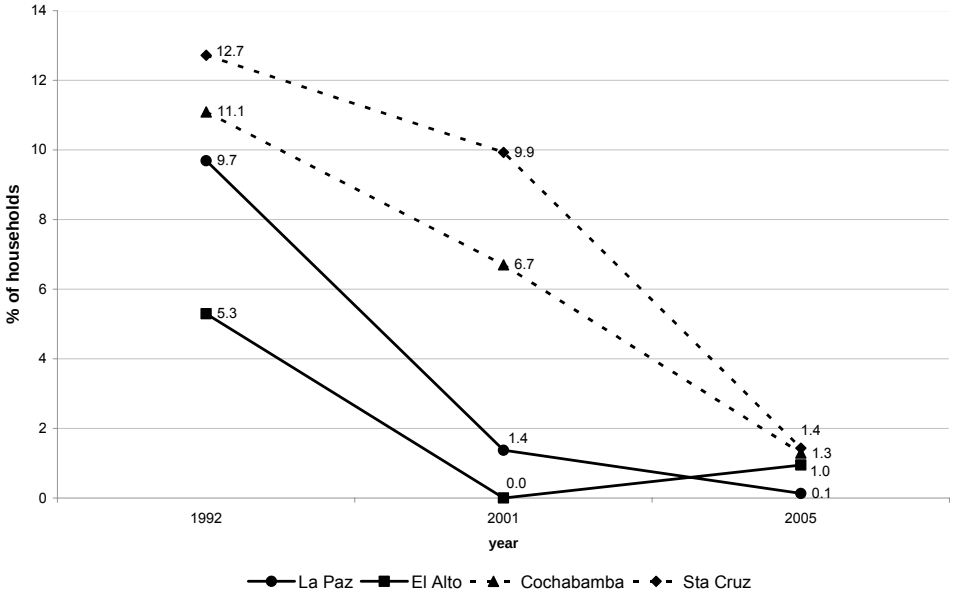
Table 10: Average per capita water expenditure of households connected to the utility – lower and upper quintiles

		Water expenditure		Y per capita		Share of income (%)		Change in expenditure (%)	Change in Y per capita (%)
		2001	2005*	2001	2005*	2001	2005		
La Paz	QI	2.8	3.4	101.8	127.2	4.7	2.6	23.2	25.0
	QV	12.0	13.6	1621.1	2437.1	0.9	0.7	14.1	50.3
El Alto	QI	1.4	2.6	83.4	104.7	1.9	2.6	79.5	25.5
	QV	2.5	4.8	609.0	833.8	0.5	0.6	93.1	36.9
Cochabamba	QI	4.7	5.3	123.2	129.9	4.6	4.0	12.6	5.4
	QV	22.8	18.7	2215.9	1827.8	1.3	1.5	-18.2	-17.5
Sta Cruz	QI	6.7	9.4	89.3	150.0	8.8	5.9	39.6	68.0
	QV	19.9	23.0	1395.5	2295.3	1.6	1.4	15.5	64.5

Note: Authors' calculations based on INE. * Deflated to 2001 values.

In a cross period analysis, we find that the average share of income the poor spent on water has decreased for all cities but El Alto. In El Alto, households connected to the utility in 2005 spent on average 2.6 per cent of their income against 1.9 per cent share in 2001. In this city, household per capita expenditure on water has grown on average about 80 per cent for the poorest whereas their income has increased by about 26 per cent only. A possible explanation for this is the expansion of metered connections in the region and the improvement on billing collection by the private provider, which started charging for the water that was freely available before (see Figure 5). It is worth mentioning that the tariff structure was the same for La Paz and El Alto.

Figure 5: Share of households connected to the utility who did not pay for water



Source: Authors' calculations based on INE.

The most relevant information extracted from our expenditure data is the affordability measure. Table 10 presented the average share of household per capita income spent on water, while Table 11 analyses the share of households in the lower and upper income quintiles spending above the accepted water affordability measure. As expected, the lowest quintiles in each city contain the highest incidences of non-affordable households. In a cross-city comparison, despite El Alto being the poorest, both in terms of per capita income and water expenditure, the city has the best affordability indicators in both years. Cochabamba and Santa Cruz have the highest non-affordability incidence. About 63.9 per cent and 78.4 per cent of the population in the bottom quintile of these cities spent more than 3 per cent of their income on water in 2001.

Table 11: Share of the non-affording among the population connected to the utility – lower and upper quintiles

year	2001		2005	
	QI	QV	QI	QV
La Paz	34.8	6.1	42.1	0.6
El Alto	25.6	0.0	15.1	1.8
Cochabamba	63.9	5.3	23.2	10.4
Santa Cruz	78.4	9.6	73.1	7.1

Source: Authors' calculations based on INE.

On comparing affordability across years, we find no common pattern within the

two groups (privatized vs. non-privatized). In the privatized cities, La Paz has increased non-affordability rate in the lowest quintile (from 34.8 to 42.1 per cent of population), whereas El Alto has decreased it to 15.1 per cent. In the non-privatized group, Santa Cruz remains at a very high level of non-affordability (73.1 per cent), while Cochabamba shows a significant affordability improvement for the poorest quintile (from 63.9 to 23.2 per cent of population not affording water). This later result may be partially due to a decrease in water tariffs after 2000, when the public utility reassumed water provision after a brief privatization period. The result, however, must not be interpreted as purely positive given that there was a contraction of coverage rate in the city during the period. It is likely that the poorest households got disconnected (remember that affordability measure is calculated among the connected households only) and that is why the affordability indicator may have partially improved.[18]

A last issue to be mentioned refers to the connection fees. The initial costs that households incur to obtain access to the utility are frequently barriers excluding the poor from access to water. The public utility before the concession in La Paz and El Alto used to charge differentiated fees according to the household location and the exact cost of each specific connection (composed of extending the secondary network and installing the household connection). The concessionary implemented a uniform connection fee, only limited by the concession contact's maximum fee. Households, however, were given the option to buy the building material and execute the reform by themselves instead of paying the full connection fee (Komives 1999). In La Paz and El Alto costs ranged from $105 to $155 for water connections, and from $130 to $180 for sewer (August 1998 figures). Other incentives from the concessionary included 3 to 5 years financing plan for the connection fees and different interest rates according to the geographic location of households. Despite the incentives, Israel (2007, p. 61) highlights that "increases in connection fees were a key part of the protests against Aguas del Illimani".

As an overall conclusion, the delivery analysis so far has shown that the post-privatization period is associated with expanded access to water in the reformed cities, especially within the low-income population. The distribution analysis found that targeting the poor had clearly contributed to having a more equitable society in terms of access to water. The results of the affordability analysis were, however, mixed. The evolution of expenditure between 2001 and 2005 denoted both increase and decrease of population who could not afford water in the two groups (privatized and non-privatized cities). No inference, however, can be made on the effect of water prices on each city's affordability given the shortage of data. What is evident from expenditure data is that non-affordability is a common problem also on households living in the non-privatized cities.

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[18] One needs to be careful on interpreting the affordability results. Expenditure data shows that in the privatized cities the household per capita expenditure in water is lower than in the non-privatized cities. The share of non-affording population in the privatized cities is also lower than in the privatized ones. In spite of this positive result, we do not know the level of consumption (quantity of water) of households in each group. In addition, households who used to benefit from free water (illegal or unmetered connections) became subject to the billing system after privatization. Any inference about households' welfare is therefore incomplete.

4.4 Econometric approach

But, can we really be certain that privatization caused increased access? A regression exercise points out the relationship between having access to water and living within cities where the water utility was privatized. The positive coefficient for *effect* (see Equation 2 and Table 12) suggests that there was a variation more than proportional in the expansion of access to water for households living in cities where the utility was privatized, relative to households living in the cities where water supply was not reformed. This was found when analysing the total privatization period (1996 to 2005). In other words, controlling for household wealth and for regional specific characteristics, living in a privatized city is associated with having a larger probability of having access to water in the longer run (analysed up to 9 years after privatization). An interesting point is that the result in the short run period (1996-2001) shows a not statistically significant *effect*. In the first 5 years of privatization, living in a privatized city did not translate into a larger probability of having access to water. This goes back to an issue raised in the literature about the existing time lag between basic infrastructure investments and an effective supply response. Since investments in heavy infrastructure (such as building treatment plants and extending water grids) may need a certain time for impacting coverage changes, any analysis of privatization process may consider evaluating different points in time.

Table 12: Regression Results

water	Coeff.	Std. Error	Coeff.	Std. Error	water	Coeff.	Std. Error	Coeff.	Std. Error
1996 and 2001					**1996 and 2005**				
post	0.021	(0.016)	0.038**	(0.017)	post	-0.030*	(0.016)	-0.010	(0.015)
privatized	0.080***	(0.016)	-0.099***	(0.020)	privatized	-0.103***	(0.022)	-0.123***	(0.023)
effect	**-0.025**	(0.025)	**-0.025**	(0.025)	**effect**	**0.077*****	(0.016)	**0.075*****	(0.015)
lnY/capita	0.054***	(0.006)	-	-	lnY/capita	0.046***	(0.008)	-	-
rooms	-	-	0.027***	(0.004)	rooms	-	-	0.023***	(0.004)
electricity	-	-	0.508***	(0.061)	electricity	-	-	0.231***	(0.046)
wall	-	-	0.030	0.019	wall	-	-	0.111	0.076
Number of obs.: 3240			Number of obs: 3277		Number of obs.: 2917			Number of obs: 2945	
Population size: 1385919			Pop. size: 1401111		Population size: 1476802			Pop. size: 1487615	
Design df: 3239			Design df: 3276		Design df: 2916			Design df: 2944	
F(6, 3234)= 30.41			F(8, 3269)= 32.84		F(6, 2911)= 35.44			F(8, 2937)= 31.23	
Prob > F=0			Prob > F=0		Prob > F=0			Prob > F= 0	

Note: Marginal values reported. Regional dummies included in the regression.
Source: Authors' calculations.

5 Concluding Remarks

We found that access to water by the poor was enhanced during the privatization period. However, the concession contract was terminated in 2005 and the water sector in La Paz and El Alto was renationalized in 2006. Why?

a. *Meeting the targets.* The coverage rate is often used as an argument for explaining the success/failure of private concession contracts. Coverage has expanded significantly more in La Paz and El Alto than in the non-reformed cities. Nevertheless, the concessionary has failed in achieving precisely the consensual targets stipulated in the contract (Universal access in the city of La Paz and 82 per cent coverage in El Alto).

b. *Water prices*. We were limited by lack of data. However, it is widely known that the bidding process for the La Paz/El Alto concession did not take as a criterion the lowest water price; it focused instead on the offer of the largest network expansion. In addition, the water authority has adjusted tariffs upward just before the privatization, what may have led households to associate the price increases with the utility reform. Israel (2007, p. 62) notes that:

> ``Burdens may be examined either in absolute or relative terms. With absolute progressivity, the burden is greater in monetary terms for high-income groups than for low-income groups, whereas with relative progressivity, the burden as a proportion of income is increasing with income. If price increases are the same for all income groups, then if low-income households spend a larger percentage of income on water than do high-income households, these across-the-board water price increases would be regressive."

c. *Unpopularity of the company Aguas del Illimani.* The concession contract required that communal standpipes were eliminated, and dwellings were provided with in-house connections (Komives, 1999). The underlying reason was helping the government to achieve the political target of providing universal in-house water access, as stated in a national water plan. Standpipes, however, were inexpensive alternatives to in-house connection for some households, especially to those who were unable to afford the high initial connection costs to the utility network. This was a potential source of public discontentment from the low-income households, who would have to search for alternative sources, usually more expensive.

d. *Contract design and enforcement of expansion goals*. A mix of well designed contracts and rigid regulation (periodic revision of expansion targets) is advocated as essential for a successful private provision. For designing a successful pro-poor water concession, it is required that the contracts clearly specify the output standards (type of services to be provided), quality and reliability (high-quality service in low-income areas). In the case of La Paz/El Alto, although the concession contract seemed clear on the penalties for non-compliance with the contract goals[19], the company failed on meeting the expansion targets of new connections in the city of El Alto. Households have also complained about the low water pressure in this city, the increase in tariffs after the first term, and high connection fees. The company was also accused of environmental contamination of the Titicaca Lake. All of these contributed to the popular movements which ended up into the termination of the concession contract.

[19] See Komives (1999), and the concession contract Appendix 5 and clause 27.

The lesson is that when privatization contracts stipulate clear targets, concessionaires do attempt to reach them – though it did not fully materialise in Bolivia's case. Nonetheless, we are aware that the distributional impacts of privatization go beyond coverage and affordability aspects only. Privatization may also affect the concentration of assets, returns on labour and employment rates (mostly in the low- and middle-income classes), returns on capital, and public tax structures. Future research exploring other aforementioned aspects in the context of privatization reforms will be useful.

7 References

Atkinson, Anthony B. (1970) "On the Measurement Of Inequality", *Journal of Economic Theory*, Vol. 2, pp. 244-63.

Barja, Gover and Miguel Urquiola (2001) "Capitalization, Regulation and the Poor: Access to Basic Services in Bolivia", *UNU Wider Discussion Paper* No. 2001/34.

Bayliss, Kate and Tim Kessler (2006) ``Can Privatisation and Commercialisation of Public Services Help Achieve The MDGs? An Assessment'', International Poverty Centre (IPC), *Working Paper*, No.22. Brasilia.

Bayliss, Kate (2009). "Private Sector Participation in African Infrastructure: Is it Worth the Risk?" *IPC-IG Working Paper Number 55*. Brasilia, International Policy Centre for Inclusive Growth. Brasilia.

Birdsall, Nancy and John Nellis (2003) "Winners and Losers: Assessing the Distributional Impact of Privatization", *World Development*, Vol. 31, No. 10, pp. 1617–33.

Brown, Ashley C. (2009). "Poverty Issues in Infrastructure Regulation: Why, Who and How?" *Poverty in Focus* No. 18, International Policy Centre for Inclusive Growth (IPC-IG). Brasilia.

Costa, Joana; Degol Hailu; Elydia Silva; and Raquel Tsukada (2009). "Water Supply and Women's Time Use in Rural Ghana" *Poverty in Focus* No. 18, International Policy Centre for Inclusive Growth (IPC-IG). Brasilia.

Dagdeviren, Hulya. And Simon. A. Robertson (2009). "Access to Water in the Slums of the Developing World?" *IPC-IG Working Paper Number 57*. International Policy Centre for Inclusive Growth (IPC-IG). Brasilia.

Dagdeviren, Hulya and Degol Hailu (2008) ``Tariff Hikes with Low Investment: The Story of the Urban Water Sector in Zambia'', International Poverty Centre (IPC), *One Pager*, No.57.

Estache, Antonio (2006) "Infrastructure: A Survey of Recent and Upcoming Issues", *The World Bank - Infrastructure Vice-Presidency*, mimeo. World Bank (Washington, D.C.).

Foster, Vivien; Erwin R. Tiongson; and Caterina Ruggeri Laderchi (2004) "Poverty and Social Impact Analysis: Key Issues in Utility Reform", available at http://siteresources.worldbank.org/INTISPMA/Resources/Training-Events-and-Materials/PSIA_utilityreform.pdf World Bank (Washington, D.C.)

Hailu, Degol and Portia Hunt (2008) "Utility Provision: Contract Design in the Interest of the Poor", *Policy Research Brief*, No. 10, International Poverty Centre (IPC). Brasilia.

IADB (1998) *Aguas del Illimani Water and Sanitation Project – Environmental and Social Impact Report*, Project Document, Inter-American Development Bank.

Israel, Debra K. (2007) "Impact of Increased Access and Price on Household Water Use in Urban Bolivia", *Journal of Environment Development*, Volume 16 No. 1, pp. 58-83.

Kakwani, Nanak (1993) "Performance in Living Standards – An International Comparison" *Journal of Development Economics*, Vol. 41, pp. 307-336.

Kikeri, Sunita and John Nellis (2004) "An Assessment of Privatisation", *World Bank Research Observer*, Vol. 19, No. 1, pp. 87-118.

Komives, Kristin (1999) "Designing Pro-Poor Water and Sewer Concessions: Early Lessons from Bolivia", *Policy Research Working Paper*, No. 2243. World Bank (Washington, D.C.).

Komives, Kristin and Penelope J. B. Cowen (1999) "Expanding Water and Sanitation Services to Low-Income Households: The Case of La Paz-El Alto Concession", *The Private Sector in Water Competition and Regulation*. World Bank (Washington, D.C.).

Rees, Judith A. (1998) "Regulation and Private Participation in the Water and Sanitation Sector", *TAC Background Papers*, No. 1, Global Water Partnership

UNDP (2006) *Human Development Report - Beyond Scarcity: Power, Poverty and the Global Water Crisis*, United Nations Development Programme. New York: Palgrave Macmillan.

Whittington, Dale (1992) "Possible Adverse Effects of Increasing Block Water Tariffs in Developing Countries", *Economic Development and Cultural Change*, Vol. XX, pp. 75-87.

WHO and UNICEF (1990) *Joint Monitoring Programme for Water Suply and Sanitation*, World Health Organisation and United Nations Children's Fund. Available at

http://www.wssinfo.org/en/122_definitions.html, accessed on September 2008.

World Bank (2002) “Bolivia Water Management: A Tale of Three Cities”, *Précis No.222*, World Bank Operations Evaluation Department (Washington, D.C.).

Yepes, Guillermo (1999) “Do Cross-Subsidies Help the Poor to Benefit from Water and Wastewater Services? Lessons from Guayaquil”, *UNDP-World Bank Water and Sanitation Program Working Paper Series* n.38757. World Bank (Washington, D.C.).

APPENDIX

Per centage points change of access to water before and after privatization, by quintile of income

	1992-1996	1996-2001	2001-2005	1996-2005	AI -1992-1996			AI - 1996-2001			AI - 2001-2005		
quintile	change	change	change	change	0.1	0.5	1	0.1	0.5	1	0.1	0.5	1
La Paz													
1	0.223 **	-0.043 **	0.171 **	0.128 **	0.06	0.05	0.05	-0.01	-0.01	-0.01	0.05	0.07	0.09
2	0.045 **	0.088 **	0.081 **	0.168 **	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.03	0.05
3	0.168 **	0.013	0.037	0.051 **	0.04	0.05	0.05	0.00	0.00	0.01	0.01	0.02	0.02
4	0.099 **	-0.027	0.094 **	0.067 **	0.03	0.04	0.04	-0.01	-0.01	-0.01	0.03	0.06	0.12
5	0.088 **	0.003	0.018 **	0.021 **	0.03	0.05	0.09	0.00	0.00	0.01	0.01	0.03	0.53
total					0.03	0.04	0.04	0.00	0.00	0.00	0.02	0.04	0.07
El Alto													
1	0.022	0.224 **	0.079	0.303 **	0.01	0.00	0.00	0.05	0.04	0.03	0.02	0.02	0.02
2	0.092 **	0.174 **	-0.070	0.104 **	0.02	0.02	0.02	0.04	0.04	0.05	-0.02	-0.03	-0.03
3	0.242 **	-0.368 **	0.479 **	0.111 **	0.06	0.05	0.04	-0.07	-0.06	-0.04	0.12	0.11	0.09
4	0.277 **	-0.403 **	0.411 **	0.008	0.07	0.07	0.06	-0.08	-0.07	-0.06	0.10	0.10	0.08
5	0.078 **	0.018	0.035	0.052 **	0.02	0.02	0.02	0.00	0.00	0.01	0.01	0.01	0.02
total					0.04	0.03	0.03	-0.01	-0.01	-0.01	0.05	0.05	0.05
Cochabamba													
1	0.051 **	-0.048	-0.326 **	-0.374 **	0.01	0.01	0.01	-0.01	-0.01	-0.01	-0.08	-0.05	-0.03
2	0.124 **	-0.044	-0.421 **	-0.466 **	0.03	0.03	0.02	-0.01	-0.01	-0.01	-0.10	-0.07	-0.05
3	0.167 **	0.058 **	-0.136 **	-0.078 **	0.04	0.04	0.03	0.01	0.01	0.01	-0.04	-0.04	-0.03
4	0.109 **	0.055 **	-0.072 **	-0.017	0.03	0.03	0.03	0.01	0.02	0.02	-0.02	-0.02	-0.03
5	0.027	0.084 **	-0.189 **	-0.105 **	0.01	0.01	0.01	0.02	0.03	0.03	-0.05	-0.06	-0.07
total					0.02	0.02	0.02	0.00	0.00	0.00	-0.04	-0.04	-0.03
Santa Cruz													
1	0.159 **	0.020	-0.021	0.000	0.04	0.05	0.05	0.00	0.01	0.01	-0.01	-0.01	-0.01
2	0.125 **	0.022	-0.030	-0.007	0.03	0.04	0.05	0.01	0.01	0.01	-0.01	-0.01	-0.02
3	0.187 **	-0.024 **	0.024 **	0.000	0.06	0.11	0.66	-0.01	-0.03	-0.44	0.01	0.04	0.55
4	0.134 **	-0.015	0.014	-0.001	0.04	0.06	0.11	0.00	-0.01	-0.02	0.00	0.01	0.03
5	0.079 **	0.012 **	0.000	0.012 **	0.02	0.05	0.11	0.00	0.02	0.41	0.00	0.00	0.00
total					0.04	0.05	0.08	0.00	0.00	0.00	0.00	0.00	0.00

Note: ** Significant at 5per cent level.

Source: Authors' calculations based on INE.