An assessment of water utilities efficiency using the Portuguese case(*)

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Abstract

In this paper we study the determinants of performance in the water industry in Portugal. We use a set of performance indicators on financial and quality of service indices, regressing these and an overall composite index on a set of explanatory variables. We find evidence that the PPPs in the water industry in Portugal provide better services than the state-owned providers, but are not necessarily in better financial shape. We also find evidence that Portugal's fast track to build infrastructure in this area paid off, as the age of the concessions positively affects the financial performance. The regressions also indicate that the recent financial crisis did not significantly affect the companies operating in the industry, but recent developments in enhancing the quality of service are paying off. This paper helps better understand the water sector in Portugal and provides solid evidence that there is room for the different possible models of concessions: PPP, state-owned companies or government run services.

Keywords: Water utilities, efficiency, Portugal

(*) VERY PRELIMINARY WORK. DO NOT QUOTE WITHOUT PERMISSION.

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1. Introduction

Over the last decades, private sector involvement in the water utilities has increased significantly. In fact, in this type of public utilities, as in other types, we can observe a large variety of different contractual arrangements. The increase in the private sector participation has led to concerns about the use of public resources in this field. OECD (2000), "Water is a basic human need, and an economic good, a volatile mix". The social factor and need for universal access in water distribution is undeniable, and a source of discussion in reference to private sector participation. According to Gassner, Popov and Pushak (2009), the water sector is, in its majority, a natural monopoly, as well as a source of externalities. Additionally, the demand is somehow inelastic, which brings enormous pricing power to the provider, all reasons that have been used to justify public management in the past.

Water also encompasses an important paradox: Public entities have to ensure the financial incentives and attractiveness for the private partners, especially due to the high and irreversible level of investments needed; but the public authorities have to provide sufficient regulation to protect customers from monopoly abuse (Ouyahia, 2006).

This paper uses the Portuguese experience in the water management sector, in order to analyse how some variables affect the performance of these companies. This paper looks at the impact of private management, scale, productivity and contracts on overall performance, financial performance and quality performance. For the purpose of this analysis, first we have computed a methodology to assess these three types of performance. Having the scores for each type of performance, for each company, under a five-year period (2007-2012), we have run regressions on the variables in order to estimate the potential impact of each type of performance.

We will refer to "water sector" throughout the text, but the industry under analysis is much broader than just water. The firms engaged in these services are suppliers of household water and domestic wastewater treatment and solid household waste management. We will analyse firms that deal directly with households at a municipal level, which we refer to as "downstream". The other part of our sample is the firms that act as wholesalers for the municipalities, which we refer to as "upstream".

We find evidence in this paper that the performance in the water sector is indeed determined by ownership structure and by earlier consensus surrounding a concession. Many other factors also affect performance, such as population density (the mix households served and area covered), size of the companies and the recent developments in the quality of service in Portugal.

This paper is organized as follow: A short overview of the Portuguese experience is described in chapter 2. Chapter 3 presents a literature review on performance in the water sector with emphasis on the local experience. Chapter 4 presents the methodology and data used in this study. Chapter 5 presents results and chapter 6 concludes.

2. The Portuguese water utilities sector[1]

The water sector in Portugal comprises three different sub-sectors. These sub-sectors are the distribution of water to the public, the wastewater system, and also the waste management services. All three of the sub-sectors have a chain of processes. These processes are divided into the "upstream" and "downstream" stages. The upstream stages are correspondent to the wholesaler or bulk, being the downstream stages correspondent to the retailer.

The stages are the following:

Drinking water supply service to domestic households:

- Upstream – Groundwater abstraction, treatment, elevation, adduction
- Downstream – Storage, distribution, consumption

Wastewater management service from domestic households[2]:

- Downstream – Discharge, drainage, retention
- Upstream – Elevation, transport, treatment, rejection

Solid waste management services from domestic households:

- Downstream – Waste production, Municipal waste collection / Separate collection
- Upstream – Organic recovery/recycling, incineration, landfill

It is possible to see that in the drinking water supply services the upstream phases comprise the steps going from the extraction until the public network, being the downstream stages responsible for storage and distribution to the individual households.

In the wastewater management service, the downstream stages are correspondent to the collection of wastewater from the general public until the transfer to appropriate facilities. In these facilities, the water is treated and given a proper destination.

Regarding the waste management services, the case is similar to the wastewater management. Downstream stages include waste production and collection; upstream stages contain all the processes responsible for recycling or proper rejection of the items in question. The terms "upstream" and "downstream" in the last two sub-sectors may be misleading, as the "downstream" stages are delivering wastewater and solid waste to the "upstream" stages respectively. However, if you think of services being provided at a wholesaler and retailer scale then the terms become more intuitive even in these cases.

In order to comply with European infrastructure requirements and to take advantage of European funding provided by the III Community Support Framework, Portugal engaged in a frantic expansion of the water system infrastructures from the start of the century. In 2000 the

[1] We are restricting ourselves to the analysis on Continental Portugal, excluding the Islands of Azores and Madeira.
[2] On purpose, we inverted downstream and upstream in the cases of wastewater and solid waste. Notice that in the water supply case the upstream literally means abstraction of water upstream and delivering it to the downstream companies who ultimately deliver them to the consumers. However, in the case of wastewater and solid waste the stream of the waste goes against the stream of service: the ultimate consumer delivers the waste to the downstream company, while receiving the "retail" collection service; the downstream collection company delivers the waste to the upstream collection company, while receiving the "wholesale" service.

Government approved the I Strategic Plan of Water Supply and Wastewater Management (PEAASAR I, in the acronym for the Portuguese nomenclature). Over a period of 6 years the infrastructure was bound to meet the top European standards assuring a level of water supply service to 95% of the population and of wastewater infrastructure to 90% of the population. These goals where reached and surpassed for urban populations[3], when the expansion was completed with the II Strategic Plan (PEAASAR II) in 2013, but it remain lagging in rural areas. Figure 1 describes the fast progression of the sector in Portugal.

Insert Figure 1 here

This expansion has allowed the country to assure water supply to almost all population, especially in urban areas. Also, water quality has improved significantly. According to National Water Regulator, in 1993 only 50% of the domestic water supplied was considered safe, whereas within less than a generation, in 2011, that number climbed to 98% (RASAARP 2012). Naturally this rapid growth was only possible due to a massive investment. However, such an expansion as raised questions on the quality and efficiency in the use of public (National and Communitarian) funding and resources.

Further description on how the sector is structured follows within the literature review section.

3. Literature review

In the spectrum of private sector participation in the water sector, two main models have been dominant in terms of study and application. One is the model of full privatization of ownership and management, implemented in England and Wales. The second is the model of delegated management observed in France. This model works on a base of lease and concession contracts, with public ownership but mixed management (Ouyahia, 2006). Other models of the water sector development have been tested around Europe, with highlights to the Dutch model, of total absence of private participation (Prasad, 2006).

Results from these two main experiences have been mixed. In England and Wales, despite the full privatization in 1989, the involvement of the public sector had to come extensively in other ways. An extensive regulatory system was created to protect the customer. This lead to the imposition of a more regulated model instead of the de-regulation that a complete openness to the private sector would promise at the beginning (Bakker, 2003). In England and Wales, several studies show that in the first years, water charges for customers increased continuously. At the same time water companies' profits increased in a range between 50% and 700%, as well as the salaries of managers. Tariff increases were only used to increment profits and also to finance the expansion of the water sector holding companies to other sectors (Seppälä, Hukka, Katko, 2001). Other studies from the English case have also proven that leakage rates increased after the privatization (in some cases at 40% levels), due essentially to under-investment in the structures. The consequence is water waste and added risk in drought situations (Bakker, 2003).

In the French case, the output has been a bit more positive. French water sector companies have built a reputation and dimension based on the successful domestic case. Nevertheless, some

[3] Urban coverage ratios are at 99% and 95% when it comes to water supply and wastewater coverage. Also it should be noticed that the coverage data is more conservative now, since it measures households, rather than populations. This means that specially rural areas will be more penalized by this change.

problems still arose. The decentralization of power to municipalities raised several regulation issues, with problems such as corruption, water contamination and increased fees being reported. Additionally, the low negotiating skills of municipal power officials contributed to fewer positive deals, and consequently, a shake in the public-private harmony (OECD, 2000). The relative success of the French case is corroborated by the fact that the model has been replicated in several developing countries.

In Portugal, the rapid growth of the water sector has led to a considerable amount of research in this field. As pointed out by Cruz & Marques (2012), the challenge in the water sector has passed from extending coverage to upgrading efficiency and performance. There have been several studies on the Portuguese water sector, mainly focusing on efficiency. Several works use non-parametric methods, such as DEA, stochastic frontier or the Malmquist index to assess the overall efficiency of these companies.

In Portugal there are three models of management of companies in the water sector: direct state management (only downstream), delegation and concession. Direct state management, means a local or supra-local (so called, "inter-municipal") governmental services take responsibility for the service to be provided. Delegation means a state-owned company (usually Águas de Portugal, EP or one of its subsidiaries at the upstream level; or local and supra-local state-owned companies at the downstream level) provide the services. Concession allows for the entrance of private companies. These companies are either state-owned companies or privately owned (private majority shareholders) or partly privately owned together with municipalities (private minority shareholders). When the company is mostly privately owned, the concession is considered a PPP. Concessions can be municipal or multi-municipal. Figure 2 illustrates the distribution throughout the country or the different models for the water supply downstream sector.

Insert Figure 2 here

The sector of water distribution has a low level of horizontal integration. There are around 300 companies, for a total population of 10 million. From these 300 companies, less than 20 serve more than 100 thousand inhabitants. More than 100 cover a population below 10 thousand people. This provides a sense of the low integration patent on the sector (Cruz and Marques, 2012).

Several studies from Marques et al. (Marques, 2008; Marques & Witte, 2011; Carvalho & Marques, 2011; Correia & Marques, 2011), have used the non-parametric methods to asses efficiency on Portuguese water companies. Inputs used were capex, opex, staff cost (Marques & Witte, 2011; Carvalho & Marques, 2011), with outputs as billed water volume, drinking water costumers, volume of water delivered and total revenues.

This research has reached some relevant conclusions for our study. Marques & Witte (2011) point out that there is some evidence of scale economies, along with natural monopoly features. They also have found that the optimal dimension for a water company in the Portuguese market is between a population of 160 and 180 thousand. Carvalho & Marques (2011) found that local regulation has increased efficiency. The study is inconclusive about form of ownership but found that when the same company horizontally concentrates water and wastewater services performance is reduced. The later is partially reaffirmed in Carvalho, Marques & Berg (2011)

that found that large utilities have diseconomies of scope, particularly if the ownership is public. This is reaffirmed by Correia & Marques (2011) that also found increased economies of scale but decrease economies of scope. In Marques (2008), the study found that private management increases quality, but apparently have the opposite effect on efficiency.

4. Methodology and data

We divided efficiency into financial, quality and overall efficiency. The financial efficiency measures the financial performance of each company. The quality efficiency addresses the quality and sustainability of the service provided to users by each company. These two scores were computed independently on a yearly basis. Table 1 identifies the indicators used for each type of efficiency. A five-year period, from 2007 to 2012 was used. The data needed to feed the indicators was collected from the yearly reports of the National Water Regulator (RASAARP2007 to RASAARP2012). Each indicator was measured in different units and scales, but then a ranking order with a score from 1 to 5 (5 being the highest score) was used to harmonize and aggregate the information. The individual indicators were aggregated into a weighted average grade of 1 to 5 in terms of financial and quality efficiency grades, using the methodology used by Reis (2009) and Ribeiro (2015).

Insert Table 1 here

Overall efficiency is a composite grade originated from the previous two efficiencies, as both scores are weighted to reach the final score of performance of each company. For that, we assume a weight of 40% for financial performance and 60% for quality performance. The additional weighting of the quality versus the financial indicator hinges on the fact that we believe that quality is more relevant on an industry with high social objectives such as this one. The fact that we later always provide the separate analysis between financial and quality indicators also turns the discussion around the weights somewhat irrelevant.

By using a panel data of 5 years, with a total of 103 companies (45 on the upstream and 58 on the downstream), allow us to collect a total of 322 observations). Data availability reduced the total usable observations to 274.

In order to address how efficiency is determined by some variables, we used an OLS, with the dependent variable being the global efficiency in the first test, the financial efficiency in the second test and the quality efficiency in the third test.

$$Yi = \beta_0 + \beta_1\, concyear + \beta_2\, concper + \beta_3\, contractchanges + \beta_4\, public + \beta_5\, land + \beta_6\, houses + \beta_7\, workers + \beta_8\, EPAL + \mu i \quad (1)$$

where:

- *Yi* is the explained performance variable and can be the financial efficiency grade ($FinancialPerf_i$), the quality efficiency grade ($ServiceQual_i$) or the global ($GlobalPerf_i$) efficiency grade. All 3 grades are defined in a range between 1 and 5
- *concyear* is the year that the concession was awarded.
- *concper* is the number of year of the concession.
- *contractchanges* is the number of changes in the contract, in terms of contract extensions.

- *public* is a dummy variable capturing whether the project is managed by private companies or state owned entities. The dummy has the value of 1, if the company/services/concessionaire is held in majority by state owned companies or entities.
- *land* is defined as the area served by the company, measured in square kilometres.
- *houses* is a variable that considers the number (in thousand) of homes in the area of the concession. That will allow us to consider the potential impact of population density.
- *workers* measures the number of workers in each company. This variable is a proxy for the size of the company.
- *EPAL* is a dummy variable referring to the upstream water supply company in Lisbon, named EPAL. This entirely state-owned company has specificities, but serves a significant portion of the population of the country. We did not want to exclude this company from the sample, but think that this special case deserves to be in a category of itself.

We have performed several data diagnostic tests. The correlation matrix (Table 2) shows little to no evidence of strong correlations between variable pairs (nor did the VIF tests). Therefore, multicollinearity is not likely to lead to estimation problems. The only exception pertains the variable *EPAL*, which configures an outlier situation. [4] We also performed a Breusch–Pagan test for heteroscedasticity and rejected the null hypothesis. In addition, the Wald test was statistically significant, which implies that the regressors have an important collective impact on performance. The statistics descriptive is presented in Table 3.

Insert Table 2 and 3 here

Insert Figure 13 here

5. Hypotheses and Results

We next outline our expectations with regard to the different signs of the coefficients in regression (1) and develop the hypotheses we want to test and then comment on the results we found.

When it comes to the variable *concyear*, we postulate that the earlier contracts are more efficient than the later ones. Most of the concessions and delegations of water services are political problems. As such the first ones to get sorted out are usually the most consensual and these were the ones where efficiency gains would be visible first. Hence we expect β_1 to be negative.

A similar argument would apply to *concper*. It would be easier to agree on longer contracts for less controversial concessions and delegations. As such, β_2 should be positive, since longer periods mean higher performance.

The hypothesis surrounding the following variable, *contractchanges*, should follow a similar logic, though the problem there is one of reverse causality: we expect the coefficient β_3 to be

[4] We ran the entire analysis, including all the regressions, excluding EPAL from the sample. The results were not significantly different. However, we thought that excluding the largest company in the sample and the one that supplies roughly a quarter of the population would be too limiting of the overall picture of the Portuguese water sector. Hence, we opted to leave EPAL in, taking all risks associated with this.

negative, since more contractual changes are needed when things are not working out in the concession. However, this prediction is hard to make, since it is expected that these contractual changes result in improvements on the original contracts, and hence improve efficiency.

The most controversial hypothesis would be the one relating to the *public* variable. We hypothesize that the arrival of private partners should be an improvement in efficiency. After all, one of the key arguments to bringing private partners to running public services is the mobilization of private management skills. In our case, this would mean that β_4 should be negative.

The next two variables work in tandem to capture opposite effects: covering larger surfaces is something that is more cumbersome and leads to inefficiencies, but, on the other hand, serving more households is something that creates scale and helps efficiency. The two variables are useful to isolate these effects and we expect the signs to be opposite, β_5, the coefficient on the variable *land*, should be negative, while β_6, the coefficient on the variable *houses*, should be positive.

The next variable, *workers*, is a proxy for size of the companies. We think that larger water companies should provide more efficient services and hence β_7 should be positive. This should be true, even after controlling for the scale provided by the variable counting for the number of households served.

Finally, EPAL, the state owned company providing the upstream water supply services to the Lisbon region[5] is one of the oldest operators in the industry. It is also the largest company in size and in the number of customers it serves. Its specificities, the fact that it needs to serve a large population that is further away from the water source than the average company in Portugal, which leads us to hypothesize that β_8 is negative on all regressions.

On separate regressions, we also test the hypothesis that there are year effects on the performances' grades. We expect the financial performance to decrease with the financial crisis. However, the regulator claims that the quality performance has increased in recent years, so we expect the coefficients on the year effects to be positive on the regressions explaining the quality of service.

We also proceed to replicate the regressions for the subsamples of the upstream companies and the downstream companies, where the hypotheses for the all the variables are the same.

The results we present next validate some, but not all of these hypotheses.

Insert Table 4 here

The strongest evidence in terms of significance, matching our expectations concerns the fact that indeed $\beta_1$is always negative (at under 1% significance), confirming that the oldest companies are more efficient financially, operationally and globally. Possible explanations for this range from a certain degree of survival bias (the companies that are less efficient were terminated and re-concessioned) to the possible argument raised earlier in the hypothesis development. Indeed the political process was sorted out easier in the more consensual cases, in those cases requiring less investments and likelier to succeed.

[5] And also the downstream services for the Municipality of Lisbon. It gets its water from the Castelo de Bode Dam in the Zezere River more than 100 kms North of Lisbon.

Also considerably strong is the evidence that serving larger territories hurts efficiency, especially financial efficiency (1%). But the evidence is also quite strong for the quality efficiency (5%). The level of infrastructure required to cover wider surfaces obviously damages efficiency. Also, when it comes to quality efficiency, we are considering coverage rate as one of the sub-indices that define performance. The coverage rate is lower in rural areas, where the territory covered is larger.

Linked to this variable is the number of households to capture the effect population density has on the quality parameters. We found significance (5%) in the relation between the number of households served and the quality of service, but not on the other dimensions of performance. In other words the economies of scale of servicing larger populations lead to higher levels of service, but not to financial efficiency, partially confirming our hypothesis.

Another significant variable is the size proxy we use. Financial (at 1%) and overall (5%) efficiency seems to be determined by the number of workers used. Larger companies are more profitable than smaller companies. To our surprise, however, this effect is not relevant in the quality of service. In other words, more workers do not imply any improvement in the service provided, which hints at the fact that there is a reduced human intervention in the quality of the services rendered.

The control dummy we introduced for the Lisbon water supplier proves itself significant (5% for financial and quality performance, reinforced to 1% on overall performance) on all regressions with the expected negative sign, confirming our hypothesis that the particularities of EPAL hurt its performance financially and in terms of quality of service.

Finally, the year effects are also quite interesting to analyse. First of all, the introduction of year dummies does not change the previous conclusions on the variables analysed so far and only marginally changes some of the significances, mostly by reinforcing them. This can be seen by comparing the columns on Table 4 with and without year effects. Second, year effects do not affect performance in the financial grades, but they do have an impact on the quality performance. As the regulator attests, the quality of service has been improving throughout the recent years and that is noticeable by the positive significant coefficients on the year dummies for 2009 and 2010 (both at 5%) and even more in magnitude and in significance (1%) in 2011.

Insert Tables 5 and 6 here

Tables 5 and 6 present separated results for the regressions applied to upstream and downstream companies.

For the upstream companies the results in Table 5 generally confirm the results for the joint regressions: namely the older contracts are more efficient in all measurements of performance (financial, quality and overall); changes in contracts have an undetermined effect on the performance measurements; larger territorial coverage negatively affects financial efficiency more than quality efficiency; economies of scale from the number of households served help quality rather than financial performance; and there has been an improvement in quality of service over the last years. Partially verified is the fact that EPAL underperforms the upstream peers only in quality of service, but not in the financial. We lose the significance on the result of the private companies outperforming in quality the state owned ones.

Probably the most surprising result is the fact that the concession duration becomes significant here with the upstream subsample. Namely, it very significantly affects negatively the financial performance. This is somewhat a surprise and contradicts our previous hypothesis, as we expected the duration of the concessions to be longer in more consensual contracts. It seems however that in the case of the upstream companies an alternative explanation holds. Possibly the more troublesome concessions are given more time to recover.

When it comes to the downstream companies, apart from the significance on the age of the concessions, again confirming that older contracts to be more efficient, everything else is not significant.

6. Conclusions

Using the very well documented water sector in Portugal, we analyse which would be the determinants of performance in this industry. We find evidence that hints at the fact that concessions in this industry is a delicate political issue, and that the governmental entities are not always the best solution for providing a service of quality to the populations.

Among the most interesting conclusions from our work, we would emphasize that in Portugal the earlier concessions are the best performers and the passage of time to negotiate looks like the best indicator of less successful stories. Another interesting result is the evidence that private concessions are better at running the companies, but only when it comes to quality of service. This efficiency does not lead to better financial performance.

The paper has some limitations in the analysis which can be tackled in further research. A more detailed analysis of the individual components of performance can be done. It is also possible to improve the description of the industry by looking into more detail in the different shades of state intervention and vertical integration in the industry with companies that operate simultaneously in upstream and downstream. Further it would be useful to understand the separate subsectors (water supply, wastewater and solid waste management) in this analysis. It would be further useful to analyse horizontal integration, by looking at companies that specialize in just one subsector, or operate in more than one.

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Table 1 – Financial and quality indicators

Financial Performance	
Indicator	**Formula**
Equity Ratio	Equity / Assets
Exploration Margin	Operational Profit / Revenues
Permanent Capital Coverage	Operational Profit / Permanent Capital
Capitalization	Equity / Share Capital
ACP	Average Collection Period
% owned by AdP on the concession	

Quality Performance
Service Availability
Occurence of failures on the network
Water safe for consumption
Coverage Ratio
Unbilled Water
Reabilitation of distribution networks
Suitability of Human Resources
Respect of legal parameters

Source: Ribeiro (2015)

Table 2 – Correlation Matrix

	Concyear	*Concper*	*Contractchanges*	*Public*	*Land*	*Houses*	*Workers*	*EPAL*
Concyear	1							
Concper	0,054	1						
Contractchanges	-0,008	0,283	1					
Public	-0,149	0,128	-0,337	1				
Land	-0,086	0,162	-0,126	0,594	1			
Houses	-0,509	0,277	-0,125	0,509	0,354	1		
Workers	-0,484	0,366	-0,102	0,401	0,417	0,758	1	
EPAL	-0,656	0,347	-0,096	0,124	0,21	0,588	0,738	1

Table 3 – Statistics descriptive

	Obs.	Mean	Median	Mode	Standard Deviation	Minimum	Maximum
GlobalPerf	280	3.112	3.1	3.514	0.525	1.7	4.657
FinancialPerf	280	3.696	3.86	4.29	0.659	2	4.86
ServiceQual	280	2.723	3	3	0.648	1	5
Concyear	280	1.999.886	2000	2001	5.331	1974	2011
Concper	280	30.993	30	30	7.407	15	50
Contractchanges	280	0.443	0	0	0.625	0	2
Public	280	0.543	1	1	0.499	0	1
Land	280	2.103.621	919	379	2.744.182	41	17037
Houses	280	165.464	82.05	7	224.491	4.7	1142
Workers	280	111	77	12	121.78	4	815

Table 4 – Results all sample

VARIABLES	(1) GlobalPerf	(2) FinancialPerf	(3) ServiceQual	(4) GlobalPerf	(5) FinancialPerf	(6) ServiceQual
Concyear	-0.0358***	-0.0357***	-0,0358***	-0.043***	-0.0378***	-0.04643***
	(0.01)	(0.01)	(0,01)	(0.01)	(0.01)	(0.01)
Concper	-0.0005	-0.0068	0,0037	0.001	-0.0065	0.00596
	(0.01)	(0.01)	(0,01)	(0.01)	(0.01)	(0.01)
Contractchanges	0.0467	0.0114	0,0702	0.0226	0.0066	0.03335
	(0.06)	(0.07)	(0,07)	(0.06)	(0.07)	(0.07)
Public	-0.1308	-0.0360	-0,1943*	-0.1551*	-0.0438	-0.22958**
	(0.09)	(0.11)	(0,12)	(0.09)	(0.11)	(0.11)
Land	-0.00006***	-0.00009***	0**	-0.0001***	-0.0001***	-0.00003*
	(0.00)	(0.00)	(0)	(0.00)	(0)	(0.00)
Houses	0.0003	-0.0001	0,0006**	0.0004*	-0.00004	0.00065**
	(0.00)	(0.00)	(0)	(0.00)	(0)	(0.00)
Workers	0.0011**	0.0023***	0,0003	0.0009*	0.0022***	-0.00004
	(0.00)	(0.00)	(0)	(0.00)	(0)	(0.00)
EPAL	-1.1996***	-1.1713**	-1,2171**	-1.3169***	-1.2011**	-1.3928**
	(0.43)	(0.54)	(0,57)	(0.42)	(0.55)	(0.55)
2008.Year				0.0413	-0.0649	0.11269
				(0.09)	(0.12)	(0.12)
2009.Year				0.1192	-0.0617	0.24024**
				(0.09)	(0.12)	(0.12)
2010.Year				0.167*	0.009	0.27243**
				(0.09)	(0.12)	(0.12)
2011.Year				0.2872***	0.0463	0.44805***
				(0.09)	(0.11)	(0.12)
Intercept	74.64***	75.23***	74,189***	89.02***	79.55***	95.26***
	(16.93)	(21.38)	(22,24)	(17.12)	(22.08)	(22.33)
Observations	280	280	280	280	280	280
R-squared	0.23	0.22	0.13	0.27	0.23	0.18

standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 5 – Results for upstream

VARIABLES	(1) GlobalPerf	(2) FinancialPerf	(3) ServiceQual
Concyear	-0.0505***	-0.0358*	-0.0602***
	(0.01)	(0.02)	(0.02)
Concper	0.0004	-0.0272***	0.0188*
	(0.01)	(0.01)	(0.01)
Contractchanges	-0.0032	0.1819	-0.1265
	(0.09)	(0.12)	(0.12)
Public	-0.1562	-0.1523	-0.1596
	(0.14)	(0.18)	(0.19)
Land	-0.00004**	-0.0001***	0.
	(0)	(0)	(0.00)
Houses	0.0007**	0.0002	0.001***
	(0)	(0)	(0.00)
Workers	-0.0001	0.0014	-0.0011
	(0)	(0)	(0.00)
EPAL	-1.151*	-0.3876	-1.6577**
	(0.6)	(0.79)	(0.82)
2008.Year	0.0427	-0.1113	0.1457
	(0.11)	(0.15)	(0.16)
2009.Year	0.1292	-0.2295	0.3685**
	(0.11)	(0.15)	(0.15)
2010.Year	0.1713	-0.2257	0.4353***
	(0.11)	(0.15)	(0.16)
2011.Year	0.3089***	-0.1056	0.5852***
	(0.11)	(0.15)	(0.15)
Intercept	104.08***	76.39**	122.34***
	(27.96)	(36.46)	(37.91)
Observations	158	158	158
R-squared	0.35	0.36	0.25

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 6 – Results for downstream

VARIABLES	(1) GlobalPerf	(2) FinancialPerf	(3) ServiceQual
Concyear	-0.0380***	-0.0367***	-0.0389***
	(0.01)	(0.01)	(0.01)
Concper	0.0021	0.0169*	-0.0078
	(0.01)	(0.01)	(0.01)
Contractchanges	0.0347	-0.1385	0.1502
	(0.08)	(0.09)	(0.1)
Public	-0.2208	-0.1761	-0.25
	(0.3)	(0.35)	(0.36)
Land	0.00005	-0.0001	0
	(0.00)	(0.00)	(0.00)
Houses	-0.0028	0.0012	-0.0054
	(0.00)	(0.00)	(0.00)
Workers	0.0024	0.002	0.0026
	(0.00)	(0.00)	(0.00)
2008.Year	0.0454	0.0269	0.0587
	(0.16)	(0.19)	(0.19)
2009.Year	0.1165	0.1998	0.062
	(0.16)	(0.18)	(0.19)
2010.Year	0.1734	0.3745	0.0407
	(0.15)	(0.18)	(0.19)
2011.Year	0.2594*	0.2679**	0.2546
	(0.15)	(0.18)	(0.18)
Intercept	78.96***	76.43***	80.69***
	(24.03)	(27.88)	(28.88)
Observations	122	122	122
R-squared	0.17	0.20	0.15

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Figure 1: Evolution of Coverage Rate in the Water Sector

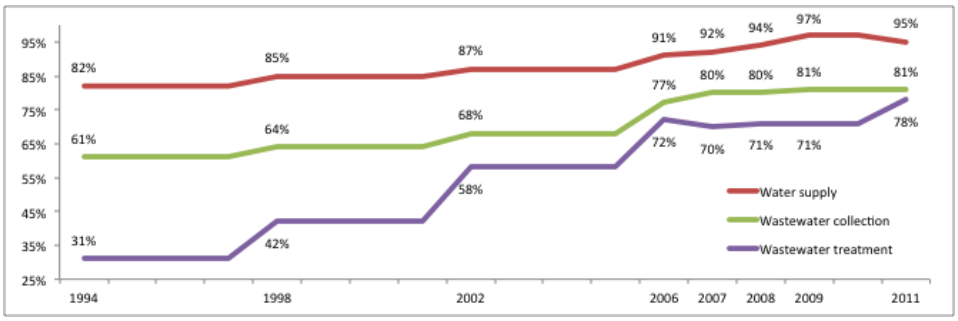

Figure 1: Coverage rates for population in water supply, wastewater collection and treatment according to National Water Regulator Report (source: RASAARP 2012). Coverage for 2011 refers to households.

Figure 2: Distribution of different models of water supply downstream companies

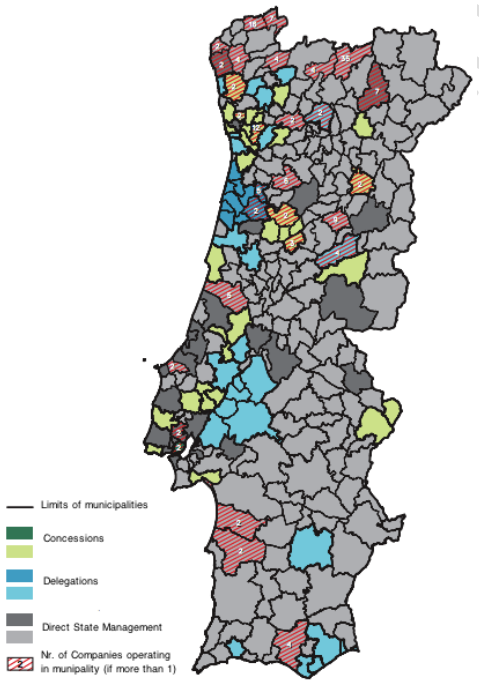

Figure 2: Distribution of different models of water supply downstream companies (source: RASAARP 2012, adapted and translated by the authors)

Figure 1 – Histogram of global performance