Catolica Lisbon School of Business and Economics

Performance Drivers and the Public vs. Private Management debate on Water Sector Companies – Conclusions from the Portuguese Case

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Public Private Partnerships – Dissertation Seminar

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Abstract:

Since the introduction of Public Private Partnerships as a financing model that the discussion around its advantages has been intense. Using as example a strategic and fundamental sector as the water sector, we analyzed what are the main drivers for financial and service quality performance. Public databases for Portuguese water companies were used and performance levels computed, using an evaluation model, Finally, regression analysis was used in order to achieve conclusions on the variables that enhance performance, and also to access the best management model – public or private. Aligned with the findings of the literature review, no clear advantage in private management was found. Nevertheless, solid conclusions were found that longer periods of concession and shorter periods until the end of the concession yield higher performance levels.

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1. Introduction

Motivation

PPPs have been increasingly used on the last couple of decades as a financing instrument, especially in what concerns investments on big infrastructure. The financial capability of private partners, and the fact that a PPP brings risk sharing possibilities and usually defers the costs of an investment through multiple generations have been some of the main points of interest. Additionally, using private management on public infrastructure also usually has the objective of benefiting from the private sector expertise and efficiency.

Portugal is not different, and on the last few years, PPPs have been a really hot topic, since its utilization has been majorly considered as an off balance sheet financing scheme for all the governments. The performance of these PPPs is debatable, and a large discussion on the costs these projects have for taxpayers has been installed. Risk assessment has also been debated, since evidence shows that he risks are not being shared on the optimal proportion, with current benefit for the private parties. However, the main focus of PPPs in Portugal has been dedicated to transport concessions, and also health facilities, as two examples.

The Portuguese water sector[1] has been having private participation for some years now, but in a method a bit different from the usual PPP instalment for infrastructure investment. Whereas PPPs are usually a conglomerate of private companies organized to develop a certain project, on the water sector, the PPP methodology used is one of concessions.

Therefore, the importance and scepticism about PPPs on the Portuguese context, and also the impact that the water sector has on the daily life of all people were the main motivations to pursue the study of this topic.

The international experience of private participation on the water sector has also been a subject of some research and mixed conclusions. All throughout the world there are some

[1] 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/or domestic wastewater treatment and/or solid household waste management. We will analyze firms that deal directly with households at a municipal level, which we refer to as "retailers" or "downstream", and firms that act as wholesalers for the municipalities, which we refer to as "wholesalers" or "upstream". In Portugal, the largest player in these several industries is Águas de Portugal, which explains the association with the "water sector".

different private participation models, but at the time there conclusive and solid evidence is lacking on which one is the best management model for the water sector – public or private.

Given the mixed findings on private participation on the global water sector, performance evaluation and drivers came up as an interesting topic for analysis.

Scope of analysis

The objectives of this study are mainly two. The first one is to assess which are some of the potential drivers for increased performance on this particular sector. To reach this objective the first step is the usage of an evaluation methodology to classify the performance of the concessions (public and private) working on the Portuguese water sector. After this step, choosing potential variables whose impact might be relevant for the study and performing the adequate statistical processes to evaluate their impact.

A second objective is to assess and to add evidence to the discussion on which one is the best management model for the water sector – public or private. Furthermore, the analysis will be more directed to finding which model provides the best service to the customer, not only which model is financially more stable.

2. Literature Review

Introduction to Public Private Partnerships

The concept of Public Private Partnerships is broad and difficult to exactly define. Several descriptions have been made in the past few years, by multiple authors and organizations. The OECD defines PPPs as "an agreement between the government and one or more private partners (which may include the operators and the financers) according to which the private partners deliver the service in such a manner that the service delivery objectives of the government are aligned with the profit objectives of the private partners and where the effectiveness of the alignment depends on a sufficient transfer of risk to the private partners.".

Yascombe (2007) defines some generic attributes of PPPs, compiling a definition of PPPs as: a long term contract between a public sector and private sector party, for the design, construction, financing, and operation of public infrastructure by the private-sector party, with payments over the life of the PPP Contract to the private-sector party for the use of the Facility, made either by the public-sector party or by the general public as users of the Facility, and with the Facility remaining in public-sector ownership, or reverting to public-sector ownership at the end of the PPP Contract.

Generally speaking, it is possible to define PPPs as a long-term agreement in which a private sector entity is contracted by the public sector to provide a service widely accepted as a public good.

The tasks of the private partner are defined in the contract, but usually comprise the financing, construction and operation of the facilities, at least for a determined period of time. Nevertheless, the state still possesses some power over the ruling of the infrastructure. The financial gain for the private partner comes either from receiving service fees from the government, or by charging directly the users. In some cases, there might also be a combination of both schemes (OECD, 2011).

In the same document published by the OECD, we can read "The effectiveness of the alignment depends on a sufficient and appropriate transfer of risk to the private partners." This provides evidence that for a successful PPP to arise, the main factor is a correct transfer of risk among the public and private partners.

In terms of water sector PPPs in Portugal, we can see some of these characteristics: long term contracts, mainly used for operational purposes, regulated and controlled by state authorities, and where the risk transfer has not always been considered the best.

Why incur in PPPs?

There are several reasons for Governments to adopt the PPP option. However, according to Grimsey and Lewis (2005), the main reason is of course to deliver higher value for money in these projects, compared to the service if offered by the public sector, especially due to the efficient transfer of risks between partners.

The expertise that the private sector brings to the project is also valued. Management skills, and also more efficiency and effectiveness on the provision of services are critical aspects in the option for a private partner (McQuaid & Scherrer, 2009). This is even more relevant when the public sector has a widely accepted image of being a less effective services provider, when compared to private companies, usually with projects with longer completion times and costs. Even though the provision of public goods must be analysed with different patterns, the public sector does not have the best of reputations in what concerns effectiveness of service provision and project management.

Other motives emerge as possible drivers for PPPs. The pressure of the private partner to secure profits, and therefore efficiency gains might lead to innovations in the area that otherwise would not be funded. Moreover, PPPs can be used as a way to provide a benchmark in terms of performance to the public sector. In this case, PPPs are used to provide a model for public projects in the same area. By using this, the state gets a benchmark in terms of effectiveness and budget management, transferring than this knowledge to the fully public projects. This model is being used in Norway, for example (Yascombe, 2007).

Another advantage that a PPP contract brings is that it allows the capital cost of the facility to be dispersed all along the life of the project, instead of being immediately allocated to Governmental budgets (Yascombe, 2007). This is especially appealing to European Union countries, after the budget deficit limits imposed to them by the Maastricht Treaty. This specification of a PPP contracts has also raised some issues related to the purpose of PPPs. As Bovaird (2004) states, "Of course, this gives rise to the possibility that these partnerships have not been marriages based on love, or even on respect for the qualities each could bring to the relationship, but rather marriages for money.". The fact that PPPs present themselves as a good opportunity for off-budget financing is an important issue to evaluate the true intentions of the design of a PPP project.

In the Portuguese case of water PPPs, we might argue that at some extent the benefit of private expertise has been important, since many municipalities don't have the business knowledge to run a water system. Nevertheless, given the country experience with PPPs, the

public opinion tends to consider that the off-public budget financing, has been a decisive motive for PPPs incurrence in Portugal, especially due to shortage of public funding, allied with electoral pressure for infrastructure development.

PPPs on the Water Sector

The water sector presents in its core characteristics a number of specifications that make it a really special case. Quoting 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.

On the International Conference on Water and the Environment in Dublin (1992), participants classified water as a "as an economic good, i.e., a commodity that should be priced at its cost of provision (including environmental externalities) and its true value to society".(Ouyahia, 2006) Water also closes an important paradox: Public authorities have to ensure the financial incentives and attractiveness for the private party, especially due to the high and irreversible level of investments needed, as well as provide sufficient regulation to protect customers from monopoly abuse. The regulatory burden is even more important when taking into account that if demand becomes stagnant, financial recovery for the partner becomes essentially dependent on price increases (Ouyahia, 2006).

The only possible source of competition for PPPs in the water sector is regarding the attribution process of concessions or other contracts. Usually, the more competitive the bidding process, the more efficient the overall future result tends to be. Nevertheless, even in those processes, a lack of competitive environment has been noticed. First of all, there is the need for a policy of total transparency by the public sector, to avoid asymmetries of information towards future partners. Additionally, the high costs of setting a bid usually end up excluding smaller companies from the process. For example, as mentioned by Ouyahia, each company bidding for the Buenos Aires concession reportedly spent an average of 2,5 million USD in setting up the bid, whereas in the case of Manilla, these costs raised up to 5

million USD. These high costs have are a possible trigger for non-competitive/corruptive behaviors on the bidding process (Ouyahia, 2006).

In the particular case of the water sector in Portugal, the closest we get to these issues would be to analyze and discuss the governance and the background of the main player in the industry: Águas de Portugal, which is a state owned holding of companies dominating the industry, especially when it comes to upstream.

Models of Private Sector Participation in the Water Sector

In the spectrum of private sector participation in the water sector[2], 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 functions on a base of lease and concession contracts, with public ownership but mixed management. This last one has been promoted by the World Bank as model of development, and therefore replicated on several developing countries (Ouyahia, 2006). Other models of 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, and at the end, more regulation ended up being imposed, 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 researches show that in the first years, water charges for customers increased continuously, and in parallel, water companies' profits increased in a range between 50% and 700%, as well as the salaries of managers. At first sight, it seemed at the time that tariff increases were only used to increment profits and also to finance the expansion of 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, leading to water waste and risk in drought situations (Bakker, 2003).

[2] Here water sector excludes the solid waste management and relates solely to water supply and wastewater management.

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 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 less 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, and also due to the fact that two of the biggest references in water services provision worldwide (Veolia and Suez) are originally French.

In the particular case of Portugal we see evidence of several different models in place. The fact that the main mainstream player (AdP) remains in the sphere of the state owned companies mixes the existing model significant into something hybrid between the French and the Dutch models. In the event of a full privatization of AdP we may even move to something close to the English-Welsh model.

Overall Impact and Performance of PPPs in the Water Sector

Notwithstanding all the specifications of the water sector mentioned above, it still has remained attractive for private sector participants. Despite the big investments needed to build a network, private companies usually perceive some aspects for fast change in public water companies, which customarily translate into efficiency and monetary gains. Improving customer records, billings and collections, together with better management of water treatments and unaccounted water (leaks plus illegal connections) are regularly fast ways of cutting costs and boosting revenues, therefore contributing easily to an improved financial record (OECD, 2000).

Gassner, Popov and Pushak (2009), studied several examples of private sector participations in the water sector, and derived some conclusions. In their study, the authors calculated that, on average, the private sector companies were responsible for an increase in 12% in residential connections, a 41% increase in daily water service, and considerable increases in various labour productivity ratios. However, the authors point that much of this enhanced productivity comes from considerable layoffs. On the studied cases, the average workforce on water companies gradually decreased by 22% after some years of private sector entrance.

Marin (2009) analysed a set of PPPs on the water sector of developing countries. Marin observed, in the majority of cases, reduction on water losses, in some cases even to levels matching up with the best performing water utilities in developed countries. An overall increase on the performance in terms of bill collection was also noticed, corroborating the above-mentioned arguments. In terms of labour productivity, once again evidences of increase after private action were found. In the case of developing countries, increases in productivity came from extension of customer bases, but also due to layoffs. Marin states "Many of the utilities concerned were overstaffed, and PPP projects were often accompanied by significant layoffs, ranging from 20 percent to 65 percent of the initial labor force. The layoffs were often motivated not just by overstaffing but also by the need to change the overall profile of employees and to hire more skilled staff."

In terms of tariffs, Gassner, Popov and Pushak (2009) find no evidence of systematic increase in residential prices, or at least no differences between the cases of private and public sector management. For Marin (2009), with the sample from developing countries, data was a bit different. Significant tariff increases were found, but the author states that "analyzing the impact of PPPs on tariffs can be easily misleading, because it is heavily dependent on prevailing tariff policies. Tariff increases are not necessarily a bad thing for customers when they also translate into wider access to better services, as happened under many PPPs.". Additionally, many governments had a record of providing water at below-cost levels, either by social or political reasons (OECD, 2000). Taking this into account, tariff analysis must be done carefully, since price increases are not necessarily applied just with an "extra-profit" motivation, but sometimes for a matter of sustainability and as a result of increased service levels. Tariffs are highly dependent on the policy previous to PPP, the cost-recovery level, and also the potential efficiency gains that the private operator is able to achieve (Marin, 2009).

Regarding investment, the impact of PPPs seems to be more dubious. Gassner, Popov and Pushak (2009) found no evidence of increased levels of investment coming from private partners.

Experience with PPPs has shown that the initial focus on potential private financing was wrong. Private operators have been successful in improving service and operational efficiency, what ends up having an indirect effect on financing, since it potentially increases revenues and profits, therefore increasing the credit profile towards possible lenders. Nevertheless, this advantage could emerge even if the water companies were still in public hands. No clear advantage has showed up just based on ownership differences (Marin, 2009).

Additionally, especially in emerging countries, PPPs have failed to fully provide the agreed levels of investment on utilities. Furthermore, in some cases where reasonable levels of investment have been made, a big stake has been financed by public grants. The case of developing countries is very relevant for investment analysis, because there are immense infrastructure needs and social goals tied up with water distribution, which cannot be exclusively financed with cash flow from operations, as corroborated by difficult cases such as the Buenos Aires and La Paz (Marin, 2009).

PPPs in the water sector have in fact gathered mixed reports. Prasad states that despite the apparent operational gains, cases of bribery, corruption, non-compliance with contractual goals, together with layoffs, tariff increases and pollution have been reported, usually leading to premature renegotiations. Some factions start defending that a successful service is not dependant on ownership (public vs. private), but decisively on the efforts made to sustain financial viability, even when in public control (Prasad, 2006).

Performance measures in water sector PPPs

In terms of performance measurement and analysis, several methodologies can be used. Yardstick comparison is of course the most utilized, comparing data from one PPP to the other. Nonetheless, it is not straightforward at all. Factors such as topography, population density and social stratus can influence performance of water utilities. Some of the basic factors used for performance evaluation are product price, leakage levels, as well as investment expenditures (Ouyahia, 2006).

Chong et all (2006) use as a basic tool the above mentioned factors, but decompose expenditures on infrastructure on maintenance and expansion of network, to differentiate.

Marin (2009) also uses several indicators to perform the PPP analysis on developing countries. Water losses, collection rates, tariff levels and labor productivity (staff per thousand customers) are some of the examples.

Gassner, Popov and Pushak (2009) use multiple indicators to access the performance of water companies. Amongst all of them, the following are highlighted:

- Residential connections
- Water sold per connection
- Employees
- Water sold per worker
- Residential connections per worker
- Residential coverage
- Collection rate
- Water lost in distribution
- Hours with water daily
- Capex per worker
- Average residential tariff

PPPs in the water sector – the Portuguese case

The Portuguese case in water PPPs presents an interesting case. In the last decade, the Portuguese water sector suffered an enormous expansion in terms of coverage, reaching nowadays pretty much the entire population. Nevertheless, the managing structure did not always set the same pace of development. Problems with water losses, bad allocation of staff, inadequate tariff systems and ineffective management are still on the agenda. The challenge in the water sector has passed from extending coverage to upgrading efficiency and performance (Cruz and Marques, 2012).

In Portugal, PPPs in the water sector can be created using essentially two legal and organizational frameworks – concessions or mixed capital companies. Concessions correspond to the usual term, and mixed capital companies are companies where the public sector has the majority of the capital, but there is also a private shareholder, usually with a non-controlling but big share of the company (Marques and Silva, 2008).

The sector of water distribution has a really low level of horizontal integration. To serve a population of around 10 million people in terms of water distribution, there are around 300 entities, all throughout national territory. From these 300 entities, less than 20 serve more than 100 thousand inhabitants, and more than 100 cover a population inferior to 10 thousand people, giving a good notion of the low integration patent on the sector (Cruz and Marques, 2012).

A big problem that has emerged in the water sector in Portugal is essentially linked to the low horizontal integration. Municipalities have the control of management of water

distribution, and are also responsible for launching the individual PPP program. A problem emerges because municipalities usually launch these programs and open the water distribution systems to private partners on a situation of almost despair. Consequently, the due diligence process is often not well performed, and important measures such as the public sector comparator are left out of the analysis. This rudimentary analysis process has harsh consequences, because it leads usually to a choice of a proposal that is not the best, influencing the future financial sustainability of the water utilities. The efficient level of risk sharing amongst public and private partners is also usually not achieved, with clear prejudice to the public (Marques and Silva, 2008).

The bidding processes are usually long (average of 21 months) and costly. The average number of bidders for each utility has been of 4 on the past, and big international players are usually on the contest. Nevertheless, municipalities usually do not have the resources to deal with such complex bidding processes. The tight budgets compel municipalities to hire inexperienced and low cost consultants, usually politically aligned with the mayor's team, ending up in a completely biased selection process. Some cases of players lobbying municipal power have also been suggested (Berg and Marques, 2010).

The fact that local municipalities, with low management expertise, see themselves negotiating with big national and international consortiums is already a dangerous factor. The potential private partners are way more experienced, and the negotiation gap usually biases the selection and contractual processes as well. A proof of badly negotiated contracts is the fact that in Portugal pretty much all water sector PPPs have already been renegotiated, some of them 3 or 4 times. Renegotiations usually even start at very early stages of the contract. "The main reasons for renegotiation are the volume of consumption (or wastewater much lower than what was initially forecasted (optimism bias), change of the investment plans (unilateral change by the sponsor), change in law, change of the "bulk" water price and change of the scope and PPP object, among other factors" (Cruz and Marques, 2012).

In Portugal, even despite sufficient proof of badly designed deals and poor monitoring by the local power, no sanctions have been filled. Even despite all the evidence against PPPs in the water sector in Portugal, these mistakes occur essentially on the planning stage. The outcomes and performance from private partners have been positive, usually performing better than public ones (Berg and Marques, 2010).

Nevertheless, a cautious approach must be made. Private partners perform better than public ones, but the record of public companies is not perfect, so the standard of comparison

is not high enough. The Portuguese water sector seems to be performing well, the question being now on how much better could it perform if properly managed and institutionalized.

3. The Portuguese Water Sector

Introduction

The water sector of a determined country is a vital part of its development and quality of life. In 2010, the General Assembly of the United Nations declared that the access to potable water and to a proper wastewater system were vital rights in order for individuals to have quality of life and to enjoy all the other basic human rights. This clearly illustrates the importance of this sector for a country, and for the life of all populations.

Given this importance, these services are usually labelled as strategic public goods, with economic interest. In Portugal, the law[3] defines water services as essential public services.

Like all public goods, managing a water system is a complex task. The water services, as a public good, must fulfil the requirement of universality in terms of distribution, at reasonable prices and rates, respecting the socio-economical paradigm of the country, since it possesses an important status in terms of social balance. Furthermore, this sector naturally creates monopoly power, and is considered as capital intensive, with long maturities in terms of return on investment, which adds even more speciality to its management.

In Portugal, this sector witnessed a big expansion in the last couple of decades, imposed mostly by the EU Directives on water supply and sanitation, with many of the management entities having resources that match the excellence levels of other European countries. This expansion has been coordinated by domestic strategic plans for the sector, such as the PEAASAR II, occurring from 2007 to 2013.In the beginning of the 90s, the water system reached 80% of the Portuguese population, and in 2011 those figures reached the level of 95%. In terms of water quality, in the year of 1993, only 50% of the water available in the system was considered safe for consumption, whereas in 2011 that percentage reached 98%. In terms of the wastewater system, the coverage reaches 81% for the drainage of residual

[3] Essential Public Services Law - Lei dos Serviços Públicos Essenciais (Lei nº23/96, de 26 de Julho)

waters and 78% in the treatment of those same waters. The objectives for 2013 were to reach 90% in both indicators.

Services chain

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 in the "upstream" and "downstream" stages. The upstream stages are correspondent basically to the wholesaler, or bulk, being the downstream stages correspondent to the retailer.

The stages are the following:

- Drinking water supply service
    - Upstream – Groundwater abstraction, treatment, elevation, adduction
    - Downstream – Storage, distribution, consumption
- Wastewater management service
    - Upstream – Elevation, transport, treatment, rejection
    - Downstream – Discharge, drainage, retention
- Waste management services
    - Upstream – Organic recovery/recycling, incineration, landfill
    - Downstream – Waste production, Municipal waste collection / Separate collection

Summarizing, 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.

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. 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.

Organizational structure of the services

All the services mentioned above are organized regarding the entity that is responsible for managing them.

In fact, a multiplicity of agents coexists on the Portuguese water sector, in order to assure a continuous provision of water and complementary services.

At a more broad level we have the Central Administration, or government branches, together with the regulatory agency – ERSAR. These agencies are responsible for legislation and regulation of the sector. In terms of management of the water system, municipalities play a big role, together with municipal associations and municipal and intermunicipal companies. In Portugal, municipalities are responsible for the management of the water services, and also for its concession, if that is the local decision.

Also in the management level of the water infrastructure, other companies exist. Public companies sometimes are awarded with the concession, but there are also private partners in charge in some municipalities. The law[4] allowed the entrance of private partners on the capital structure of water distribution companies in 1993. The presence of private players occurs mainly on the downstream part of the water sector. The upstream faction of water collection is usually awarded to public companies, but still there are some exceptions, as Águas da Serra (owned by AGS, a private group), Águas do Vouga or Tratave (both controlled by Aquapor). The downstream market is easier to enter for private parties. Upstream facilities are even more demanding in terms of capital than downstream, which creates additional entry barriers. Additionally, upstream companies are responsible for serving several downstream companies and consequently a large costumer basis. Given this, the regulatory system itself imposes limitations for private participation at this level, since it's easier to control and regulate the system while holding the upstream sector. One extra factor for a less open upstream sector compared to the downstream sector is that to enter in the downstream distribution, companies have to negotiate with municipalities, which have the power to attribute the governance of local water management. For the upstream sector, it is a different scenario, since a lot of municipalities are involved, and the negotiation would have to pass through the state holding company Águas de Portugal.

[4] Law number and reference: "Decreto-Lei nº372/93, de 29 de Outubro"

On the urban waste sector, the upstream faction is more dispersed in terms of ownership. Associations created by groups of municipalities own several of the local companies. Nevertheless, recently it was announced that EGF, a sub-holding company from Águas de Portugal for the management of the urban waste sector, has been sold to a private consortium, indicating an additional opening for private parties on the sector.

This brief introduction about the players in the water sector provides a good panorama about the difficulties of managing such a complex and fundamental service. Amongst the several management entities there are enormous differences in scale, resources but also management system. This heterogeneity brings several issues in terms of management and regulation.

4. Methodology and Data Description

The purpose of this study was to assess the impact of some variables in the performance of concessions on the Portuguese water sector, ultimately trying to find possible drivers for success in terms of water sector PPPs. Given that this sector in Portugal has private and public participation, another objective was to evaluate what was the best management model (public vs. private or mixed). Therefore, the first step was to develop an evaluation method for the performance of the concessions, followed by choosing some potential important variables, being the last stage the assessment of their importance for the performance, by using regression analysis.

Concession Evaluation Method

The evaluation method for the concessions was the basis for the rest of the work. The scores achieved in this model would be the components of the dependent variable necessary to the subsequent regression analysis.

The starting point for the model was the concession evaluation model developed by the Centre for Applied Studies of Catolica Lisbon School of Business and Economics (CEA, 2008), as part of the work developed by this Centre regarding the study of Public Private Partnerships.

Nevertheless, due to the time elapsed since the model was created, and also due to some specifications wanted for this study, the initial model was slightly changed.

Giving this, the model was altered and based on two major sets of indicators. First, financial indicators, to measure the financial balance of the company responsible for the provision of water and waste management services. Second, a set of indicators was used, majorly to estimate the quality and sustainability of the service provided to the client. The two scores (financial performance and quality of service) were computed independently and on a yearly basis, and then weighted, to reach the final score of the performance of the water company. The weights used were 40% to the financial performance and 60% to the quality and sustainability of the service. This last part had a higher score because even though this study's objective was to assess the performance of the water services providers, it was more

focused on assessing the advantages for the client of public/private management of water services.

Each indicator used was measured in different units and scales so, using some criteria, all of them were transformed to correspond to a 1 to 5 score. Finally, with all the variables filled, a final score was computed, also in a 1 to 5 scale, being 1 the lowest score possible and 5 the highest score possible. For the most part, the same methodology used in the original study was used (CEA, 2008).

One of the objectives while building a model was that it could be used in future occasions, easily updated, and that the information used would be standardized and publicly and easily available. Consequently, the vast majority of the information contained in the model was present on RASARP, a periodic report issued by the Portuguese regulatory agency for the water sector ERSAR (RASARP, 2007 to 2012).

In terms of financial information, some ratios and useful data were used, whereas in terms of quality and sustainability the information used in the model was part of a set of evaluation criteria published on the above mentioned RASARP. The selected variables were used in the model based on some criteria. Some of them were already part of the initial model, mainly in the financial side. On the quality and sustainability part, the differences to the original study were bigger. The majority of the variables were chosen by the impact that their performance has on the customers. Also, the choice of a great part of these variables was backed by the findings made in the Literature Review of this same thesis. On this Literature Review, some performance impacting variables were more consensual. Therefore, while building the model that served as basis for this thesis, some indicators were chosen to reflect these same impacting variables, to already incorporate the findings of previous studies. For a complete list of all the metrics used on the model, see Table 15.

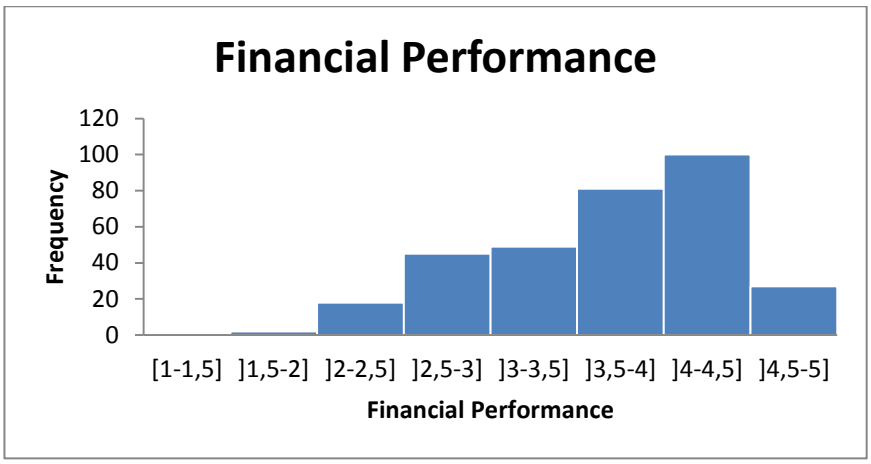
In terms of sample, a 5-year sample was chosen to conduct this work, corresponding to the years of 2007 to 2011. 2011 was the last chosen year because the last report issued by ERSAR only covers until that year. So, 5 years worth of data for every player on the water sector, whose desired information was available, were computed. A window of 5 years was chosen not only because it would already give a good overall sample, but also because complete information prior to 2007 was not as complete, reliable and easy to access, especially due to the changes in the number of entities operating.

On total, samples from 103 companies on the Portuguese water sector were collected. On this total number, 45 companies are on the upstream sector and 58 on the downstream.

Even taking into account some shortages of information that did not allow the collection of 5 years of data for some companies on the list, a total of 322 observations were built.

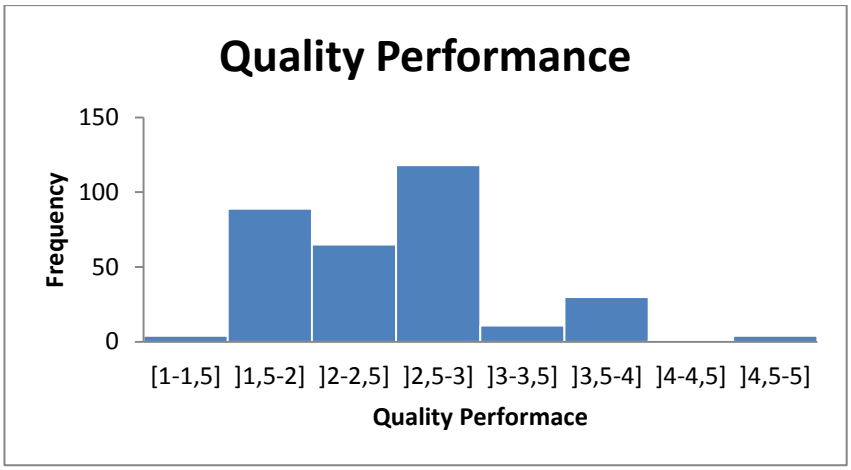
Dependent Variables

As explained above, two scores were computed for each company, in each one of the years of analysis – a quality score and a financial score. These two scores combined ended up resulting in the overall performance score.



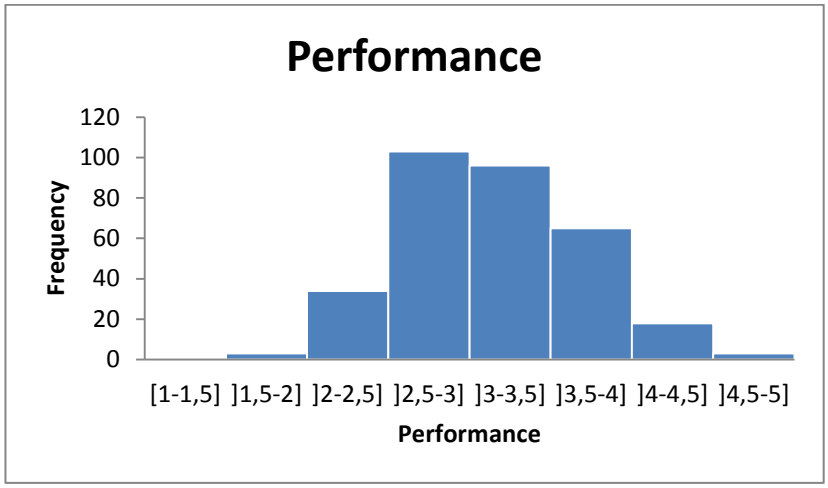
Average	3,74
Standard Deviation	0,68
Maximum	5
Minimum	2

Graph/Table 1 – Descriptive statistics for Financial Performance



Average	2,74
Standard Deviation	0,67
Maximum	5
Minimum	1

Graph/Table 2 – Descriptive statistics for Quality Performance



Average	3,14
Standard Deviation	0,54
Maximum	4,89
Minimum	1,70

Graph/Table 3 – Descriptive statistics for Overall Performance

Briefly analysing the data patent above, it is possible to see that at an overall level, the scores for financial performance are more concentrated on the right bound of the distribution,

whereas for the quality performance the paradigm is slightly different. Companies that are part of the sample performed better in financial terms that in providing a quality service to customers, corroborating the differences between the variables, and the greater attention to the quality performance.

Independent Variables

Using the evaluation model described above, a final performance score was built for every one of the 103 companies above mentioned, for every one of the years for which information was available.

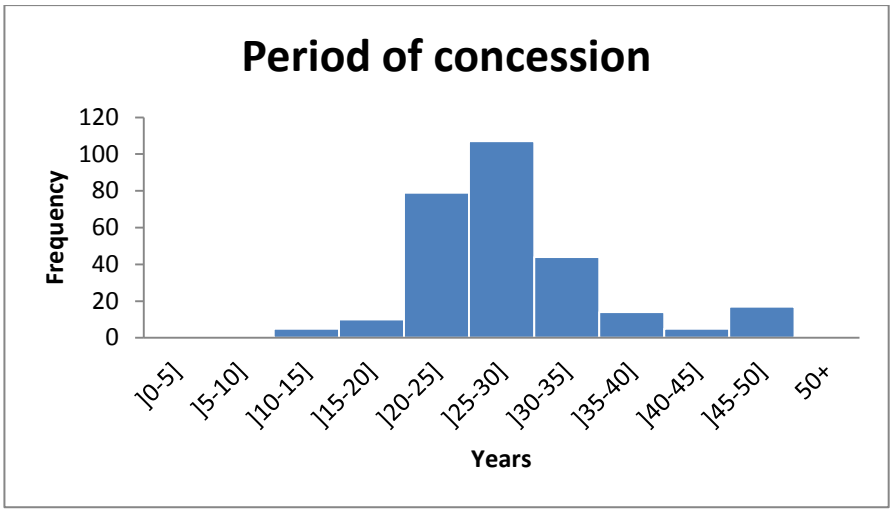
With all the available information on the sector, the next task was to choose the variables whose impact to assess on the overall performance of the water companies. Taking into account some of the findings of the literature review and the information that was accessible about the sector, the final list of variable was:

- Period of concession (years)
- Remaining years of concession (years)
- Nº of contractual changes
- Public vs. Private management (dummy variable)
- Area served (km^2)
- Nº of residences served (000)
- Urban vs. Rural areas served (dummy variables)
- Price Score
- Productivity (Percentile)

Period of concession

This variable contains the information regarding the total period of concession, in years, for the water services providers (initial period plus extensions, when existent). These contracts are, in their majority, long time contracts, therefore being no surprise on the maximum and average number of years.

The main purpose of this variable was to analyse first of all if there was a relation between the contract length and performance and, if existent, what kind of contracts (longer vs. shorter) brings the greatest performance in terms of water services provision.

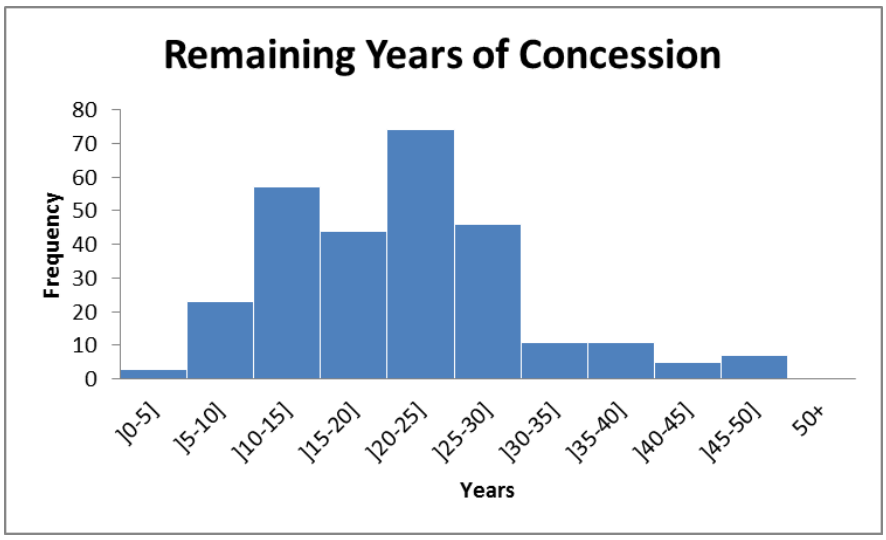


Average	30,40
Standard Deviation	6,92
Maximum	50,00
Minimum	15,00

Graph/Table 4. Descriptive analysis for the Period of Concession in years

Remaining years of concession

This variable has data on the remaining years of the concession contracts for every company, on the 5 years of data collected. In other words, how many years until the contract ends. The objective of this variable was to assess if the simple passing of time could serve as a performance enhancer. More specifically, if the fact that companies are more experienced every year brings some benefits in terms of performance, or even if, on the other side, performance is increased in years closer to the anticipated renegotiation process.



Average	21,57
Standard Deviation	9,14
Maximum	50,00
Minimum	5,00

Graph/Table 5. Descriptive analysis for the remaining years of concession

Number of contractual changes

The number of times the initial contract has been renegotiated. Does not include all kinds of renegotiations, but rather is focused on contract extensions. The objective of this variable was to draw conclusions on the effect of contract extensions on performance, if an extension increases the confidence in the company and boosts performance or, on the other hand, if it has a relaxing effect and harms the overall performance.

Average	0,388199
Standard Deviation	0,601435
Maximum	2
Minimum	0
0 Contractual Changes	217
1 Contractual Change	85
2 Contractual Changes	20

Table 6. Descriptive analysis for the number of contractual changes

Public vs. Private Management

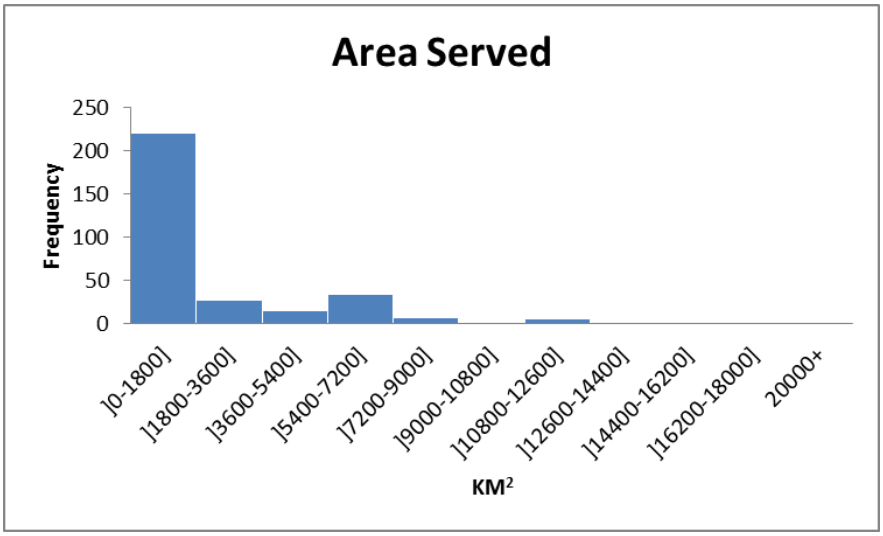
This one is a dummy variable that assumes the value of 1 if the company is publicly managed or 0 if a private party is responsible of the management. The purpose here was to once again answer the question of if there is a preferable management method in terms of performance delivery on the water sector.

Observation from Public Management Companies	Observations from Private Management Companies
189	133

Table 7. Amount of public and private companies on sample

Area Served

Area served by the water company, measured in squared kilometres (km^2). The drive for this variable was to evaluate if there is any relation between the areas supplied by one company and its performance. From this relation, important conclusions can be drawn in terms of economies of scale, and on the optimal way to organize the water services geographical structure.

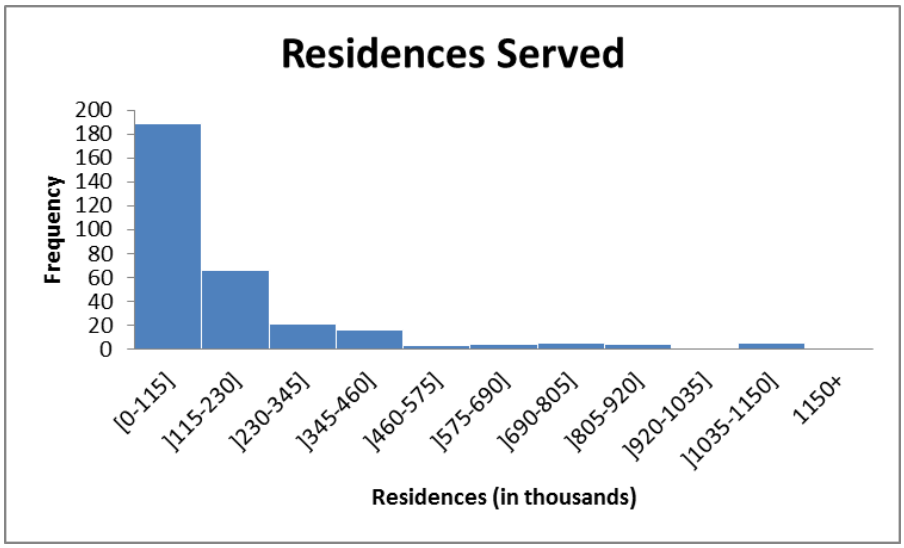


Average	1.996
Standard Deviation	2.691
Maximum	17.037
Minimum	2

Graph/Table 8. Descriptive analysis for the area served

Number of residences served

Number, in thousands (000), of homes in the area served by the company. Aligned with the Area served variable, this variable also takes into account population density trough the number of houses.



Average	155,50
Standard Deviation	215,44
Maximum	1.142,00
Minimum	1,50

Table 9. Descriptive analysis for the number of residences served

Urban vs. Rural areas served

This variable is divided into 3 dummy variables. The regulatory board ERSAR divided the Portuguese territory in 3 areas:

- APU – Urban Areas
- AMU – Median Urban Areas
- APR – Rural Areas

Using that information, 3 dummy variables were created – APU, AMU and APR. In each one of them, the value 1 means that the company's operation area includes regions in that area. The value zero means the opposite, that the company's operating territory does not include any terrains with that classification. Since the companies can operate in more than one type of areas, the three dummies are required to capture all possibilities (there are three instances of area accumulation in the entire sample of 152 entities).

These variables emerge as complementary to the two variables mentioned above. Despite area and number of residences being already a possible indicator of level of urbanization, these variables add some interest. There are big differences in terms of water supply for a big population on a small area or in a big area. Serving a city needs a more concentrated structure, whereas serving big rural areas needs different infrastructure, in which the financial return on

investment is not as high. For example, taking water to more isolated places may mean having to build pipes on difficult terrains, necessity to elevate the water, and therefore spend more energy on transport, amongst other things that might impact the overall performance.
The data for this variable was only published to companies that serve the downstream water sector, and therefore the analysis on this variable was only made regarding those companies.

	Total
APU (Urban areas) +	38
AMU (Medium Urban areas) +	77
APR (Rural Areas) +	40
Total number of entities sampled (*)	152

(*) there are 3 entities operating simultaneously in two urbanization levels.

Table 10. Entities operating in different urbanization levels

Price Score

Being price such an important variable on the performance of a company, it could not be left out. Nevertheless, comparing prices on such a varied pool of companies presented some challenges.

First of all, upstream and downstream companies do not have the same kind clients. Upstream companies usually sell to downstream companies, and downstream companies usually sell to the final customer. The volumes sold are also different. Finally, the units of measure for water companies are different of those for waste management companies, as well as the prices.

In order to have the largest possible sample, there was a need for a way of ensuring comparable information.

In this work, the solution found was to develop a price score variable. The tariffs for each service that each company provides were computed, and then 5 percentiles (20% intervals) were calculated for every service's tariffs (upstream or downstream water distribution, sanitation or waste management). With the percentiles calculated, the next step was to compute in which percentile every tariff sample was in its service group. A score of 1 was attributed to the first percentile (lowest prices), a score of 2 to the second percentile, and so on until 5, that represented the highest prices. Finally, an average of the company's tariffs percentiles was computed, being that the final prices score for that company, in that year.

Since the percentiles were calculated individually for every above mentioned service, and the tariff by itself is not used as method for analysis, this method ensures the comparability of prices. Despite not comparing the individual tariffs directly, this variable compares if being on the cheapest or most expensive set of companies impacts on the performance.

Average	2,90
Standard Deviation	1,31
Maximum	5
Minimum	1

Graph/Table 11. Descriptive analysis for the Price Score

Productivity

For this analysis, productivity was simply calculated as Activity Level divided by the number of workers. Due to the differences in measurement units, and consequently activity levels, between companies of the water and urban waste sector, a percentile method was also used in this case.

First of all, the productivity for every sample was calculated. The next step was to calculate the percentiles for each group (water and waste, both upstream and downstream). Using this methodology, we are not comparing productivity by itself directly, but grouping the companies on intervals and scaling them from the most productive to the least. In this case, due to the amplitude of productivity levels, even amongst companies of the same operational group, deciles were used. After the calculation of the percentiles, each sample was

than classified with a score of 1 to 10, being 1 the group with the least productive firms and 10 the most productive firms.

After the percentile characterization, each sample has a sort of "productivity score", based on the group of origin, either water or urban waste, upstream or downstream, to serve as a comparison method.

This measure of productivity was the chosen one for some reasons: First of all, it offers a reliable and simple method of comparison amid companies of the water sector. Second, it includes in its simple calculation two variables – activity level and number of workers – which are very important when analysing the performance of companies. Furthermore, due to the above mentioned differences in scale and measurement units between companies, both these variables would also need some transformation in order to be used when comparing companies. This productivity measure therefore simplifies the process, while including information from both variables. The choice for not using revenues in the productivity analysis was also based on the fact that the tariffs charged throughout the country for the same services are fixed and considerably different, and not dependant exclusively on the cost structure. Given this, using the revenues as a variable for calculating productivity could possibly bias the analysis on this matter. Even though the chosen method for productivity calculation doesn't capture the possible differences in productivity inherent to the different sectors (water vs. urban waste), it ends up capturing the effect of the appropriateness of the human resources structure, to the usual activity level of the company.

Activity level is of course important, because it is the most direct indicator for a company's size and also gives important information regarding its the financial strength. The number of workers is also a good indicator of size of the company, and also suitability and sustainability of Human Resources and recruitment policies.

In the literature review findings, this was an important variable to analyse, hence it was included in this analysis. This variable brings additional value to the discussion of who is the best manager of water companies, private or public entities. Supposedly, one of the biggest advantages that private management brings to the water sector is the enhanced staff productivity, measured like in this work, even though this many times happens due to massive layoffs. On the other hand, the public sector is usually associated with some benevolence in terms of human resources, with public companies frequently having staff in excess, therefore reducing productivity levels.

Regression analysis

To best find the actual impact of the above-mentioned variables on the performance of companies on the water sector, the chosen method was regression analysis.

In order to have the most complete possible set of conclusions, a set of 9 regressions was computed. On these nine cases, 3 different dependent variables were used. The first one was the global performance of the company as measured by the evaluation model described earlier on this chapter. This final performance score was the combination was two sub-scores, a financial one, and a quality and sustainability one. Those individual scores, financial performance and quality and sustainability performance were the two other dependent variables used. For the purpose of this thesis, the analysis of the combined scores but also the individual ones seemed important, not only due to the main objective of analysing which governance model is better for the client, but also to find if the independent variables have different impacts on the financial and quality side.

For each one of the 3 dependent variables, 3 regressions were computed. The first one with the global data, including upstream and downstream companies, and then individual ones for both those sub-sectors. Because of some slight differences on the dynamics of the upstream and downstream sectors, the impact of some variables on the performance of companies on each one of the sectors could potentially differ, therefore the separation of the global performance for further analysis.

As independent variables, all the variables on the section above were used for all regressions, with the exception of the APU, AMU and APR, which were used only for the regressions including the downstream sector companies.

Detailing a bit more the regressions used, we ran performance indicators as dependent variables against all the described explanatory variables. We started with the general performance indicator:

$$PERF_{it} = const + ß1\ PCONCESS_{it} + ß2\ REMAIN_{it} + ß3\ CHANGE_{it} + ß4\ PUBLIC_{it} + ß5\ AREA_{it} + + ß6\ RESIDENCE_{it} + ß7\ PRODUCT_{it} + ß8\ PRICE_{it} + error_{it} \quad (1)$$

PERFit is the performance indicator outlined previously, $PCONCESS_{it}$ is the concession duration, $REMAIN_{it}$ is the remaining years of the contract, $CHANGE_{it}$ is the number of contractual changes, $PUBLIC_{it}$ is the dummy on public vs private management, $AREA_{it}$ is the variable on the square kilometres served by each entity, $RESIDENCE_{it}$ refers to

the number of residences, $PRODUCT_{it}$ and $PRICE_{it}$ refer to the productivity and score price indicators created.

We expect longer contracts to perform better and the performance to improve with the passing of the years (which actually means a negative predictive sing on the REMAIN coefficient). We find contradictory explanations for the number of contractual changes: on the one hand, we can expect that worse performing contracts to have more changes in the contracts, on the other hand, contractual changes may help fix what was originally poorly done. Larger areas will make performance harder, but more residences would help financial performance. Better productivity (higher score) and better price (lower score) will enhance financial performance.

We next regressed similar regressions on FINANCIAL and QUALITY sub-indices:

FIN_{it} = const + ß0 $QUAL_{it}$ + ß1 $PCONCESS_{it}$ + ß2 $REMAIN_{it}$ + ß3 $CHANGE_{it}$ + ß4 $PUBLIC_{it}$ + +ß5 $AREA_{it}$ + + ß6 $RESIDENCE_{it}$ + ß7 $PRODUCT_{it}$ + ß8 $PRICE_{it}$ + $error_{it}$ (2) and

$QUAL_{it}$ = const + ß0 FIN_{it} + ß1 $PCONCESS_{it}$ + ß2 $REMAIN_{it}$ + ß3 $CHANGE_{it}$ + ß4 $PUBLIC_{it}$ + +ß5 $AREA_{it}$ + + ß6 $RESIDENCE_{it}$ + ß7 $PRODUCT_{it}$ + ß8 $PRICE_{it}$ + $error_{it}$ (3).

FIN_{it} indicates the financial performance index explained previously, while $QUAL_{it}$ indicated the quality of service indicator.

The hypotheses formulated postulate that on regression (2) the financial performance will depend positively on the quality of service, as a better service will lead to a better financial compensation. On regression (3), we test the reverse implication, which is likely more plausible, namely that the quality of services will be better for firms who are financially sounder. The hypotheses formulated for the general PERF dependent variable, concerning the other explanatory variables hold for regressions (2) and (3) as well.

Next we ran regressions separately on downstream and upstream entities. For the upstream firms the regressions used were exactly the same. But for the downstream entities, we added the urbanization areas served as described above.

APU_{it} is the dummy variable to analyse whether a company is servicing urban areas or not, whereas AMU_{it} evaluates if a company is present in Medium Urban Areas. Finally, APR_{it} makes an evaluation on the presence of rural areas on the company's area of influence.

Since, as mentioned above, more populated areas are more prone to having a better financial performance, due to the higher customer base, but also to the lower tariffs associated with lower costs of bringing these services to a bigger amount of people, we expect the variable of urban areas to have a positive impact on performance. On the other hand, companies in rural areas are expected to perform at a worse level.

Sometimes samples do not meet the assumptions required to perform complete regressions. To deal with this potential problem, robust regressions were computed (applying the robust function on Stata, the software used for data analysis and regression), in order to correct possible concerns about normality or heteroscedasticity on the sample.

5. Results Analysis

After computing the regressions mentioned on the Methodology chapter, the next step is to analyse those results and summarize the resulting conclusions. As said in the previous chapter, three main types of regressions were performed. The first including all the companies on the sample, and then two others, one with data exclusively from upstream companies and finally one with data only from downstream companies. The following results presentation will therefore separate the findings on these three big groups.

Global Sample

Regression	(1)	(2)	(3)
Dependent variable	PERF	FIN	QUAL
Number of observations	274	274	274
F-statistic	14.51	10.92	7.23
R-squared	0.2665	0.2203	0.1847
Constant	2,653***	3,411***	1,524***
QUAL		0,122*	
FIN			0,127*
PCONCESS	0,046***	0,019	0,057***
REMAIN	-0,044***	-0,026**	-0,048***
CHANGE	0,051	0,071	0,026
PUBLIC	-0,119	0,051	-0,219**
AREA	-0,0317**	-0,047**	-0,014
RESIDENCE	0,3323	0,092	0,438
PRODUCT	0,025**	0,028*	0,017
PRICE	-0,038	-0,079**	0,00017

(*), (**), (***) indicate statistical significance at 10%, 5% and 1% respectively.

Table 12: refers to the coefficients and relevant statistics for the regressions (1), (2) and (3). PERF refers to a composite performance indicator mixing financial and quality of service subindices, QUAL refers to the quality of service performance subindex, FIN to the financial performance subindex, PCONCESS is the variable measuring total number of years in the contract, REMAIN is the remaining number of years, CHANGE is the number of contractual changes in the contract, PUBLIC is a dummy variable with the value of 1 for public, state-owned entities, AREA is the number kilometres (in 1000km2) served by the entity, RESIDENCE is the number of residences (in 1000) served, PRODUCT indicates the performance quintile in terms of productivity and PRICE indicates the performance decile in terms of a price score index.

Analysing the results of the regressions performed for the global sample, the independent variables that show more promising explanatory potential are the period of concession and also the remaining years of concession. Both these variables are statistically significant in at least two of the regressions, with the remaining period of concession being significant in all three of them. The coefficient signs for these variables are the same as the ones initially expected. The initial period of concession displays a positive coefficient, meaning that longer periods of concession yield better performance levels in general. Relatively to remaining years of concession, the coefficient is negative, indicating that companies with fewer remaining years of concession have better performances.

The area of influence variable also showed up to be statistically relevant for both the general and financial performances, presenting for both a negative coefficient. Making once again the parallelism with the initial expectations, we can say that they are corroborated. Larger areas of influence mean additional costs in terms of water provision to more distant costumers, impacting the profitability of the water company. Being this a capital intensive industry, with conservation and reparation costs being an important part of the cost structure, a larger area to monitor harms the financial performance, and increases the cost per costumer, reducing profitability.

Aligned with the area of influence we have the productivity factor. As expected, more productive companies perform better in terms of overall and financial performance.

Also as expected, the price variable was significant in terms of financial performance, also aligned with the initial expectation that a lower price would yield a better performance, especially in financial terms. Water services are a volume industry, not a price one, and lower prices mean more volumes, improving performance. Furthermore, lower prices are often traditional of more densely populated areas, where the cost of bringing water to costumers is lower, as discussed above analysing the area variable.

An interesting turn of events is that productivity and price are not significant as explanatory variable for quality performance. Adding the fact that from this regression we can see with a statistically significant confidence that public companies perform better quality wise, and these regressions are aligned with some of the findings presented in the literature review. Public companies tend to supply better quality services, whereas private companies increase financial performance, usually leveraged by productivity increases, as a result of considerable layoffs.

Even with the greater percentage that quality performance has on the overall performance index, variables that are significant for financial performance are usually

significant for the overall performance, indicating that it is easier to improve considerably the financial performance, whereas quality gains are less noticeable and harder to achieve.

Upstream Sample

Regression	(1)	(2)	(3)
Dependent variable	PERF	FIN	QUAL
Number of observations	153	153	153
F-statistic	13.66	16.55	5.09
R-squared	0.3763	0.4455	0.2241
Constant	2,816***	5,308***	0,954
QUAL		0,026	
FIN			0,034
PCONCESS	0,044**	-0,04*	0,1***
REMAIN	-0,044***	0,001	-0,073***
CHANGE	0,035	0,312***	-0,157
PUBLIC	-0,113	0,02	-0,199
AREA	-0,0169	-0,034*	-0,004
RESIDENCE	0,3791	0,22	0,47
PRODUCT	0,02	0,004	0,029
PRICE	-0,088***	-0,214***	0,00379

(*), (**), (***) indicate statistical significance at 10%, 5% and 1% respectively.

Table 13: refers to the coefficients and relevant statistics for the regressions (1), (2) and (3). PERF refers to a composite performance indicator mixing financial and quality of service subindices, QUAL refers to the quality of service performance subindex, FIN to the financial performance subindex, PCONCESS is the variable measuring total number of years in the contract, REMAIN is the remaining number of years, CHANGE is the number of contractual changes in the contract, PUBLIC is a dummy variable with the value of 1 for public, state-owned entities, AREA is the number kilometres (in 1000km2) served by the entity, RESIDENCE is the number of residences (in 1000) served, PRODUCT indicates the performance quintile in terms of productivity and PRICE indicates the performance decile in terms of a price score index.

The following regressions to be analysed are the ones containing exclusively the database of upstream companies.

At first, it is noticeable that the R-squared levels for these regressions are generally higher than the ones obtained with the global sample. Possibly the fact that in this group all

companies belong to the same fraction of the water sector and have more similar characteristics increases the explanatory potential of the data.

Once again, the variables related to the period of concession show interesting values in terms of significance. The period of concession and remaining years of concession are significant and with the same coefficient signal as in the regressions for the global sample. For the financial performance, the period of concession shows a negative coefficient, possibly indicating that shorter periods of concession result in increased financial performance. Nevertheless, since this coefficient is only significant at 10% and shows an inverse signal to the ones obtained for the period of concession on all other regressions, its validity is questionable.

In these regressions, the number of contractual changes also showed up as a significant variable for the financial performance. Contractual changes in this case are essentially related to period of concession extensions, therefore having some connection in terms of conclusion potential with the variables connected with the period of concession. As said before, the expectation towards the number of contractual changes was hybrid, since more contractual changes might mean a worse performing contract and, at the same time, it might indicate that the initial mistakes were corrected. In this case the coefficient for this variable is positive, therefore indicating that more contractual changes increase the financial performance of companies. Making a comparison with the initial expectation, what we can say is that contractual changes, when applied, tend to increase performance, at least financially.

Coherently with the findings about area of influence achieved in the global sample regressions, this variable shows once again a significant coefficient with a negative signal, relevant for the financial performance. As discussed above, in a capital intensive industry such as the water sector, a larger area to monitor involves greater costs, and harms financial performance. There is also a probable connection with greater areas and level of urbanization. Greater areas might easily include rural areas to supply, where the costs per costumer of supplying water are greater, reducing the profit per costumer. In addition, rural areas also usually have higher tariffs, and at least looking at the results in terms of price score displayed in these regressions, a lower price seems to have a connection with increased productivity.

Continuing with the price subject, in the upstream sample the price score also shows interesting results. In the upstream sector, it seems that price is relevant for both financial and general performance, also with a negative coefficient, corroborating the initial findings that lower prices increase performance. In this case, the variables are significant for both financial

performance and general performance at a 1% level. Even with financial performance having a lower weight on general performance, the impact on financial performance of the price score was sufficient to also make in impact on the overall score, giving a coherent idea on how much the price score affects financial performance.

Once again, besides the period of concession and the remaining years of concession, little or no variables seemed to make a difference in terms of quality performance, whereas the findings for financial performance are more varied. Time does seem to have a big influence on quality performance. Longer concession periods seem to have positive impact, as well as fewer years remaining on the concession. In terms of concession period, a longer one might give the concessionary a greater availability to invest, since the period for returns is higher. Additionally, longer periods of concession allow for a more stabilized and solid structure. Regarding the remaining years of concession, one approach might indicate that as time passes by and companies become more experienced in managing their water sector customer base, the quality of the service provided increases. Another approach might suggest that as the time for a concession renewal arrives, companies increase performance, in order to have a more appealing status towards the entities approving the concessions.

Downstream sample

Regression	(1)	(2)	(3)
Dependent variable	PERF	FIN	QUAL
Number of observations	121	121	121
F-statistic	2.58	5.66	3.64
R-squared	0.2067	0.3862	0.2879
Constant	1,921***	1,945	0,522
QUAL		0,344***	
FIN			0,414***
PCONCESS	0,047***	0,056***	0,006
REMAIN	-0,052***	-0,041***	-0,025*
CHANGE	0,04	-0,246***	0,263**
PUBLIC	0,312	0,38	0,029
AREA	-0,0219	-0,106	0,067
RESIDENCE	-4,1329	1,548	-6,165*
PRODUCT	0,039**	0,049**	0,002
APU	1,017	-0,199	1,358
AMU	0,656	-0,585	1,277
APR	0,523	-0,633	1,165
PRICE	0,061	0,134***	-0,047

(*), (**), (***) indicate statistical significance at 10%, 5% and 1% respectively.

Table 14: refers to the coefficients and relevant statistics for the regressions (1), (2) and (3). PERF refers to a composite performance indicator mixing financial and quality of service subindices, QUAL refers to the quality of service performance subindex, FIN to the financial performance subindex, PCONCESS is the variable measuring total number of years in the contract, REMAIN is the remaining number of years, CHANGE is the number of contractual changes in the contract, PUBLIC is a dummy variable with the value of 1 for public, state-owned entities, AREA is the number kilometres (in 1000km2) served by the entity, RESIDENCE is the number of residences (in 1000) served, PRODUCT indicates the performance quintile in terms of productivity and PRICE indicates the performance decile in terms of a price score index. APU is a dummy variable making the distintion between companies whose are of influence whether includes urban areas or not. AMU is a dummy variable categorizing companies with presence in medium urban areas, and APR a dummy variable for companies with presence in purely rural areas.

The final regressions are the ones performed using the sample of companies from the downstream water sector. In these regressions, the R-squared levels are also higher than on the overall sample regressions. The addition of 3 variables and the fact that the companies have more similar profiles might potentially explain this increase on the explained variance.

First of all, it is noticeable that in these regressions the financial performance seems to be a decisive factor for quality performance, and vice-versa. This might be explained by the intrinsic costumer basis differences between upstream and downstream companies. Upstream companies have as customers municipalities or downstream companies, resulting in a short customer base. Downstream companies have as costumers the individual consumers. Despite the fact that we are talking about an essential service like water, sanitation or urban waste management, and that these companies are monopolists, the majority of the eventual elasticity of consumption (even considering how low it certainly is) is put on the side of downstream companies, giving an extra weight to quality. Additionally, in downstream companies, just a small investment like a quick repair on a neighbourhood supply system might make a big difference in terms of quality for thousands of customers. All this to say that in downstream companies, there is a more obvious and direct connection between the financial and quality performance. Another possible vector of influence is that costumers that are more satisfied might be more prone to pay on time their bills. Being bill collection and average collection period one of the biggest financial problems of this sector, a reduction of this period, as small as it is, might have an important financial impact.

Once again the variables related to the period of concession (period of concession and remaining years of concession) present themselves as important to the overall performance. The signal of the coefficients is also coherent to the findings of previous regressions. The period of concession presents a positive coefficient, whereas the remaining years of concession show a negative one. As in both previous regressions analysed, it seems that longer periods of concession yield better performance levels. Performance also seems to be affected by the passage of time, with the experience factor possibly being an important factor for the fact that as the time for the end of the concession approaches, the performance of companies seems to be enhanced.

The number of contractual changes also shows up as a relevant variable for both financial and quality performance. Nonetheless, the findings are proof of the ambiguity of this variable. For the financial performance the coefficient is negative, indicating that fewer contractual changes result in better performance. For quality performance, it has the opposite signal, indicating that potentially more contractual changes result in increased quality performance. As said in the initial expectations, more contractual changes might mean a poorly designed contract, but it can also be positive if the outcome is increased productivity. This indicator has additional importance on the downstream level. Since local power is more influential on this fraction of the sector, the potential for poorly conceived contracts is higher, with financial gains for the concessionary that are not proportional quality wise, with the negative coefficient for financial performance possibly meaning that those differences are corrected in contractual changes. Nevertheless, the positive coefficient for quality performance also might mean that regulators and the state holding are aware of the situation and intervene when necessary to fix poorly performing contracts.

For quality performance, the number of residences also showed up to be a relevant variable, with a negative coefficient. As it seems by this regression, fewer residences might mean increased service quality. Possibly structures close to over usage perform worse and with a larger customer base, customer service might get less accurate and repairs take longer to perform. Nevertheless, this finding is not 100% coherent with findings about dimension on previous regressions.

Productivity also showed up as a significant variable for the downstream sample, being relevant for both financial and overall performance. As expected, the coefficient is positive, meaning that more productive companies perform better at a financial and overall level. It is noticeable that productivity comes up as a significant variable in the downstream sample, where the exposure to private companies is greater. One of the main apparent

advantages of private participation is the increased productivity, even if sometimes leveraged by considerable layoffs, resulting in better per worker performance indicators. Even despite these debatable gains of productivity brought by private companies, it is not negligible the fact that productivity showed up as s significant variable for both the global sample and also the downstream sample, possibly corroborating the hypothesis that private participation yields in fact productivity gains.

Price score was also significant for financial performance, but this time with a positive coefficient, meaning that higher prices result in an increased financial performance. Assuming an inelastic demand, *coeteris paribus*, a price increase would result in increased cash flows. Nevertheless, the findings for the previous regressions about price and also the initial expectation tend to make us believe that a lower price strategy is more successful in the water sector as a whole.

6. Conclusions

Following the results analysis, some conclusions can be drawn in response to the primary objectives of this thesis.

At first sight, looking at the results, a strong case is built in favour of the period of concession and also the remaining period of concession. The period of concession showed up as a relevant variable 7 times on the total of the 9 regressions computed. It was a constant presence on the regressions where the overall performance was the dependent variable, but also ended up being related to both the financial and the quality performance. Even more relevant than the number of appearances, it is even more remarkable that the coefficient's signal was positive in 6 of those cases. Therefore, using the findings from this study, it is prudent to say that the period of concession in years has an impact on the performance of concession on the water sector. Furthermore, it is backed up by evidence on this sample that the longer the period of concession, the greater the performance.

Even though periods of concessions are usually long, the fact that even longer periods are attributed to the company might work as a confidence statement on the management capabilities of that concession, also allowing it to develop longer-term plans. Given that the water industry requires huge investments on a water network development and management, and that the sector is heavily regulated, a longer period of concession also brings more guarantees to the company that they'll end up having a return on investment, therefore increasing their appeal to invest.

Another variable that was recurrent was the remaining period of concession. This variable was considered significant on 8 of the 9 regressions, being present in all the 3 kinds of performance as well. The coefficient signal across these regressions was also constantly negative. Interpreting these negative coefficients tells us that as the remaining number of years of concession decreases, performance increases.

The analysis of this conclusion has essentially two sides. The first one, with a more positive outlook, indicates that the simple passing of time increases the performance of the company. As time goes by companies move on the learning curve, get more experienced, understand the business better and better, and apply all that knowledge being able to obtain significant efficiency gains and customer satisfaction, therefore increasing their financial structure and quality of service. Furthermore, at the final stages of the concession,

investments start paying off, and the property plant and equipment structure is increasingly stable, contributing to a more balanced financial structure.

Another analysis might indicate that as the time for a possible contract renegotiation or extension approaches, companies increase their efforts, in order to take advantage of the last period performance bias, and therefore be better positioned to ensure a new contract.

These two variables were the ones that presented the more solid and relevant results, but besides the initial period and the remaining years of concession, some other variables are noteworthy.

Price Score showed up on 4 of the 9 regressions. It was present on all the financial performance regressions indicating, as expected, that price as an impact on the financial performance. However, for the global and upstream samples the coefficient was negative, whereas for the downstream sample it was positive. Price score also showed up as a significant variable on the overall performance regression for the upstream sample, also with a negative coefficient.

Despite this small contradiction, evidence still ends up suggesting some importance for the price variable. This is curious taking into account the particularities of the sector being analysed, because it is a sector with no competition, since all the companies have local monopolies on the services provided.

Even though the coefficient's signal was not unanimous throughout all the regressions, there is still relevant evidence that companies with lower prices perform better, at least financially. Taking into account the characteristics of the sector, such as high price regulation and monopolist structure this is not an easily explainable situation. Nonetheless, lower prices might for example reduce customer's worries with water saving and end up increasing consumption to levels above needed. As a final review, data indicates that companies benefit from adopting a lower price policy, with possibly higher quantities. One other possible explanation might come from the connection between tariffs and area of influence. Tariffs are fixed and defined each year, depending on the cash flows needed to maintain the operation. Therefore, companies with lower maintenance structure and with a lower cost per costumer will probably have lower tariffs. As mentioned during this study, those are the characteristics of companies in urban areas, with several costumers, that benefit from efficiency gains and scale economies. In that sense, the indirect connection between the variables might help to explain this situation.

The numbers for productivity are also noticeable. In 4 cases this variable showed up with a positive coefficient indicating that more productive companies have increased

performance. Nevertheless, this variable never showed up as explanatory for quality performance. Due to the calculation being made as activity level divided by number of employees, and revenues and staff costs being two of the most important items of results analysis, it makes sense that the impact is more financial related. Once again, it is important to highlight that using the downstream sample productivity showed up as a significant variable, whereas in the upstream sample it did not. Taking into account that in the downstream sector private participation is higher, this might corroborate that independently of the mechanisms used to increase productivity, private sector parties' end up bringing some extra productivity to the table. Even questioning the usual layoffs, it is also known that public structures are usually over staffed and don't apply reasonable criteria of meritocracy for selection. Given this, possibly some of those layoffs and structure reduction end up creating a more balanced and reasonable structure to the needs of the company.

For the remaining variables the results are isolated and sometimes even contradictory, so they are considered not relevant for conclusions.

The main objective of this thesis was to assess which were some of the drivers influencing performance on the water sector, and to do this working already with the findings of previous studies as a basis. Almost at the same level there was the objective to understand, if possible, if there is a proved better management structure to provide quality service to the final customer – private or public.

Relative to the first objective, some solid conclusions were reached on what concerns the period of concession and also the remaining years of concession. If these conclusions are corroborated by future studies, it might bring additional value to the methodology of contract negotiations.

In terms of the second objective, no clear evidence was obtained about the best management model, even considering that some findings corroborate the hypothesis that private participants enhance productivity Nevertheless, this incognita is aligned with the findings of previous studies already described on the Literature Review. The private entrance on the water sector had some proved advantages, especially in terms of productivity, but still there is no clear advantage that private entities provide a better service managing the water structures.

Possible further studies

One of the major issues while studying the Portuguese water sector is still data availability. A lot has been done on recent years, but still there are some information gaps when trying to build long databases.

One of the suggestions for further studies is of course to increase the database, especially because the report of ERSAR from 2012 is the most complete one, but the previous ones lack information on several concessions.

The inclusion of more observations could also allow for a separation of water and waste management services. Since these services have different dynamics and scales, having the possibility to have considerable individual samples for both could also bring some interesting conclusions.

Another possible relevant addition is to find data on the municipalities that run themselves the water sector services on the city/town, which are still a very big number. As a pure example of public management, and more important, local public management, the introduction of these samples to the overall scenario could yield important findings and contribute to the public vs. private management debate.

With the data available in terms of geographical conditions only the variables APU, AMU and APR could be built. A possible improvement would be to elaborate more on the creation of a single variable for terrain conditions and infrastructure, since the potential for this variable is still probably underrated with the study that was conducted on this thesis. A more accurate variable related to this dimension could even help raise findings to a better planning of the areas of influence of companies, launching the debate if the current "micro" management structure is sustainable and effective or if there would be noticeable gains in merging structures and companies.

In terms of evaluation of private vs. public management, a more complete study could also involve finding solid comparable information between companies in full private models (such as in Britain and Wales), and studying their financial and specially quality performance comparing to companies in the hybrid "French" model, also similar to the one applied in Portugal. That would be a direct comparison between private and public management, and could yield more solid and interesting results for this debate.

As final remark, the introduction of new hypothetical drivers for performance is also a value added idea, when the lack of good data is surpassed.

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8. Appendixes

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	

Table 15 – List of Financial Indicators used on the Concession Performance Evaluation Model

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

Table 16 – List of Quality and Sustainability Indicators used on the Concession Performance Evaluation Model

Note: On the Quality and Sustainability part, these were not the exact indicators used. The indicators used are present on RASARP, and the chosen ones are intended to evaluate each one of the above-mentioned variables

Variables' descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Performance	321	3,138	0,539	1,7	4,89
Financial Performance	321	3,738	0,678	2	5,00
Quality Performance	321	2,739	0,672	1	5,00
Period of Concession	281	30,402	6,934	15	50
Remaining Years of Concession	281	21,566	9,161	5	50
Contractual Changes	321	0,389	0,603	0	2
Public vs Private Management	321	0,586	0,493	0	1
Area served (km2)	313	1996,160	2695,335	2	17037
Nº of Residences (000)	313	155,600	216,127	1,5	1142
Productivity	318	5,586	2,815	1	10
Price Score	321	2,903	1,310	1	5

Table 17 – Descriptive Statistics for Global Sample Variables

Variable	Obs	Mean	Std. Dev.	Min	Max
Performance	170	3,051	0,533	1,871	4,657
Financial Performance	170	3,641	0,699	2,140	5
Quality Performance	170	2,659	0,667	1	5
Period of Concession	156	30,051	6,698	20	50
Remaining Years of Concession	156	20,718	9,032	5	50
Contractual Changes	170	0,218	0,455	0	2
Public vs. Private Management	170	0,906	0,293	0	1
Area served (km2)	166	3461,825	2966,430	2	17037
Nº of Residences (000)	168	257,889	252,393	15	1142
Productivity	170	5,506	2,909	1	10
Price Score	170	2,891	1,415	1	5

Table 18 – Descriptive Statistics for Upstream Variables

Variable	Obs	Mean	Std. Dev.	Min	Max
Performance	152	3,232	0,531	1,7	4,886
Financial Performance	152	3,846	0,637	2	5
Quality Performance	152	2,823	0,669	1,5	5
Period of Concession	125	30,840	7,222	15	50
Remaining Years of Concession	125	22,624	9,247	5	49
Contractual Changes	152	0,579	0,686	0	2
Public vs. Private Management	152	0,230	0,422	0	1
Area served (km2)	147	341,054	615,942	8	6498
Nº of Residences (000)	146	37,684	32,024	1,5	180,5
Productivity	149	5,648	2,728	1	10
APU	152	0,250	0,434	0	1
AMU	152	0,507	0,502	0	1
APR	152	0,263	0,442	0	1
Price Score	152	2,918	1,183	1	5

Table 19 – Descriptive Statistics for Downstream Variables