Does competition affect prices in the urban water industry? Evidence from Spain

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Summary: In recent decades, developed countries have privatized the provision of certain municipal services, but the presence of private enterprise in the urban water industry remains scarce. One of the arguments against privatizing this service is that, due to the virtual absence of competition, privatization raises water prices. Is there really a relationship between the degree of competition in the industry and the price of water? This article aims to answer this question using data from 162 municipalities in Southern Spain. Our main contribution is analyzing whether market concentration, as a proxy for lack of competition, affects prices. Empirical evidence shows that competition reduces the price of water for residential uses. The main policy recommendation is that urban water service privatization must be accompanied by appropriate regulatory and institutional frameworks to promote competition among businesses and monitor water pricing. Otherwise, the combination of market and regulation failures can lead to unequal access to an essential commodity such as water for residential uses.

Keywords: water industry; privatization; competition; water pricing.

JEL Classification: D43; D44; L11; L95.

1. Introduction

Many governments have implemented measures of economic liberalization since the late 1970s. Inspired by the *Public Choice Theory*, decisions were taken to reduce the presence of the public sector in the economy in favor of private enterprises. At local government level, these reforms resulted in outsourcing and, in some cases, privatizing many municipal services. Following the regulatory changes during the liberalization process, many local governments opted to outsource some municipal services, mainly for pragmatic reasons (Bel and Fageda, 2007, 2009).

Among the services under the competence of local governments, the urban water supply has generated the most controversy regarding the privatization option; in fact, there are many developed economies where reforms have not addressed the privatization of urban water services. In most OECD countries, less than 10% of the population, and in some cases none whatsoever, are supplied by the private water industry (Pérard 2009). Only in France, England and the Czech Republic does privatization represent more than 50%. In Greece, Italy and Spain, privatization

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accounts for between 30% and 50%, while in Australia, Germany, Hungary, Mexico, Portugal, Slovakia and the United States, this figure ranges from 10% to 30%.

Governments are reluctant to privatize the service due to the nature of the water industry. One peculiarity is that this service provides access to a basic good, at least up to certain levels of consumption (García-Valiñas et al. 2010). Secondly, it is a market that is difficult to introduce competition into. Before the privatization of the service, the water market is oligopolistic and once privatized the supplier is a local monopolist. A third feature is the high transaction costs associated to the privatization of the service. Consequently, in order to ensure universal access to water, many countries and cities have preferred to keep the service in public hands.

One argument that has also been traditionally used to oppose privatization of the urban water service is that private enterprises charge higher prices, without necessarily improving the quality of the service. Evidence shows that water prices are higher in private firms than in public ones in France (Carpentier et al. 2006, Chong et al. 2006a), Spain (Martínez-Espiñeira et al. 2009) and Germany (Ruestes and Zschille 2010).[1] These papers made use of several techniques to overcome potential problems of endogeneity in the choice made by the local government regarding firm ownership, whether public or private. In this way, evidence suggests that local governments are more likely to privatize water services the higher the complexity of the service, implying that producers need to incur in higher costs (González-Gómez et al. 2010). Another possible explanation has to do with market structure. Imperfect competition among the few companies operating at national level could explain the higher prices charged by private enterprises.

In this context, the objective of this research is to analyze the relationship between market structure in the private sector of the water industry and water prices. As far as we are aware, only two studies have addressed this issue previously, both focusing on the French case. Neither of them obtains robust evidence on the relationship between competition and water prices. On the one hand, Garcia et al. (2005) shows that the presence of a small local firm (outsider) in a competitive bidding process does not automatically increase competition leading to a fall in prices. On the other hand, Chong et al. (2006b) finds that when operators control the monopoly for the entire duration of the contract their prices are not mitigated by a direct competition effect. Furthermore, no relationship is found between the prices charged by private operators and ex post competition in water contracting.

[1] Thorsten et al. (2009) found no significant evidence that producer ownership influenced the bill paid by consumers in North Carolina.

Our paper performs a dynamic analysis of the relationship between competition and water pricing based on data from 162 municipalities located in the Southern Spanish region of Andalusia. Our main contribution is analyzing whether market concentration, as a proxy for lack of competition, affects prices. Competition is measured by variables representing both the degree of concentration in the industry,[2] and also the market share of the company that manages the service. Contrary to the results obtained in the French case, we obtain strong evidence that competition influences the pricing of water for residential uses. The implication of this result for policy-makers is straightforward: there is a risk of unequal access to a basic commodity such as water in those countries that opt for privatizing water services without creating a regulatory and institutional framework to monitor pricing.

The rest of the article is organized as follows. Section 2 describes the regulatory framework for privatizing water services in Spain and the market structure in Andalusia. Section 3 describes the data, specifies the model and establishes the main hypothesis to be contrasted. Section 4 explains the methodology and describes the results and their policy implications. A final section summarizes and concludes.

2. Privatization of urban water management in Andalusia

2.1 Legal framework

The legal framework that regulates the management of municipal services in Spain is made up of Law 7/1985 (Local Government Regulations) and Law 57/2003 (Measures for the Modernization of Local Government). Article 25 of the first of these two laws stipulates that municipalities are responsible for the water supply.

Local government is authorized to decide the legal entity to provide urban water services. Current legislation also establishes different possibilities. In the first place, the local government may choose to manage the service from the council itself (in house) or to outsource it. In the second case, management may be transferred to a public company, a private one, or a public-private partnership.

Concession agreements are the most widespread form of privatizing local services in Spain. Concessions are made official through a management contract of public services by which the local government, which usually retains ownership of the

[2] Dijkgraaf and Gradus (2007) have used this variable to study costs solid waste collection in the Netherlands and the find that high levels of market concentration imply higher costs. In Gómez-Lobo and Symanski (2001), the number of firms bidding for solid waste contracts is found to be negatively related to delivery costs.

service, entrusts operations to a natural person or legal entity.[3] Through a concession, the private company will manage the service at its own risk and venture during the term of the contract. At the end of the contract, the local government must decide once more how the service is going to be managed. Public-private partnerships can be considered a partial privatization of urban water services which allows combining the promotion of public interests with private management benefits (Bel and Fageda, 2010). Ownership is shared between the public partner, who is supposed to ensure the public purposes of the service are achieved, and the private partner, who has the *know-how* of the industry and is often in charge of the day-to-day management of the service (Bel and Warner 2008, González-Gómez et al. 2009).

The full or partial transfer of water service management to a private company is awarded for a certain amount of time after the competitive tendering process. There is a limit of fifty years in contracts that involve the construction of infrastructure and operations, and twenty-five years in those which only involve running the service. Candidates in the bidding process place a first-price sealed-bid in response to a public notice in the *Province Official Gazette* announcing the public tender of the contract of water service management. This announcement includes the adjudicating entity, the purpose of the contract, the technical and economic conditions and the procedure and assessment criteria; at the same time, it details the commitments that the contractor will have to fulfill after signing the contract. Bidders must submit their technical and financial proposal in sealed envelopes and the contract is awarded to the company that makes the most advantageous proposal, not only taking into account their economic value, but also considering a number of criteria. The contractor may also declare the public tender void.

2.2. Privatizing water services in Andalusia

Andalusia is a European region located in Southern Spain with a surface area of 87,268 km^2 and a population of around 8.2 million inhabitants. Its 1,101 kilometer long coastline harbors strong tourist activity and attracts visitors from different places, particularly the Central and Northern European Union. Administratively, this region is made up of 8 provinces and 771 municipalities. As mentioned before, local governments are held responsible for the local water services, which can be delivered using their own administrative organization or, otherwise, transferring management to a public, private, or a mixed public-private firm.

[3] More detailed information of the regulatory aspects of the procurement process with public administrations can be found in Law 30/2007 on Public Sector Contracts and in the Royal Decree 1098/2001, which approves the General Regulation of the Law of Public Administration Contracts.

With the passing of Law 7/1985, many local governments decided to privatize their water service. Privatization was a pragmatic solution adopted by municipalities with financial problems (Miralles 2009), as well as by the ones located in an environment that made the provision of water a complex job (González-Gómez et al. 2010).[4] In the year 2009, less than 24% (183 municipalities) of the municipalities in Andalusia had fully or partially privatized the management of urban water services. In 53% of them (97 municipalities), management had been completely transferred to a private company, while just 47% (86 municipalities) had delegated management to a public-private partnership. Although in the late 80's and first half of the 90’s, municipalities mainly opted for full privatization, since the end of the 90’s public-private partnerships have been preferred (González-Gómez et al. 2009, Ruiz-Villaverde et al. 2010).

Table 1 shows the share of total privatization contracts of the companies involved in the management of the urban water service in Andalusia in 2009, in addition to some indicators of the degree of market concentration, in terms of municipalities and population. One of the main features of the market is the high concentration in a few companies. Together, the two largest firms –*Aquagest* and *Aqualia*– supply water to 57% of the municipalities that have fully or partially privatized management and to nearly 80% of the population. *Aquagest* belongs to *Aguas de Barcelona* (*Agbar*), the holding company that comprises over 150 companies and around 13,000 employees, which provides water services in Spain and also in countries like the United Kingdom, Mexico, China, Chile, Cuba, Colombia and Algeria. *Agbar* was taken over by the French company *Suez* in 2010. As regards the other company, *Aqualia* is part of *Fomento de Construcciones y Contratas* (*FCC*), a holding that, in addition to providing water services to more than 850 Spanish municipalities, is also present in 54 countries, including China, Mexico, Portugal, Czech Republic, Poland and Algeria.

INSERT TABLE 1 ABOUT HERE

The *concentration ratios* for the largest (CR1) and the four largest firms (CR4) are very high, particularly when considering population.[5] The *Hirschman-Herfindahl* (HHI) index also indicates a much higher degree of concentration for population. According to the *Federal Trade Commission* and the *US Department of Justice*,

[4] In a recent, paper Picazo-Tadeo el at. (2010) show, however, that beyond pragmatic reasons, ideological and political motives also matter in the public choice of management of local water services in Andalusia.

[5] The reason is probably that once companies gain a certain level of market power, as may be the case of *Aquagest* and *Aqualia*, they show more interest in new privatization tenders for the most populous cities.

markets can be categorized as unconcentrated (HHI below 0.10), moderately concentrated (HHI between 0.10 and 0.18) and highly concentrated (HHI above 0.18). Furthermore, the *European Commission* establishes that competition may be considered tough enough in markets with an HHI below 0.20. Taking these figures as benchmarks, it can be asserted that the market in the private sector of the Andalusia water industry is tightly concentrated. In this scenario, the question we pose in this paper is whether or not there is a relationship between the degree of competition in the water industry in Andalusia and the price of water for residential use.

3. Data, model specification and hypotheses

Our database includes information from 162 Andalusia municipalities which in 2009 had privatized the management of urban water services; in 77 municipalities management is purely private, while in the last 85 municipalities management is carried out by a public-private partnership. The sample is representative of almost 90% of the municipalities that had privatized the management of water services in the year of reference.

In all the municipalities within the sample, urban water suppliers charge non-linear and non-uniform prices. The tariff is divided in two parts: one as a fixed share for the service connection and another as a variable share, rising in accordance with blocks of consumption. As in Martínez-Espiñeira et al. (2009), we have used the tariff structure to calculate a *representative* or *theoretical* average price for each municipality corresponding to several levels of consumption. We have done so because of the lack of homogeneity in water tariffs on the one hand, and the unavailability of information about the distribution of consumption on the other. In particular, we have calculated the average price paid per cubic meter of water corresponding to a bill for consuming 5, 10, 15, 20, 25 and 50 cubic meters per account and month. Those prices, alongside the fixed fee applied to the water bill, are included in the estimations as the dependent variable. The stacking of the seven observations on price as separate observations for each municipality resulted in a total of 1,134 observations (7×162).

Except in those cases where the same company provides water services to several neighboring towns and chooses to set the same price for the entire service area, the price of water in Andalusia is different in each municipality. In this regard, it should be highlighted that decisions on prices are decentralized to local level or, where applicable, to association or consortium level. It is worth mentioning that in Andalusia the regulatory and institutional framework do not provide strict guidelines on what the structure of the pricing system or the level of water prices for residential use should be. Table 2 shows descriptive statistics for water prices in our sample.

INSERT TABLE 2 ABOUT HERE

In order to ascertain the factors that explain the differences across municipalities in the average price corresponding to several levels of water consumption, we have considered as explanatory variables those listed in Appendix 1, which also includes their description and data source. Some descriptive statistics are in Table 3.

INSERT TABLE 3 ABOUT HERE

The choice of the variables that may account for differences in the price of water between municipalities was based on the previous literature (Garcia et al., 2005; Car-pentier et al. 2006, Chong et al. 2006a, b; Martínez-Espiñeira et al. 2009; Thorsten et al. 2009; Ruestes and Zschille 2010) and also the availability of statistical information. First of all, four binary or dummy variables indicating if the observation refers to a consumption of 5, 20 or 50 cubic meters and to the fixed quota are considered in order to control for the artificial variability generated in the dependent variable. Since most tariffs are based on an increasing block structure, we expect the coefficients of consumption dummies corresponding to 20 and 50 cubic meters to be positive and the coefficient of the dummy corresponding to consumption of 5 cubic meters to be negative.

Likewise, as is usual in this type of study, we have considered proxy variables to account for the socioeconomic characteristics of the environment and the technical characteristics of the service. In all instances, they have an impact on service costs and, therefore, water prices. The first of these variables is *POPULATION*, its effect on prices being ambiguous. The larger a municipality, the more it can exploit the economies of scale in the sector; however, at the same time, this implies greater complexity in the management of the service, which can raise costs. Secondly, we have introduced the variable *DENSITY OF POPULATION*, the relationship of which with the price of water is not at all clear either. Higher population density leads to higher congestion expenses, while greater dispersion leads to higher pumping costs because of diseconomies of density. Regarding technical characteristics, we include the *STRONG WATER TREATMENT* variable which is a dummy that identifies municipalities where it is necessary to carry out major water treatment in order to make it suitable for human consumption. As more complex treatment processes entail higher costs for the company, this variable is expected to be positively related to prices. [6]

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[6] In relation to the technical characteristics of the service, we have also considered to include the length of the delivering network as an explanatory variable which could be

In Spain, it is common for a single company to provide urban water services to several adjacent municipalities. The strategy of expanding the service area allows companies to exploit the economies of scale in the industry and, consequently, to reduce average costs (González-Gómez and García-Rubio 2008). In order to contrast the influence of this kind of strategy on water prices, two other variables have been included: CONSORTIUM and CONSORTIUM WITH EQUAL PRICES FOR ALL MUNICIPALITIES. While the first of these variables is expected to be negatively related to water prices, the second is intended to test whether setting the same price for water in all municipalities in their area of service is due to a strategy on behalf the suppliers to increase prices.

Finally, we have included the variable PRIVATE MANAGEMENT to test whether there are differences between the prices charged by private companies and mixed public-private firms. The control over the activity and, in particular, over the pricing process exerted by the local government can influence in two ways. On the one hand, it can contain prices better; however, on the other hand, it can force companies to make decisions aimed at promoting general interests that imply higher costs and, therefore, higher prices. The expected effect of this variable is therefore uncertain. The variables DUMMY FOR FIRM 1 TO 5 represent the five companies with the largest market share in Andalusia and have been included in our model to control for possible differences in water pricing strategies among firms.

3.1. Variables representing competition

In addition to the explanatory variables of water prices described in the previous Section, in order to achieve the main aim of our research a set of variables aimed at measuring the current degree of competition in the Andalusian water industry has been included. In Spain, given the legislation governing the privatization of water, the potential relationship between competition and prices can be held in two different points in time, namely, when the concession is awarded and during the term of the contract when the supplier acts as a local monopoly.

Concerning the first of these times, a first-price sealed-bid auction system is used in Spain, as described before, to award concessions. A requirement for the bidders when submitting their offer to the local government is to set a water price to be paid by service users. The price proposed by each bidder will be important for them to win

positively correlated to the price of water. In this sense, the more extensive the network, the more likely it is that pipelines will have leaks, resulting in the company needing to use more material and human resources to conserve and maintain the network or, alternatively, incur in higher expenses to inject a larger quantity of raw water. However, the high correlation between this variable and population has led us to exclude it from the estimation.

the contest. In order to capture this first relationship between competition and water prices three *MARKET CONCENTRATION* indicators have been used at provincial level: *CR1*, *CR2* and *HHI*. *CR1* and *CR2* represent, respectively, the market share of the first company and the first two companies, while *HHI* represents the index of concentration of *Hirschman-Herfindahl*. In all cases, market shares are computed according to the population served. These variables were introduced taking into account the value of each indicator in the year in which the local government decided to privatize the urban water service and aim to capture the competition risk perceived by the bidders in the competitive tendering process. A greater degree of concentration implies fewer potential competitors.

An alternative variable to measure competition when franchising the service could be the number of bidders participating in the contests. However, the relationship between the number of bidders and the price of water is not clear yet. On the one hand, *Auction Theory* predicts that the more competitors in the auction, the more favorable conditions for recruitment for the auctioneer. When applied to urban water services, the more bidders, the lower water prices should be, as a result of greater competition. On the other hand, *Market Contestable Theory* argues that merely due to seeing their market position threatened by the presence of potential competitors forces companies that act within a monopolistic or oligopolistic environment to behave as they would in a context of perfect competition (Baumol et al. 1982). Therefore, the number of bidders in public tenders may be irrelevant in the pricing of water. The threat of a potential competitor would be enough for companies to offer prices close to the cost of the service and to avoid significant differences in proposed rates.

The second time when the relationship between competition and prices might exist is, as noted, when the contractor acts as a local monopoly. Spanish legislation allows water rates to be modified, which usually occurs annually. The process begins with the preparation of a tariff review record by the supplier company, which must then be approved by the municipal government. Since there is a clear situation of asymmetric information and transaction costs are high, the company may exercise its dominant position in the pricing proposal, year after year. The relationship between supplier market power and price is captured by the variable *MARKET SHARE OF THE SUPPLYING FIRM*. The more market power a company has, the higher prices are expected to be. The reason is that the smaller the number of external references for local governments, the more asymmetric their information will be and the more benefits the supplying company will reap from its dominant position.

Concerning the annual review of tariffs, one might expect water prices to increase as years go by since the privatization of the service. Indeed, the course of time since privatization can increase the market power of settled firms, thus eroding competition (Bel and Costas, 2006 show evidence in this regard for the solid waste service), which might have made it easier to increase effective prices through the various tariff reviews. Thus, the variable *YEARS SINCE PRIVATIZATION* is expected to be positively related to the price of water. However, one might expect this relationship, while positive, to decrease over time, such that with the passing of time, firms will tend to contain the rise in water prices. The reason is really straightforward. The contract is limited in time, so the company will have to adjust its pricing strategy to take into account that the local government may reconsider its decision to privatize in the future. Therefore, as the end of the contract approaches, companies would adopt a pricing strategy that increases their options to renew the contract. Consequently, the coefficient associated to the variable *YEARS SINCE PRIVATIZATION-SQUARED* is expected to be negative and significant.

4. Methodological notes, results and policy implications

In this research we have used ordinary least squares regression to explain water prices set by private companies in Andalusia as a function of the variables described in Section 3, including those that represent the level of market competition. Results appear in Table 4. In order to test the robustness of these results, five different models have been estimated. All of them include socioeconomic and technical variables as explanatory factors, as well as firm dummies and dummies representing the level of consumption observations belong to. Models 1 to 3 include variables representing competition at the time when the decision to award the contract for the provision of the water service is taken (*CR1*, *CR2* and *HHI*, respectively), while model 4 includes the variable that proxies competition once the contract is terminated, namely, *MARKET SHARE OF THE SUPPLYING FIRM*. Finally, model 5 includes variables representing competition at both times.[7] Furthermore, all models include the variable *YEARS SINCE PRIVATIZATION* and its square.

INSERT TABLE 4 ABOUT HERE

Concerning the results, it is worth mentioning that a large percentage of the explanatory variables introduced in the model appear to have a significant effect

[7] In model 5, competition at the time of awarding service management has been measured by the *HHI* concentration index. The reason is that the use of other indicators such as the *CR1* led to major problems of multicollinearity due to their correlation with the market share of the firm that provides the service.

on water prices. Furthermore, the explanatory power of the model is satisfactorily high, with an R-squared of around 0.75 in all regressions. As regards the estimated parameters, the variable *POPULATION* is found to have a significant and positive effect on water prices in all of the models estimated.[8] On the contrary, the sign estimated for the variable *DENSITY OF POPULATION* is negative and statistically significant, suggesting the existence of economies of density in the provision of water services.

The estimated parameter for the variable *STRONG WATER TREATMENT* is statistically significant and has the expected sign. More intensive treatment to ensure the quality and drinkability of water for residential use entails higher costs and therefore higher prices. There is also a close relationship between the treatment used for making water suitable for human consumption and its source. Generally, dirty surface water is poorer quality than water from the subsoil, since it is more exposed to external pollutants and, therefore, needs more intensive treatment in order to make it suitable for human consumption.[9]

The result obtained for the variable *CONSORTIUM* suggests that the association of municipalities is a good strategy to reduce costs. Prices are significantly lower when a single manager provides the service to several surrounding municipalities. On the other hand, we find a positive and statistically significant relationship between the variable *CONSORTIUM WITH EQUAL PRICES FOR ALL MUNICIPALITIES* and the price of water. This result seems to suggest that the benefits that firms obtain from situations with asymmetric information are greater when the service is provided to several municipalities and that the decision to establish a single price for all municipalities in the service area might well be the result of a business strategy to achieve higher prices.

The significant and negative relationship between *PRIVATE MANAGEMENT* and water prices indicates that prices are higher when the service is managed by a public-private partnership. Probably the more direct control that the local government exercises on managing the service in a public-private partnership leads to more ambitious conditions on the extent and quality of water services, which will tend to be reflected in higher costs and ultimately, in the bill paid by the user.

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[8] Let us recall that the variable *POPULATION* is strongly correlated with the length of the delivering network, as already noted. Furthermore, *POPULATION* is also highly correlated with an indicator of the economic activity in the municipality, which has not been included either in our model as an explanatory variable to avoid problems of collineality. It is quite plausible that suppliers set higher prices in richer municipalities by using their ability to discriminate prices as local monopolies.

[9] In fact, no proxy for underground or surface water has been introduced in the model due to high collinearity with the variable *STRONG WATER TREATMENT.*

Finally, results for firm dummies show the existence of different business strategies in the policy of water pricing in Andalusia.[10] The sign and statistical significance obtained for the parameter of variable *DUMMY4* suggests that this firm sets higher prices for water. Although the result is less robust, it also appears that the firm represented by *DUMMY2* sets higher water prices. On the contrary, the company represented by *DUMMY1* seems to set lower prices, although is worth noting that this result is not robust in all models estimated.

Turning now to the results obtained for market competition proxies, the evidence obtained clearly indicates that there is a significant and positive relationship between the degree of market concentration and water prices. Moreover, this is a robust result that appears in all our models. In models 1 to 3, the estimated coefficients for variables *CR1*, *CR2* and *HHI*, introduced to represent competition at the time contracts for the provision of water services are awarded, are all positive and statistically significant. This relationship may be due to the strategy followed by water firms at the time to stand for the tender to privatize the service. In areas with higher market concentration, bidding companies foresee the competition of a smaller number of competitors in public tenders and, consequently, propose a higher price for water.

Similarly, the variable *MARKET SHARE OF THE SUPPLYING FIRM*, introduced in model 4 to include the effect of competition once the service has been awarded, is positively and significantly related to the price of water. This result suggests that the bargaining power of water firms in the annual process of reviewing prices is greater when its market share is higher. With incomplete contracts and asymmetric information, greater market power facilitates the exploitation of the positioning advantages in the sector. Finally, model 5 includes a proxy for competition at the time the service is awarded (the variable *HHI*) and the variable *MARKET SHARE OF THE SUPPLYING FIRM*. Results, regarding the sign and statistical significance of the estimated parameters, are the same as those already discussed for models 1 to 4.

The result for the variables representing the time elapsed since the management of the service was privatized for the first time is also that expected. A positive relationship between the price of water and the variable *YEARS SINCE PRIVATIZATION* is obtained, showing that firms tend to raise their prices once they have been awarded the service. This result is significant in models 2, 3, and 5. However, the negative sign of the variable *YEARS SINCE PRIVATIZATION-SQUARED* suggests that, as years go by, the increase in prices is smaller. Probably, given that contracts for the supply of water services have a limited length, proximity to the time of completion

[10] Following confidentiality commitments, the names of firms are not disclosed.

encourages companies to moderate their rise in water prices. Thus, companies would seek to safeguard their interests. First, because the local government can decide to re-municipalize water service at the end of the contract and, secondly, because even if there is a new public tender to choose a private manager for the service, local governments could encourage the entry of new bidders.

In summary, the results of our research show that the degree of market competition influences the price for water set by private firms in Andalusia. Furthermore, this is a robust result obtained in the different models estimated. Existing market concentration in certain areas of Andalusia, in the context of a clearly oligopolistic industry, is reflected in higher prices for residential water. The main implication of this relationship is that it could cause unequal access to a basic commodity such as water.

This inequity would be the consequence of regulatory failures; in other words, it may be an effect of the absence of effective regulation of the pricing processes for water in the region studied. The only control over the awarding of tenders and tariff review processes is exerted by local governments, but it might not be enough to compensate for the lack of competition in the industry. Furthermore, local government control is usually exerted by unskilled bureaucrats who are at a disadvantage compared to private service managers (Martínez-Espiñeira et al. 2009). Moreover, in Andalusia, there is no independent body such as those which are common in Anglo-Saxon countries (e.g., *Offwat*), which control the process of water pricing and/or perform comparative analyses of the activity of water utilities in order to highlight situations of inefficiency or abuse of dominant positions in the market. In short, the absence of effective control over private water suppliers gives them a certain degree of discretion in the revision of tariffs.

Currently, water prices in Spain are relatively low (OECD, 2010); on average, Spanish households spend 0.6% of their budget on water bills (Gistau, 2010). However, the *EU Water Framework Directive* places special emphasis on setting water prices that facilitate the recovery of service costs and promote efficiency in the use of water resources. Current levels of cost recovery stand, depending on the basin, between 75% and 95% (Ministerio de Medio Ambiente 2007). Nevertheless, estimates more in line with real service costs, especially when including environmental costs, could result in a more intense and widespread increase in water prices in Spain. In a predictable scenario with much higher prices than at present, it is possible that inequity due to the lack of competition in the private sector of the water industry is revealed as a more serious problem for service users.

5. Conclusions

Available evidence shows that prices of water for residential use are, in general, higher when the service is managed by a private company. One possible cause for this relationship is that local governments tend to assign the management of water services to private managers when provision of the service is more complex, entailing higher costs and therefore, higher prices. However, another possible cause has to do with the market structure in the water industry. Before a local government assigns the management of the service to a private firm, the market is an oligopoly, so few companies compete in the public tenders through which local governments decide the concession of the service. Following the resolution of the contest, the successful company acts as a local monopoly over the term of the contract.

This research aims to analyze the relationship between water prices and the degree of competition in the private sector of the water industry. In order to do so, information belonging to 162 municipalities located in the Southern Spanish region of Andalusia is used. As for the results, empirical evidence is obtained of the relationship between competition and water prices. In the first place, it is found that higher market concentration at the time the service is awarded leads to higher water prices. Secondly, once the contract for the provision of the service is awarded, firms with a larger market share make their dominant position effective by setting higher prices for water.

Our results have an important implication: a situation of inequality may be created in the access to water due to market structure in the private sector of the industry. Moreover, the absence of a specific regulation from an independent organism that supervises the process of tariff reviews further aggravates the situation. Therefore, it seems that the lack of competition in the water industry has not been well resolved by Spanish legislators. In other words, the water industry suffers from both market and regulatory failures.

Finally, the results of this research allow formulating some recommendations for economic policy. Firstly, privatization of the management of urban water services must be accompanied by mechanisms that guarantee the presence of a certain degree of competition in the industry, both in relation to public tenders and also to the level of market concentration once the service is awarded. Secondly, it seems advisable to create independent bodies to control the behavior of water utilities and, in particular, their pricing policies and the way prices are reviewed. Benchmarking or comparing the productive activity of companies might also be a useful tool to regulate the process of establishing water prices.

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Appendix 1 Variables: Description and sources

Variable	*Description*	*Source*
VARIABLES REPRESENTING WATER PRICES		
Fixed quota	Fixed quota in € per month paid by in the water bill in 2010	Official Gazettes of the Andalusia provinces
Price corresponding to a bill of 5 cubic meters	Price in € paid per cubic meter of water corresponding to a bill for consuming 5 cubic meters, according to prices in 2009	
Price corresponding to a bill of 10 cubic meters	Price in € paid per cubic meter of water corresponding to a bill for consuming 10 cubic meters, according to prices in 2009	
Price corresponding to a bill of 15 cubic meters	Price in € paid per cubic meter of water corresponding to a bill for consuming 15 cubic meters, according to prices in 2009	
Price corresponding to a bill of 20 cubic meters	Price in € paid per cubic meter of water corresponding to a bill for consuming 20 cubic meters, according to prices in 2009	
Price corresponding to a bill of 25 cubic meters	Price in € paid per cubic meter of water corresponding to a bill for consuming 25 cubic meters, according to prices in 2009	
Price corresponding to a bill of 50 cubic meters	Price in € paid per cubic meter of water corresponding to a bill for consuming 50 cubic meters, according to prices in 2009	
EXPLANATORY VARIABLES		
Dummy for fixed quota	Variable that takes a value of 1 for observations corresponding to the fixed quota, and 0 otherwise	Own elaboration
Dummy for price corresponding to a bill of 5 cubic meters	Variable that takes a value of 1 for observations corresponding to the price per cubic meter of 5 cubic meters of water, and 0 otherwise	
Dummy for price corresponding to a bill of 20 cubic meters	Variable that takes a value of 1 for observations corresponding to the price per cubic meter of 20 cubic meters of water, and 0 otherwise	
Dummy for price corresponding to a bill of 50 cubic meters	Variable that takes a value of 1 for observations corresponding to the price per cubic meter of 50 cubic meters of water, and 0 otherwise	
Population	Number of inhabitants in 2009	Municipal Census. National Institute of Statistics
Density of population	Number of inhabitants per kilometer-squared in 2009	
Strong water treatment	Dummy variable that takes a value of 1 if water needs type A2 or A3 chemical treatment (strong treatment) in order to make it suitable for human consumption, and 0 otherwise	Ministry of Health and Social Policy

Appendix 1 (continued)

Consortium	Dummy variable that takes a value of 1 if the supplying firm belongs to a consortium that provides water services to several neighboring municipalities, and 0 otherwise	
Consortium with equal prices for all municipalities	Dummy variable that takes a value of 1 if the supplying firm belongs to a consortium and the price of water is the same for all municipalities supplied, and 0 otherwise	Water utilities
Private management	Dummy variable that takes a value of 1 for private firms and 0 for public-private partnerships. The data refer to 2009	
Dummy for *firm 1*	Dummy variable that takes a value of 1 if the observation belongs to firm *1*, and 0 otherwise	
Dummy for *firm 2*	Dummy variable that takes a value of 1 if the observation belongs to firm *2*, and 0 otherwise	
Dummy for *firm 3*	Dummy variable that takes a value of 1 if the observation belongs to firm *3*, and 0 otherwise	Own elaboration
Dummy for *firm 4*	Dummy variable that takes a value of 1 if the observation belongs to firm *4*, and 0 otherwise	
Dummy for *firm 5*	Dummy variable that takes a value of 1 if the observation belongs to firm *5*, and 0 otherwise	

EXPLANATORY VARIABLES REPRESENTING COMPETITION

Market concentration (*CR1*)	Percentage of market share held by the largest firm in the year of privatization. This concentration ratio is calculated on the basis of the population supplied in the provincial market	
Market concentration (*CR2*)	Percentage of market share held by the two largest firms in the year of privatization. This concentration ratio is calculated on the basis of the population supplied in the provincial market	Own elaboration
Market concentration (*HHI*)	*Hirschman-Herfindahl Index* defined as the sum of the squares of the market shares of all supplying firms. It has been also calculated on the basis of the population supplied in the provincial market in the year of privatization	
Market share of the supplying firm	Market share held by the supplying firm in year 2009	
Years since privatization	Number of years elapsed from the year of privatization to 2009	Town councils

Table 1 Market shares of private contracts for water supply in Andalusia and concentration indices. Year 2009

	Municipalities	*Population*
Firms' market shares (%)		
Aqualia	30.3	41.8
Aquagest	26.6	36.7
Acciona	23.8	9.0
Agua y Gestión	7.3	5.5
Gestagua	6.7	5.4
Hidrogestión	2.2	0.8
Urbaser	1.6	0.4
Añil	1.1	0.1
Concentration indices [a]		
CR1 (%)	30.3	41.8
CR4 (%)	88.0	93.0
HHI	0.23	0.32

a. CR1 is the market share of the leading firm in the market, while CR4 is the aggregated market share of the four leading firms in the market. HHI is the Hirschman-Herfindahl concentration index.

Table 2 Sample description: water prices

Variable	*Mean*	*Standard deviation*	*Maximum*	*Minimum*
Fixed quota (€ per month)	2.18	0.72	5.38	0.65
Price corresponding to a bill of (€ per cubic meter):				
5 cubic meters	0.34	0.12	0.76	0.05
10 cubic meters	0.41	0.14	0.78	0.05
15 cubic meters	0.52	0.18	0.86	0.11
20 cubic meters	0.64	0.24	1.20	0.15
25 cubic meters	0.75	0.29	1.53	0.18
50 cubic meters	1.07	0.45	2.24	0.41

Table 3 Sample description: explanatory variables

Variable	*Mean*	*Standard deviation*	*Maximum*	*Minimum*
Dummy for fixed quota	0.143	0.350	1	0
Dummy for price corresponding to a bill of 5 cubic meters	0.143	0.350	1	0
Dummy for price corresponding to a bill of 20 cubic meters	0.143	0.350	1	0
Dummy for price corresponding to a bill of 50 cubic meters	0.143	0.350	1	0
Population (thousands)	18.7	32.1	234.3	0.3
Density of population (inhabitants per kilometer-squared)	424	920	6,940	5
Strong water treatment	0.648	0.478	1	0
Consortium	0.556	0.497	1	0
Consortium with equal prices for all municipalities	0.228	0.420	1	0
Private management	0.475	0.500	1	0
Dummy for *firm 1*	0.278	0.448	1	0
Dummy for *firm 2*	0.333	0.472	1	0
Dummy for *firm 3*	0.074	0.262	1	0
Dummy for *firm 4*	0.222	0.416	1	0
Dummy for *firm 5*	0.062	0.241	1	0
VARIABLES REPRESENTING *COMPETITION*				
Market concentration (*CR1*)	0.602	0.165	1	0.253
Market concentration (*CR2*)	0.811	0.103	1	0.491
Market concentration (*HHI*)	0.428	0.183	1	0.190
Market share of the supplying firm	0.425	0.264	1	0.001
Years since privatization	10.3	5.6	24	1

Table 4 Regression on the determinants of the price of water

Variable	*Model 1*	*Model 2*	*Model 3*	*Model 4*	*Model 5*
Constant	0.3513***	0.2130	0.3754***	0.4092***	0.3366***
Dummy for fixed quota	1.6197***	1.6197***	1.6197***	1.6197***	1.6197***
Dummy for price corresponding to a bill of 5 cubic meters	-0.2256***	-0.2256***	-0.2256***	-0.2256***	-0.2256***
Dummy for price corresponding to a bill of 20 cubic meters	0.0802**	0.0802**	0.0802**	0.0802**	0.0802**
Dummy for price corresponding to a bill of 50 cubic meters	0.5119***	0.5119***	0.5119***	0.5119***	0.5119***
Population	0.0012***	0.0011***	0.0012***	0.0015***	0.0014***
Density of population	-0.0537***	-0.0542***	-0.0514***	-0.0540***	-0.0532***
Strong water treatment	0.1192***	0.1200***	0.1024***	0.1173***	0.1030***
Consortium	-0.3536***	-0.3501***	-0.3343***	-0.3099***	-0.3251***
Consortium with equal prices for all municipalities	0.1674***	0.1639***	0.1614***	0.1997***	0.1818***
Private management	-0.1648***	-0.1632***	-0.1675***	-0.0928**	-0.1217***
Dummy for *firm 1* (dummy1)	-0.0713	-0.0724	-0.0974*	-0.1715***	-0.1568**
Dummy for *firm 2* (dummy2)	0.1238**	0.1229**	0.1068*	0.0187	0.0435
Dummy for *firm 3* (dummy3)	0.0374	0.0339	0.0073	0.0803	0.0353
Dummy for *firm 4* (dummy4)	0.3970***	0.3471***	0.3547***	0.3203***	0.3455***
Dummy for *firm 5* (dummy5)	-0.0195	0.0142	-0.0386	0.0248	0.0167
VARIABLES REPRESENTING *COMPETITION*					
Market concentration (*CR1*)	0.2420***	-	-	-	-
Market concentration (*CR2*)	-	0.3237**	-	-	-
Market concentration (*HHI*)	-	-	0.2895***	-	0.2286***
Market share of the supplying firm	-	-	-	0.2613***	0.1649**
Years since privatization	0.0179*	0.0241**	0.0244**	0.0125	0.0227**
Years since privatization-squared	-0.0005	-0.0007*	-0.0008**	-0.0002	-0.0007*
F test of joint significance of the model	189.67***	189.14***	192.34***	190.94***	183.17***
R-squared	0.7538	0.7533	0.7564	0.7550	0.7575
Observations	1134	1134	1134	1134	1134

[a] ** Significant at 10%; ** significant at 5%; *** significant at 1%.*