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Ownership, Investment Policies and Funding Choices of Italian Water Utilities: An Empirical Analysis

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Abstract Nowadays, the efficient management of water has become the focus of vast debate, both in the academic literature and in the practical and regulatory field. Due to the growing importance and scarcity of water resources, it has become crucial to better understand how to improve the organizational efficiency of water utilities. By adopting an accounting perspective and using statistical methods, this paper analyzes whether and to what extent investment and financial strategies differ among clusters of water utilities with different ownership structures. The paper focuses on the Italian water industry, a context considered particularly appropriate due to the coexistence of utilities with different ownership structures. The main results of the paper show that ownership affects the level of investment as well as the financial structure and costs of water utilities. The evidence provided by this study should encourage national governments and regulatory authorities to select water utilities with the greatest investment potential measured in terms of financial efficiency and effectiveness.

Keywords Water management · Ownership structure · Financial efficiency · Investment policies

1 Introduction

Nowadays, the global water industry is the focus of debate over how best to improve the economic performance and organizational efficiency of water utilities. This article analyzes the relationship between the investment policies and related funding choices of Italian water utilities and their ownership structures. Italy provides a potentially valuable environment for

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comparing the performance and strategic choices of water utilities, given the coexistence of companies with different ownership models.

In the last 15 years, the Italian water industry has been transformed by extensive legislative reforms designed to end the in-house supply of water and wastewater services by municipalities by franchising these services to public, mixed or privately–owned independent firms. Moreover, the reforms have fostered the integration of water services (water supply and wastewater) and industry concentration, making it possible to exploit economies of scale and scope (Guerrini et al. 2011; Carrozza 2011; Danesi et al. 2007). As a result, public and private utilities now coexist, operating on different scales (small, medium and large enterprises) with various organizational structures (mono- and multi-utilities). In recent years, the Italian water industry has been at the center of widespread political debate. In 2008, the Italian government mandated the privatization of public services, including water supply and wastewater services (art. 23bis of Law 133/2008); however, in 2011, following a referendum, this decision was reversed and it once again became possible to entrust water services not only to mixed or wholly privately owned firms but also to public companies, effectively a return to the pre-reform situation (Guerrini and Romano 2012).

The Italian national water industry has traditionally been characterized by a high degree of fragmentation and by the presence of a few big players operating alongside numerous small, local firms (Guerrini et al. 2011; Romano and Guerrini 2011). This type of industry structure is typically associated with a low level of investment (Fabbri and Fraquelli 2000). Indeed, in Italy water industry investments have decreased progressively since the 1980s (Ermano 2012). In 2008, only half of the investments scheduled in the previous three years were carried out, with substantial variations in investment levels between regions. In the center and north of Italy, 85 % and 75 % respectively of scheduled investments were completed, while in the south the percentage dropped to 24 % (Co.n.vi.r.i. 2009). As a result of inadequate investments, leakages accounted for around 37.3 % of the water fed into the water grid in Italy in 2007 (Co.n.vi.r.i. 2009). In terms of the cost of services to households, data show that Italian tariffs have gradually increased (Co.n.vi.r.i. 2009), rising on average by 5 % from 2007 to 2008 and by 6 % from 2004 to 2008. Nevertheless, the Italian unit price of household water supply and sanitation services remains one of the lowest among OECD countries (OECD 2010; SMAT 2007). These low levels of investment may also be related to the water utilities' low levels of capitalization and hence the associated difficulties in accessing bank loans: the cost of capital is a relevant variable to consider when defining investment policies (Massarutto et al. 2008).

This study therefore attempted to answer the following research question: how does ownership affect investments and financial structure of water utilities? Using the financial ratio approach, integrated with other technical measures such as population served and mains length, we conducted an empirical survey designed to determine the effects on the level of investment and cost of capital of ownership structure, a relevant variable broadly discussed in the literature. The results add to the existing literature and offer practical implications for national governments, municipalities and local authorities engaged in building a regulatory framework for the water supply and wastewater industry. The research findings should guide the selection of companies with greater investment potential in terms of financial efficiency and effectiveness.

This article is structured as follows. The next section offers a review of the literature on water utilities' investment and funding decisions, and identifies the main effects of ownership structure on such choices. The third section describes the research method, paying particular attention to the process of data collection and analysis. The fourth section outlines the key findings of our empirical research, shows how ownership structure affects water

utilities' investments and funding choices, and discusses the main government policy implications.

2 Literature Review

Apart from quantitative studies on water utilities (Berg and Marques 2011), scant attention has been devoted to the link between privatization and water utilities' investment choices. The delivery of services such as water requires costly infrastructures that are essential to the welfare of citizens and to the economic development of countries (Brenneman and Kerf 2002; Briceno-Garmendia et al. 2004). The achievement of an adequate level of investment is a key issue not only for developing countries, but also for countries in which water scarcity, seasonality and water leakages are significant problems. Indeed, investments are crucial for renovating and enlarging existing facilities, for improving the quality of services and for enhancing the productivity and efficiency of water utilities.

The water industry is capital intensive, with a ratio of fixed assets to annual tariff revenue of 10:1, compared to 3:1 for telecommunications and 4:1 for electricity (Hassanein and Khalifa 2007). A number of scholars (Idelovitch and Klas 1997; Yamout and Jamali 2007) and international organizations (OECD and the World Bank) support water industry privatization, arguing that the funding of water and wastewater utilities exceeds the capabilities of the public sector and that privatization represents a promising solution to the water supply problem. However, recently Hall and Lobina (2012) have argued that publicly owned firms more effectively fund investments in the water sector both in developed and in developing countries. Hall and Lobina point to three main advantages of public finance: first, the state pays lower interest rates than private investors; secondly, the state grants all citizens access to water services even if they cannot afford to pay the whole cost; and finally, the health benefits of water and sanitation networks are social rather than private gains. Moreover, private investors have less incentive to invest in the water industry since massive sunk costs represent a significant share of total costs (Ménard and Saussier 2000), and the payback period is prolonged. Private investors are therefore conscious that investments can only be recovered after many years (Idelovitch and Klas 1997; Massarutto et al. 2008). Furthermore, Hassanein and Khalifa (2007) highlight how the water industry is incapable of effectively attracting private participants: since most of the assets of water and wastewater utilities are underground, the status of the system is unknown. Moreover, private firms take into account the losses associated with an inadequate system, such as revenue collection and water leaks.

Despite the conflict between the profit-seeking behavior of private partners and the public objectives of a water service (Hall 2001), privatization has been pursued in several developed countries: in Europe, UK, France, Portugal, Spain and Italy have all been involved in privatization processes with contrasting results (for a literature review see Renzetti and Dupont 2003; Abbott and Cohen 2009; Pérard 2009; Walter et al. 2009; Guerrini et al. 2011; Berg and Marques 2011), not only in terms of economic efficiency and profitability (Shaoul 1997; Bakker 2003; García-Sánchez 2006; Danesi et al. 2007; Lobina and Hall 2007; González-Gómez and García-Rubio 2008; Carrozza 2011; Guerrini et al. 2011; Cruz et al. 2012) but also in terms of sustainability strategies such as the reduction of household water consumption (Barret and Wallace 2011).

If the public sector progressively reduces its participation in the financing of infrastructures - by entrusting the management of the water industry to private companies and by reducing public subsidies to investments in infrastructure - the issue of financing choices become crucial if the necessary investments are to be realized. As highlighted by Massarutto

et al. (2008), the cost of capital has a decisive impact on water utilities' investment decisions. They argue on the one hand that public funding is cheap but scarce, untimely and even potentially harmful (since it may encourage inefficient investment choices); on the other hand, private funding is potentially unlimited and inspires efficient behaviors, yet it is unduly costly and may give rise to tariffs above the real economic cost. For these reasons, Massarutto et al. conclude that delegating all responsibilities and risks to private operators may lead to unsustainable tariff increases when major investments are needed.

Considering the importance of funding issues, surprisingly very few studies have focused on water utilities' investments and financial structure in relation to a key attribute such as ownership. Bitrán and Valenzuela (2003) found that private utilities in Chile were better able to meet the investment needs of a highly capital-intensive sector such as the water industry: through analysis of real annual capital expenditure, the authors showed that private firms invested more than state-owned companies due also to their bigger size. Conversely, Hall and Lobina (2006) reported that, despite considerable emphasis on privatization in recent years, private sector participation has had a negative impact on the level of investment in both developing (sub-Saharan Africa, South Asia and East Asia) and developed (UK) countries. In South Asia, no investments to extend water distribution systems have been made by private water firms; moreover in the areas analyzed, though new household connections have been made as a result of investment by privately-owned utilities, the number is far below expectations. The same finding was reported by Vinnari and Hukka (2007) for the city of Tallinn in Estonia, where tariffs increased following privatization. As highlighted by Hall and Lobina (2006), the public sector has carried out the great majority of the world's water supply investments: the authors reported that 95 % of the population with water supply connections is served by public utilities, and that investment funding has been raised through traditional public finance mechanisms. In developing countries, during the 1990s governments or public utilities financed 70 % of actual infrastructure, while the private sector financed only around 20–25 % (Briceno-Garmendia et al. 2004).

In their study of the French water industry Ménard and Saussier (2000) found that the decision to outsource water services depended on the existence of financial constraints. They also found that the larger the population, the smaller the per capita investment, and the greater the profitability for operators. In such cases, private operators have an incentive to bid, since they can reasonably expect to amortize their investments within the duration of the contract. Moreover, the authors found that water quality or water origin requiring much larger investments (such as raw or underground water) encouraged direct management by public bodies to avoid opportunistic behavior by a private operators and hence negative effects on water quality and population health.

Shaoul (1997) analyzed the UK privatized water industry and found very inadequate spend on renewal (about 1.5 % by value of infrastructure assets were spent on maintaining infrastructure, as opposed to the required 6–12 %).

With specific reference to Italy, Guerrini et al. (2011) applied the financial ratio model and analyzed two financial indicators (variation of tangible and intangible assets, and tangible and intangible assets to population served). They found that public-owned companies invested more than mixed-owned firms, and at the same time applied lower tariffs. Recently, Co.n.vi.r.i. data (2011) showed that from 1999 to 2009 in Italy around 5.6 billion euros of investment were realized by water utilities; on a yearly basis, these investments were only a part of planned investments (56 % in 2007, 60 % in 2008 and 61.6 % in 2009). Furthermore, it emerged that while 69 % of planned investments financed by water tariffs were realized in both 2008 and 2009, only 39 % and 43.5 % respectively of planned investments funded by grants were carried out. Using ownership information, Co.n.vi.r.i.

(2011) reported that mixed ownership companies seem to have completed more planned investments than public and private owned water utilities: over 80 % compared to 50 % and 28.8 % respectively. Moreover, mixed ownership firms completed more investments funded by grants than public and private companies.

Very few studies have analyzed water utilities' financial structure and costs in relation to ownership. Vinnari and Hukka (2007) highlighted how in Estonia the privatization of Tallinn's water utility led to an increase in debt exposure. Hassanein and Khalifa (2007) analyzed the debt to equity ratio of water utilities operating in different countries (USA, UK, Egypt and developing countries) and found that in developing countries and Egypt water utilities had a higher debt to equity ratio than in the USA, highlighting the dependence of the former areas on debt as a method of finance. Conversely, public utilities providing both water and wastewater services exhibited a different trend compared to pure water utilities: US firms had the highest debt to equity ratio, followed by developing countries and Egypt. Finally, the authors found that private US water utilities had the highest debt to equity ratio, which was also higher than public US utilities, while UK utilities (all private) had a relatively balanced debt to equity ratio.

Guerrini and Romano (2012) showed that the availability of bank loans and the cost of debt were crucial to water utilities' investment decisions. Moreover, Guerrini et al. (2011) found that Italian privately owned utilities used financial leverage more intensively than publicly-owned firms. On the other hand, Massarutto et al. (2008) argued that regulation and competition—rather than ownership—were the main drivers of water utilities' efficiency and also the main factors influencing market risk and return.

The literature review highlights the need to further investigate the factors that affect the investment and financing decisions of water utilities, particularly the role of ownership. This paper aims to fill this gap in the existing body of knowledge by using data from Italy, one of the most important European Union countries.

3 Data and Method

3.1 Data Collection and Description

54 companies operating as monopolists in specific areas of Italy were selected from a population of 115 utilities to which the Italian local regulatory authorities (Autorità d'Ambito Territoriale Ottimale—AATOs) entrusted the water supply and wastewater services (Sistema Idrico Integrato—S.I.I.) in 2009 (the most recent data available). The remaining 61 firms were excluded on the grounds of missing data (for 30 companies the number of inhabitants served was not in the database; for 5 companies annual reports were not available) or operating model (26 firms were multi-utility providers).

In contrast with a previous study on the Italian water industry (Guerrini et al. 2011), this analysis included only mono-utilities operating in the water supply and wastewater industry. Multi-utility providers operating concurrently in related sectors such as energy and environmental services were excluded from the analysis, as were companies operating just in one of the two subsectors identified (water supply and wastewater). In this way a perfectly homogeneous sample was obtained, composed of firms operating in the same business sector. This choice enabled significant comparisons of investments and financial structure among firms. The sample served about 40.2 % of the Italian population purchasing water from private or public companies in 2010. Although this percentage was not very high, the

sample was homogeneous in terms of business sector, a factor that ensured the reliability and validity of the study to a greater extent than the size of population covered.

Using Co.n.vi.r.i. and Bureau Van Dick AIDA databases, as well as information available on corporate web sites and from other sources such as annual reports, data were collected for each company in terms of population served, mains length and a series of financial indicators. The number of inhabitants served by each company was collected from the Co.n.vi.r.i. database, the length of mains was generally available from corporate web sites and/or financial statements, or was obtained directly from company technical staff. Financial data on investments and financial structure were obtained from the Aida database, specifically net tangible assets, net working capital, interest paid rate, shareholders' equity and total assets.

Using the data collected, five indicators were calculated: net tangible assets per capita (net tangible assets/population served), net tangible assets per kilometers of mains length (net tangible assets/mains length), shareholders' value to asset ratio (shareholders' equity/total assets), interest paid rate, and solvency. To evaluate solvency, one of the key indicators of companies' financial health widely used in the literature was chosen: net working capital (Altman 1968; Hill et al. 2010). If net working capital was greater than 0, solvency was assumed to be strong; if net working capital was lower than 0, solvency was assumed to be weak. The first two indicators (net tangible assets per capita and net tangible assets per kilometers of mains length) provided a useful measure of the relevance of investments made by firms, whereas the last three indicators (shareholders' value to asset ratio, interest paid rate and solvency) made it possible to assess a firm's financial solidity. Note that, in contrast to previous studies (Co.n.vi.r.i. 2011), net tangible assets rather than annual asset acquisitions were used to estimate investment indicators: this choice was justified by the fact that net tangible assets express cumulative investments made by a company even before the year being considered.

The study covered a four year period; data was collected for 2007, 2008, 2009 and 2010 to increase precision and robustness. Observations were adjusted for inflation, by multiplying the time series in the dataset by the consumer price indexes recorded in the period (by ISTAT, the Italian national statistics institute); this ensured that comparisons among the 4 years were significant and not distorted by inflation effects. For the four year period, only 41 companies out of the 54 initially identified had no missing data. Consequently, while the overall study referred to all 54 firms, only the 41 firm subsample was used for analysis of descriptive statistics on the four year trend. Using the data collected, the utilities were clustered on the basis of their ownership structures. Publicly owned companies, whose shareholders were one or more public entities/authorities, were distinguished from mixed ownership or private companies, respectively with either public and private shareholders or private shareholders only.

Table 1 Distribution of companies among the cluster

	Number of companies	%	Average mains length	Average population served
Public	33	61.1%	2,887	477,679
Mixed or private	21	38.9%	2,376	286,105
Total	54	100.0%		

Table 1 summarizes the characteristics of the sample.

The data highlight how sample utilities were prevalently publicly owned companies. Publicly owned firms had an average mains length and population served greater than mixed or privately owned firms.

The five indicators were estimated (net tangible assets per capita, net tangible assets per km of mains length, interest paid rate, shareholders' value to asset ratio and solvency) to obtain all the elements required to statistically test the research question.

3.2 Statistical Analysis

Having collected and organized the dataset, we proceeded with statistical analysis. The aim was to determine whether and to what extent public and mixed/private owned firms implemented different policies in terms of investments and financial structure. Statistical analysis was based on comparisons of means, medians and variances between clusters for the five indicators identified. If the differences were statistically significant, the ownership variable would be considered a relevant determinant of investments and financial structure.

We opted for non–parametric tests used in the literature (Brockett and Golany 1996) that were particularly appropriate for comparing small samples and/or samples that do not follow a known distribution (Cooper et al. 2000). The Wilcoxon-Mann–Whitney test verifies the null hypothesis according to which two independent samples are drawn from the same population (or identical population). A parametric test, the *t* test, checks the difference between two sample means: it is particularly useful when the variances of distributions are unknown and when the samples are small in size. The median test verifies the null hypothesis that the medians of the population from which two samples are drawn are identical: in some circumstances, the median test is more robust than the means test. Moreover, the Pearson chi square test was used to verify the independence of two variables, as appropriate when dealing with percentage values. The results of statistical analysis are described in the following section.

4 Results and Discussion

In this section our research results are reported. After presenting descriptive statistics, non-parametric and parametric tests are described and the key findings of the study are discussed. Table 2 shows average values for the five variables used to observe the level of investments realized by Italian water utilities (variables 1 and 2), their financial structure (3 and 4) and costs (5), measured from 2007 to 2010. Table 3 shows the trend of the five variables during the observed period, adjusted for the inflation effect. As specified in the method section, the time series were estimated on a subsample of 41 firms with no missing values in the four years: this choice ensured more precise data.

Table 2 Average values for the 54 firms

(1)Net tangible assets per capita	(2)Net tangible assets per km mains length	(3)Net working capital	(4)Degree of financial independence	(5)Interest paid rate
€ 204.57	€ 46,041	€ 11,642,208	€ 23.76%	€ 4.76%

Table 3 Average values for 41 firms

Year	Net tangible assets per capita	Net tangible assets per km mains length	Net working capital	Degree of financial independence	Interest paid rate
2007	€ 209.17	€ 50,229	€ 12,170,947	24.99%	5.40%
2008	€ 221.83	€ 51,370	€ 9,665,549	24.45%	5.89%
2009	€ 228.52	€ 51,705	€ 10,864,135	24.98%	4.42%
2010	€ 238.95	€ 52,466	€ 11,817,275	23.94%	3.74%
Average	€ 224.62	€ 51,442	€ 11,129,477	24.59%	4.85%

Only the degree of financial independence appeared to remain constant (around 24 %) during the period. This means that (on average) banks and third-party lenders funded 75 % of water utilities' current and fixed investments. In comparison with other Italian companies that had a degree of financial independence of 40–50 % (UnionCamere 2011), the index reveals the very limited financial autonomy of water utilities. This may be due to the presence of public shareholders in the majority of water utilities, with wholly public ownership or a public controlling interest (in the sample only three firms were wholly private). The EU Stability and Growth Pact restricts public spending: consequently, it is not possible for a municipality to invest massive amounts of funds in municipalized firms; mortgages and loans have to be negotiated with banks.

Conversely, other variables increased (net tangible assets) or decreased (net working capital and interest paid rate). Since 2007, net assets per capita and per kilometer have increased significantly, by 14 % and 4 % respectively. So it seems that the Italian water reform of'94 effectively encouraged investment. To confirm this trend, annual investments were determined from the sum of variation in net assets and annual depreciation and amortization (net asset year X—net asset year X-1 + amortization and depreciation year X). Water utilities invested €35 per capita in 2008 and €37 in 2010; similarly, investments per km were €4,654 in 2008 and €4,919 in 2010. Financial structure became less solid during the four year period, though differences between the 2007 and 2010 values were not huge: in short, net tangible assets were always financed with long term funds. Finally, the cost of debt decreased steadily from 5.40 % to 3.74 %, with the exception of 2008 when a peak of around 6 % was reached. These data are consistent with those of other Italian firms operating in different industries, as confirmed by a Bank of Italy report (2011).

The five indicators were observed to answer the research question. Table 4 reports average values of the indicators for the two groups of firms and the p-value of the statistical tests applied.

The effect of ownership on investments and financial structure was assessed. This item affected both variables, as showed by the p-value of Table 4. Mixed ownership firms realized lower investments than wholly publicly owned companies. The latter had net tangible assets per capita twice that of mixed and privately owned firms, while the value per kilometer of mains length was six times greater. These results demonstrate the higher propensity of public companies to invest in water mains, wastewater networks and sewerage plants. These findings are in line with expectations and the existing literature but contrast with Co.n.vi.r.i. data (2011). So, the presence of a private shareholder reduces the relevance of investments and has a corresponding impact on service quality, priority being given to increase profitability and efficiency.

We questioned whether this difference in the level of investments could be due to the greater accessibility of publicly owned firms to EU funds compared to mixed

Table 4 Statistical analysis

	Net tangible assets per capita	Net tangible assets per km of mains length	Interest paid rate	Shareholders' value to asset ratio	Solvency
Mixed ownership	134.55 €	12,438 €	5.55%	0.18	52.0%
Public ownership	246.81 €	66,313 €	4.26%	0.26	68.6%
t test	0.037**	0.009***	0.003***	0.010***	
Mann–Whitney	0.435	0.420	0.002***	0.233	
Median test	0.374	0.553	0.084	0.767	
Pearson chi square					0.021**

*** and ** indicate 1 and 5 % significance levels, respectively

ownership firms, or to different accounting rules relating to infrastructures. The presence of private companies in the most profitable areas, such as those with high population density, was recently demonstrated (González-Gómez et al. 2013). Yet although mixed and private companies are more profitable than publicly owned utilities, all receive public funds regardless of their ownership structure and other characteristics. The level of EU and Italian state funding depends only on the bargaining power of regional governments. Furthermore, the level of investments reported in the financial statements of water utilities may sometimes be underestimated, since assets acquired before the water service concession are often included in the accounts of local government or former concessionaire. However, this accounting rule applies to both mixed ownership and publicly owned firms, so it cannot explain the different levels of investments highlighted in this study.

Public companies also had a better financial structure: their solvency and independence ratios were higher than those of mixed ownership firms. A municipality that controls 100 % of a water utility provides a relevant amount of equity, so the utility is less reliant on bank loans. This is probably accounts for the lower interest rates paid by publicly owned companies: 4.26 % compared to 5.55 % for mixed ownership firms. Publicly owned utilities are usually considered by lenders to be more reliable than private or mixed companies: they are guaranteed by one or more local governments and, ultimately, by a sovereign state.

5 Conclusions

This paper assesses the performance of water utilities in Italy, aiming to improve the existing literature and to contribute to the ongoing debate on regulatory frameworks. The key results show that ownership affects the amount of investments realized by water utilities as well as their financial structure and costs. This empirical evidence should be useful to water utility boards and to public policy makers, providing an opportunity to rethink strategies relating to the privatization process.

Studies on Italian water utilities have demonstrated that wholly publicly owned firms are more efficient (Romano and Guerrini 2011), apply lower tariffs per cubic meter (Guerrini et al. 2011) and realize more investments than mixed and totally private firms. This evidence should promote discussion as to which legal framework would foster the improvement and modernization of existing infrastructures. Though Law 133/2008 introduced the compulsory privatization of public services, including water and wastewater services, its enactment was delayed by a referendum in 2011; nevertheless, privatization of water and wastewater services in Italy remains a possibility in the light of the considerable economic interest in this sector.

Further studies are necessary to improve the assessment of water utility performance and to overcome the limitations of the present study. First of all, the dataset could be improved by adding two variables, planned and realized investments, to determine the causes of gaps between these two indicators. In addition, data could be collected on water source quality and availability in the catchment areas since these two environmental variables may affect the amount of investments required by utilities. Finally, an international comparison would allow analysis of country specificities, strengths and weaknesses.

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