



water and landscape
AGUA y TERRITORIO

Exploring the Link between Corporate Governance and Efficiency of Italian Water Utilities*

Exploración del vínculo entre la gestión corporativa y la eficiencia de los servicios de agua italianos

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Abstract – *The present paper analyzes the linkage between the corporate governance of Italian water utilities (ownership, board size and board composition) and their efficiency measured through data envelopment analysis (DEA). Using a general panel data regression model, we found that board size negatively affects the efficiency of water utilities. Moreover, the presence of directors with political affiliations or who are/were members of local or national government negatively affects efficiency, and the presence of directors with a degree on the board has a slight negative effect on productivity. Conversely, other variables (ownership, gender diversity and average age of board members) were found not to affect the efficiency of Italian water utilities. The existence of economies of scale was also confirmed.*

Resumen – Este artículo analiza la relación entre el gobierno corporativo de los servicios del agua italianos (propiedad, tamaño y composición del consejo) y su eficiencia medida a través del análisis envolvente de datos (AED). Usando un modelo general de regresión de datos de panel averiguamos que el tamaño del consejo afecta negativamente la eficiencia de los servicios del agua. Además, la presencia de directores con afiliaciones políticas o que son o fueron miembros del gobierno local o nacional afecta negativamente a la eficiencia, y la presencia de directores con una carrera universitaria en el consejo tiene un efecto ligeramente negativo sobre la productividad. Inversamente, otras variables (propiedad, diversidad de género y edad media de los miembros del consejo) no afectan a la eficiencia de los servicios del agua italianos. La existencia de economías de escala también fue confirmada.

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Palabras clave: Junta Directiva; gestión corporativa; eficiencia; propiedad; Italia; servicios de agua

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INTRODUCTION

There are more than 2000 state-owned enterprises (SOEs) in OECD countries, employing close to 4.3 million people and with an estimated value exceeding US\$1.3 trillion. They have a strong sectoral concentration, as around half (in terms of value) of all SOEs in OECD countries are located in the network sectors¹. Moreover, cities and towns have a very extensive portfolio of controlling or minority equity stakes in companies of all sizes that operate in many different sectors of the economy.

Recent data show that, in Italy, 97 percent of municipalities have stakes in the share capital of one or more businesses. They have a total of about 118,000 direct or indirect stakes in 6469 different companies, of which 5288 are active companies, which employ a total of 285,000 workers. Moreover, on average, each of these companies has 6.5 board members and over half of the active companies have more board members than employees². In fact, one of the much-debated issues in the current Italian government's spending review has been expenses for the salaries of directors of companies that are wholly or partially owned by state and local government bodies.

The Italian water industry has undergone important reforms over the last 20 years, designed to end the direct supply of water and wastewater services through public administration by outsourcing them to firms of independent public, mixed, or private ownership³. However, the Italian water supply system still presents a very complex landscape, with 75 percent of water industry operators being municipalities or other public bodies (e.g. consortia of local governments or mountain communities) that provide one or more water services directly "in house"⁴. Moreover, public, mixed and private utilities now coexist, operating on different scales and with different strategic and organizational statuses (e.g. mono vs. multi utilities, stand-alone firm, corporate group). The close connection between Italian utilities and local government leads to the dominance of politically connected directors on the utilities' boards⁵, fueling a debate about the best ownership structure and the best board size and composition for the satisfactory performance of local utilities. The board of directors is the key to good corporate governance, since it defines a firm's corporate and business strategies and has an important advisory and counseling role⁶.

Although this issue has been highly debated among decision makers, scholars and citizens, the water industry literature to date has focused mainly on the ownership/performance linkage and lacks empirical investigations of the relationship between the efficiency of water utilities and board size and composition. In particular, Menozzi et al. (2011) analyzed the effects of board composition on the production, distribution, and retail sales of gas, electricity, and water of 114 Italian local public utilities. The results show that politically connected directors dominate the

boards of Italian public utilities and exert a positive and significant effect on employment and a negative impact on accounting performance. Romano and Guerrini (2014) specifically investigated the linkage between the financial performance (measured using accounting results) and corporate governance of 72 Italian water utilities and found some relevant, albeit preliminary, results. Specifically, they show that private or mixed-ownership utilities show higher profitability than entirely publicly-owned firms, even if the latter are less debt-dependent. Furthermore, boards of Italian water utilities are dominated by politically connected directors, who boost access to debt and negatively affect the firms' capital structures; board composition, in terms of the age and educational background of members, influences economic performance, since graduate and senior directors exert a negative influence on profitability.

This paper seeks to add to the existing literature on water utility management by investigating whether the corporate governance of water utilities (i.e. their ownership, board size and board composition) affect firms' decisions, ultimately impacting their performance in terms of the level of efficiency reached. The present study uses a database compiled from 255 observations of 85 Italian water utilities and over 1100 board members. It includes multi-year data (2010-2012) and applies a two-stage method, using data envelopment analysis (DEA) to determine the relative efficiency of utilities and panel regression to analyze the relationship between their efficiency and corporate governance and strategic features (ownership, board size, political connection, age, education and gender of board members, production value, number of employees, membership in a corporate group, and provision of gross sale water service).

The remainder of this paper is structured as follows. The next section reviews the literature on the effects of privatization processes on the performance and corporate governance of firms and on the links between ownership, board size and composition, and firm performance. The third section describes the process of data collection for this research, as well as the methodology and analysis. The fourth section outlines the key findings of our empirical research and discusses its main implications, and the final section summarizes the findings, offers suggestions for future research and discusses the limitations of this research.

LITERATURE REVIEW

Corporate governance of entities that are wholly or partially owned by the State or a local government and established to pursue public policy and commercial objectives is a major challenge in many economies. There has been decades of research on the role of ownership and boards of directors in the governance of these corporate entities. Some authors argue that SOEs perform less efficiently and less profitably than privately owned ones⁷ and that ownership, together with competition, is important in promoting efficiency⁸. Agency theory⁹ attributes the disparity bet-

1 Christiansen, 2011.

2 Cerved, 2014.

3 Guerrini and Romano, 2014. Massarutto and Ermano, 2013.

4 Guerrini and Romano, 2014.

5 Menozzi, Gutierrez Urtiaga, Vannoni, 2011. Romano and Guerrini, 2014.

6 Adams et al., 2010. Agrawal and Knoeber, 2001.

7 Boycko et al., 1996. Shleifer and Vishny, 1994.

8 Boardman and Vining, 1989. Bozec and Dia, 2007.

9 Jensen and Meckling, 1976.

ween publicly owned corporations and private corporations to the differences in the principal-agent relationship—the principal's objectives are related to the public interest in SOEs, whereas in private firms they are focused on maximizing the firm's value. Moreover, in SOEs the manager (i.e. the agent) has two principals, the citizens/voters and government, whereas in private firms the principal is represented by the shareholders. The principal-agent model assumes that agency costs are greater in SOEs since the incentives to achieve cost reduction and efficiency, and to supervise managers, are weak¹⁰.

Boycko et al. (1996) show that the variable that explains the inefficiency of public firms is an agency problem with politicians rather than with managers. Indeed, many researchers¹¹ concur that public enterprises are inefficient because their inefficiency serves the goals of politicians; these goals are not necessarily in line with profit or value maximization but have to do with ensuring success in elections and long tenures in power (through, for example, maximization of employment and wages, promotion of regional development, and provision of low-cost goods and services).

As a consequence, privatization is considered an appropriate way to achieve significant improvements in the performance of SOEs¹², even if in some municipal services, such as urban water, ideological and political factors have an influence in the public choice of management¹³. Mixed ownership is often seen as worse than wholly publicly or privately owned companies¹⁴, even if recent studies on water utilities contradict this result¹⁵. In fact, the results of privatization in the water industry are conflicting in terms of economic efficiency and profitability¹⁶, as well as investment and financial structure¹⁷.

In Italy, privately owned utilities have been found to be more oriented toward profit than their publicly owned counterparts, since their financial ratios, such as ROS, are higher and financial leverage is used more intensively¹⁸. Romano and Guerrini (2011) point out that publicly owned firms have the highest efficiency scores because they purchase and employ inputs in a more effective way than mixed-ownership firms. Furthermore, Romano et al. (2013) find that Italian public water utilities have healthier financial structures than mixed-ownership firms, with higher solvency and independence ratios. These results could be linked with the fact that boards of Italian water utilities are dominated by politically connected directors and that there is no significant correlation between the ownership structure and the percentage of politically connected directors on the board, so that politicians

are appointed frequently also in privatized utilities¹⁹. Indeed, the literature suggests that privatization without the transfer of control is unlikely to favor efficiency and profitability, unless firms' choices are shielded from the influence of politicians and bureaucrats²⁰. According to Bortolotti and Siniscalco (2004) and Boubakri et al. (2008), even the sale of a majority stake is not in itself a sufficient condition to avoid government interference, since many companies remain politically connected through at least one board member who is or was a politician²¹. Thus, if privatized firms and their boards do not gain complete independence from national or local government influence, they are likely to face conflicting objectives, and politically connected firms will probably exhibit poorer accounting performance than their non-connected counterparts²².

However, some scholars have argued that whereas politics is an important determinant of firm profitability, politically experienced directors aid the firm with their knowledge of government procedures and their insight into predicting government actions, and they may also act to enlist the government in the firm's interest or to forestall government actions inimical to the firm²³. Existing evidence in some cases highlights the positive effects of political connectedness on a firm's value and performance²⁴. Conversely, Faccio (2010) shows that while, on average, politically connected corporations have higher leverage, enjoy marginally lower taxation, and display much greater market power, they also have a lower ROA and market valuation than their peers. Menozzi et al. (2011) show that, in Italian local public utilities, politically connected directors exert a positive and significant effect on employment, but have a negative impact on profitability. More recently, Romano and Guerrini (2014) have highlighted that the presence of directors with political affiliations or who are/were members of local or national government boosts access to finance but negatively affects the financial structures of Italian water utilities, in terms of decreasing their financial autonomy and increasing their debt-to-equity ratio. They also found that, unlike the findings reported above, politically connected directors do not exert a negative impact on profitability.

Specific legal provisions have regulated the size and composition of the boards of Italian utilities owned, totally or partly, by public shareholders: fully publicly owned utilities can appoint no more than five board members, according to Law 78 of 2010. Mixed-owned utilities have no limitations concerning board size but a restriction is provided only for the number of members appointed by the public shareholders, which must be no more than five, according to Law 296 of 2006. For both fully publicly owned and mixed-owned utilities, Law 138 of 2011 banned the appointment of any politicians who have operated in the previous three years as administrators of the local authority owning the utility. According to the literature, the question of what constitutes an appropriate board size and composition is still a relevant

10 Shleifer and Vishny, 1994. Sørensen, 2007.

11 Boubakri et al., 2008. Boycko et al., 1996. Dinc and Gupta, 2011.

12 Arocena and Oliveros, 2012. Dewenter and Malatesta, 2001. Dinc and Gupta, 2011. Megginson et al., 1994. Shleifer, 1998.

13 Picazo-Tadeo et al., 2012.

14 Boardman and Vining, 1989. Cruz and Marques, 2012. Eckel and Vining, 1985.

15 Cruz et al., 2012.

16 Bakker, 2003. Carrozza, 2011. García-Sánchez, 2006. Lobina and Hall, 2007.

17 Romano et al., 2013. Shaoul, 1997. Vinnari and Hukka, 2007.

18 Guerrini et al., 2011. Romano and Guerrini, 2014.

19 Romano and Guerrini, 2014.

20 Gupta, 2005. Li and Xu, 2004. Shleifer and Vishny, 1998.

21 Boubakri et al., 2008.

22 Boubakri et al., 2008. Fan et al., 2007. Sørensen, 2007.

23 Agrawal and Knoeber, 2001.

24 Faccio, 2006. Goldman et al., 2009. Niessen and Ruenzi, 2010.

topic in the corporate governance debate with reference not only to SOEs but to enterprises in general.

The empirical evidence of an optimal board size that might influence firm performance and efficiency is inconclusive²⁵; similarly the literature on board composition highlights how board diversity, age and experience can contribute to improving firm performance²⁶, although the empirical findings are still controversial²⁷. The OECD's (2012) best practices for SOEs affirmed that establishing a transparent and consistent method to identify applicants from a wider talent pool will improve board composition and bring uniformity in the assessment process; state representatives should be nominated based on qualifications and independent directors should be independent from management, government and business relationships. However, further research is needed on the broader effect of corporate governance on performance. This paper attempts to contribute to the existing literature on the governance-efficiency linkage of water utility firms with an empirical research using multi-year data.

DATA AND METHOD

DATA COLLECTION

The process of data collection started from the database published by the Italian Regulatory Authority for Electricity Gas and Water (AEEG), the Italian national water authority. This report, available online on the AEEG website, includes information about all the 1235 independent firms and public bodies involved in Italy's provision of water services at the end of 2013. Of these 1235 operators, 75 percent (n. 931) are municipalities or other public bodies (such as consortia of local governments or mountain communities) that provide one or more water services directly "in house." Thus, only 304 of the 1235 operators are independent firms (water utilities).

Analyzing the financial statements and websites of these 304 Italian water utilities, we find that 202 of them provide only water services (mono-utilities) in contrast to those involved in other industries such as electricity, gas, or municipal waste management (multi-sector utilities). Further, according to the AEEG database, only 100 of these firms are mono-utilities that provide all the water services (collection, potabilization, adduction/transportation, distribution of water for civil use, sewerage, and wastewater treatment). For the purposes of our study, we focused only on these 100 utilities, thus excluding companies that provide only some services or are multi-sector utilities. This makes it possible to eliminate from the statistical analysis the effect of differentiated operations and strategies, which could severely affect a firm's performance²⁸.

The AEEG database also provides information about firms belonging to a group and whether they provide gross sale service as well. Such information is relevant because the economic and

efficiency results could be affected by these strategic and organizational choices.

The list was cross-checked with the Analisi Informatizzata delle Aziende Italiane (AIDA) database of Bureau Van Dyck. Following Romano and Guerrini (2014), the AIDA database was used to collect data on governance items: size of the board of directors, percentage of women on the board, age of directors, ownership structure, and distinction between "fully publicly-owned firm" and "not fully publicly-owned" firms. Moreover, we identified the number of directors on the board with university degrees and political connections by examining whether or not each director had a degree and held or had held political assignments, candidacies in national and local elections, and/or membership of a political party. According to Menozzi et al. (2011) and Romano and Guerrini (2014), directors were considered "politically connected" when they currently held a seat in parliament or in the municipal, provincial, or regional government or had held one in the past and, more generally, were affiliated with a political party or had a well-known relationship with a political party. The firms' websites, local newspaper websites and the main web search engines were used to identify the political connections of all the directors.

The AIDA database was also used to collect economic and financial items for the three-year period analyzed (2010-2012): total revenues, value of production, depreciation, amortization and interest paid, staff costs, and other operative costs (e.g. services, maintenance, materials) and number of employees.

The final dataset obtained comprises 255 observations (85 water utilities) that operate only in the water and wastewater industry providing all the water services. Information was collected on their 1,118 board members.

Tables 1 and 2 summarize some descriptive statistics on the governance, strategic, and economic variables involved.

Table 1. Types of Firms in the Dataset

	Fully publicly owned	Part of a group	Also provides gross sale service
Yes	174 (68.2%)	66 (25.9%)	135 (52.9%)
No	81 (31.8%)	189 (74.1%)	120 (47.1%)
Total	255 (100.0%)	255 (100.0%)	255 (100.0%)

The majority of the dataset consists of fully publicly owned firms (68%) that are not part of a broader group (74%). Around half of the dataset consists of utilities that also provide the gross sale service (Table 1).

The boards are composed of an average of four members, with a minimum of a single director and a maximum of nine members. On average, the boards are made up of 56 percent of politically connected directors and of 55 percent of college- or university-degreed members. There are on average nine percent of board members who are women, with around 70 percent of boards with no women and only one firm with a 100 percent female presence (i.e. a sole female director). The average age of the

25 Golden and Zajac, 2001. Guest, 2009. Jensen, 1993.
 26 Adams and Ferreira, 2009. Boubakri et al., 2008. Carter et al., 2003. Erhardt, Werbel, and Shrader, 2003. Faccio, 2006. Forbes and Milliken, 1999.
 27 Romano and Guerrini, 2014, and references therein.
 28 Guerrini, Romano, and Campedelli, 2013.

Table 2. Descriptive Features of the Firms in the Dataset

	Board size	%politics	%degree	%women	Age	Prod. value	Staff
Mean	4.36	56	55	9	52.69	41,158,737.32	174.58
Median	5	60	60	0	53	18,853,392	83
Standard deviation	1.92	36	31	17	5.57	77,551,177.68	300.45
Minimum	1	0	0	0	39	638,013	0
Maximum	9	100	100	100	68	552,306,126	2,000

board members is around 53 years (calculated as the average of the average age of the members of each board), but collectively they ranged from 39 to 68 years of age.

EFFICIENCY ESTIMATION AND STATISTICAL ANALYSIS

In order to estimate the level of efficiency of water utilities, we applied a non-parametric frontier model called DEA²⁹, which is an alternative to financial ratios and parametric frontier³⁰. Financial ratios allows for the development of benchmarking among many operating units, focusing on their financial results. The main weakness of using them to measure performance, as operating profit to collection revenues, is the lack of technical indicators that could estimate the effectiveness of customer service and plants, and the quality of the water. The parametric frontier method is based on a multivariate regression analysis of a specific data set, formed by inputs and outputs of production (e.g. cost of labor, cost of capital and water delivered). Efficiency is measured by the distance between observed data and the maximum production represented by the frontier. Compared with the traditional ratio analysis³¹, the advantages of frontier models are their high reliability, based on a mathematical approach, and their ability to measure efficiency considering many inputs and outputs. Their main limitation is the need to choose a cost function (i.e. Cobb-Douglas, Translog) that cannot perfectly fit with the research dataset.

A non-parametric analysis such as DEA overcomes the limitations of the financial ratios and parametric analysis, since it does not require the specification of any particular functional form to describe the efficient frontier and enables the combination of multiple inputs and outputs. DEA compares each decision-making unit (DMU) with its related virtual “best” producer. Every virtual producer is identified through a linear programming approach, which enquires whether it is possible for a real operative unit to obtain more output with the same input or to obtain the same output with less input³². DEA is grounded on an optimization algorithm that assigns a score (between 0 and 1) to each DMU given the input consumed and the output produced, providing a ranking of firms based on their efficiency. The difference between the 1 and the score assigned to a single DMU shows the amount of input that should be saved (input-oriented optimization problem) or the increase of output that could be obtained given a certain

put (output-oriented optimization problem). Therefore, hypothesizing to adopt DEA with an input orientation, a score of 0.77 assigned to a DMU shows a 33 percent margin for input saving.

The linear programming problem can be defined by choosing two different alternatives: constant return to scale (CRS) or variable return to scale (VRS). In order to determine the scale effects, both the CRS and VRS models are often adopted in research papers. The former considers that DMUs are able to linearly scale the inputs and outputs without any variation in efficiency³³. The use of both DEA models³⁴ enables the establishment of three indexes: CRSTE (constant return technical efficiency), VRSTE (variable return technical efficiency) and SE (scale efficiency). The first represents the global efficiency of a DMU, given by pure efficiency and scale; the second measures the real capability of a company to purchase, mix and consume inputs; while the third indicates the correctness of the choice to operate with a certain production scale. Thanassoulis (2000) claims that firms can be evaluated for their global efficiency regardless of the true nature of the return to scale in the water industry, and, despite counter-arguments such as the influence of non-controllable contextual variables on SE, he adopts a CRS model in his study. Garcia-Valiñas and Muñiz (2007) used a similar approach, while the majority of DEA studies have favored the joint use of CRS and VRS in order to highlight the real determinants of global efficiency.

The DEA model chosen for the current study applies an input orientation and VRS as follows:

$$\begin{aligned}
 & \text{Min } \Phi \\
 & \sum_j \lambda_j x_{jm} \leq \Phi x_{j_0 m} \quad ; m = 1, 2, \dots, M \\
 & \sum_j \lambda_j y_{jn} \geq y_{j_0 n} \quad ; n = 1, 2, \dots, N \\
 & \lambda_j \geq 0 \text{ \& } \sum_j \lambda_j = 1 \quad ; j = 1, 2, \dots, J
 \end{aligned}$$

where “ ϕ ” represents the efficiency of DMU “ j_0 ,” and “ $\lambda_j x_{jm}$ ” is the virtual DMU obtained combining input “ x ” consumed by the other DMUs “ j_m ,” properly weighted with “ λ .”

29 Charnes et al., 1990.

30 Guerrini et al., 2011.

31 Beaver, 1968. Davis and Peles, 1993.

32 Farrell, 1957.

33 Charnes et al., 1978.

34 Banker, 1984.

The model verifies whether a virtual DMU exists which consumes a lower quantity of input than that consumed by the real DMUs observed. The second equation provides a constraint that requires the output of virtual DMUs “ $\lambda_j x_{jn}$ ” to be greater or equal to that of the real DMU “ y_{0n} .” Then, the constraints provided by the third equation admits frontier with VRS.

Consistent with the literature³⁵ and the data available, we consider four inputs (the sum of amortization, depreciation, and interest paid; staff costs; other operating costs; and the length of the mains) and two outputs (population served and production value). Then we used a regression model to explore the causal relationship between some board features and a DEA score as VRSTE in order to investigate the effects of the real capability of a company to purchase, mix and consume inputs. The model is based on six independent variables for governance features:

- Ownership structure (OS), a dummy used to distinguish between fully publicly owned firms (0) and mixed-ownership or fully privately owned firms (1);
- Board size (BS), measured by the number of board members;
- Women (WOM), measured by the percentage of female directors;
- Degree (GRAD), measured by the percentage of graduates on the board;
- Age (AA), represented by the average age of directors;
- Politicians (POL), measured by the percentage of directors affiliated with a political party or who are/were members of local or national government.

Moreover, the model include also four independent variables that aim to control for strategic and operational choices:

- Staff (STF), measured by the number of staff operating in each DMU;
- Size (SIZE), to show the presence of scale economies, measured by the total amount of production value/1000;
- Group (GR), a dummy variable used to show if a DMU is part of a group of firms (1: yes; 0: no);
- Gross sale (GS), a dummy variable used to show if a DMU operates in the wholesale segment (1: yes; 0: no).

We chose a Tobit regression function since it describes the relationship between a non-negative dependent variable and the independent variables well. Scholars frequently associate Tobit functions with DEA models when studying performance across several industries because the dependent variable value, measured by DEA scores, is restricted between 0 and 1³⁶. This two-stage approach is not without criticism³⁷. One would expect DEA scores to

correlate with each other, as the calculation of efficiency of one firm incorporates observation of all other firms. Thus, regression analysis cannot be robust with this multicollinearity problem. For this reason, a double bootstrapping technique can better reveal the impact of exogenous and operational variables on efficiency scores³⁸. However, Banker and Natarajan (2008) have demonstrated that a DEA two-stage approach with ordinary least squares (OLS) or Tobit outperforms the one-stage parametric method, such as Translog and Cobb-Douglas, to define the production frontier. Furthermore, a two-stage approach, such as the one adopted in this study, yields consistent estimates of the impact of environmental and operational variables on efficiency. Despite some criticisms of this method, it offers an appropriate means to answer our research questions, considering its widespread prior use³⁹ as well as its effectiveness compared with alternative approaches, such as the one-stage parametric method⁴⁰, OLS, the Papke-Woolridge Method, and the unit-inflated beta model⁴¹.

Furthermore, we adopted a general panel data regression model under the assumption of random effects. General panel data regression models help check for individual specific effects that are not measured by the explanatory variables and refer to specific features of each selected firm and year observed. When the individual specific effects are kept “fixed,” they are included among the independent variables as a “specific constant” (α); in contrast, in the random effects model, the individual specific effects are regarded as a component of the error term, as follows:

$$VRSTE_{it} = \beta_{it} * OS_{it} + \beta_{it} * GR_{it} + \beta_{it} * GS_{it} + \beta_{it} * BS_{it} + \beta_{it} * WOM_{it} + \beta_{it} * GRAD_{it} + \beta_{it} * AA_{it} + \beta_{it} * POL_{it} + \beta_{it} * STF_{it} + \beta_{it} * SIZE_{it} + e_{it}$$

where: $i=1,2,3,\dots,N$; $t=1,2,\dots,T$

RESULTS AND DISCUSSION

Tables 3 and 4 present the descriptive statistics of DEA scores and their trends over the three years, respectively. In comparison to prior studies applying DEA to Italian water utilities⁴², the current scores are higher, showing a greater efficiency of firms. The possible reason for this difference may be explained by the analysis of both mono- and multi-utilities made by Guerrini et al. (2013) and the older data of the prior papers, which were based on 2007 and 2008 data. The tables demonstrate that the efficiency of utilities grew. Considering that the average scores recorded in 2008 were 0.78 CRSTE, 0.83 VRSTE, and 0.94 SCALE, there has been more than a 14 percent increase in global efficiency and a 9.6 percent increase in technical pure efficiency. Thus, despite the credit crunch and the associated difficulties in collecting new funds, the water industry has performed better than in previous years. This is perhaps attributable to the process of corporatiza-

35 Guerrini and Romano, 2014.

36 Aly et al., 1990. Byrnes et al., 2010. Chirkos and Sears, 1994. Dietsch and Weill, 1999. Ray, 1991. Sexton et al., 1994. Stanton, 2002.

37 Simar and Wilson, 2004, 2007.

38 Assaf and Matawie, 2010. Peda et al., 2013.

39 Byrnes et al., 2010. García-Sánchez, 2006. Renzetti and Dupont, 2009. Tupper and Resende, 2004.

40 Banker and Natarajan, 2008.

41 Hoff, 2007.

42 Guerrini et al., 2013. Romano and Guerrini, 2011.

tion started with the reform of 1994 (the so-called Galli Law) and to the new attention placed on the sector by the second wave of reforms that began in 2008.

Table 3. Descriptive Statistics of DEA Scores

	CRSTE	VRSTE	SCALE
Mean	0.89	0.91	0.98
Maximum	1.00	1.00	1.00
Minimum	0.61	0.61	0.80
Standard Deviation	0.07	0.07	0.03

Table 4. Trends in Efficiency from 2010 to 2012

	CRSTE	VRSTE	SCALE
2010	0.90	0.92	0.98
2011	0.89	0.92	0.98
2012	0.89	0.91	0.98

The results obtained from the regression model described in Section 3 are presented in Table 5.

Table 5. Results of the Panel Regression Model

Efficiency (VRSTE)	Estimate
OS	-0.014
BS	-0.010**
WOM	-0.012
GRAD	-0.047*
AA	-0.0011
POL	-0.040*
STF	-0.0001***
SIZE	0.0001***
GR	0.006
GS	-0.0006

(***, ** and * indicate 1%, 5% and 10% significance levels, respectively)

Despite claims that support the idea that corporate entities that are wholly or partially owned by the State or a local government perform less efficiently and less profitably than privately-owned ones⁴³, our results show that ownership structure does not have a significant effect on the efficiency of Italian water utilities. Thus, it seems that ownership is not a relevant variable that promotes efficiency. Prior evidence that related efficiency to ownership in the Italian water sector is conflicting: Romano and Guerrini (2011) used one-year data to show that public firms are more efficient than mixed-owned utilities; however, more recently Guerrini and Romano (2014) showed that public firms received significantly lower DEA scores when compared to those of mixed-ownership and private firms. Therefore, the current result seems to confirm that other corporate governance features than

ownership structure are able to influence that efficiency of water utilities, namely board size and composition.

Only three independent variables that describe board size and composition have a robust significance level on efficiency with a p-value at least lower than 10 percent: BS, GRAD, and POL. The empirical evidence suggests that as larger boards negatively affect efficiency, firms should reduce the number of directors, structuring tighter boards able to expedite decision-making. This result is in line with the literature⁴⁴ that affirms that when boards grow they may work less effectively and that larger boards are more likely to have difficulties in coordinating, communicating, participating in, and being committed to improving corporate performance⁴⁵. Moreover, it confirms the relevance of current legal provisions that in Italy regulated the size of the boards of the utilities owned, wholly or partially, by public shareholders by providing a threshold of five board members for fully publicly owned utilities.

The results show that the presence of directors affiliated to a political party or who are/were members of local or national government entities negatively affects efficiency. This could occur since politicians often get legitimacy through consensually-driven and populist policies, based on massive public spending and intense recruitment of workforces in those firms where a local government or the State exert a relevant role. This result seems to confirm the relevance of the legal provision in Italy that bans the appointment of any politicians who have operated in the previous three years as administrators of the local authority owning the utility. However, a prior study using 2011 data on Italian water utilities⁴⁶ found a correlation between the presence of politicians and the capability to collect funds from banks and other public sources (EU and regions). In fact, the funding problem is currently one of the most relevant in the management of local utilities⁴⁷ and the political affiliations of board members could contribute to improve the funding opportunities of the firm.

Prior evidence that college or university graduates on the board affect productivity in a slightly negative way⁴⁸ was confirmed when the level of education of board members is taken into consideration. This could be explained by the fact that only half of the board members in our dataset have these educational credentials; furthermore, many members have degrees not strictly related to water management, such as in veterinary science, medicine or foreign languages. Therefore, the research findings confirm that having a degree is not a sufficient condition for better decision-making processes or performance improvement.

Demographic characteristics, such as gender representation and average age, did not affect efficiency. However, the low presence of women in the board (less than 10%) included in our dataset makes it difficult to observe their effect on performance; since female directors represent a small minority, we can suppose both that gender board diversity is not relevant for efficiency or

44 Jensen, 1993.

45 Goodstein et al., 1994. Guest, 2009. Judge and Zeithaml, 1992. Yermack, 1996.

46 Romano and Guerrini, 2014.

47 Romano et al., 2013.

48 Romano and Guerrini, 2014.

43 Boycko et al., 1996. Shleifer and Vishny, 1994.

that only one or two female members may not feel comfortable on male-dominated boards, and have difficulties renovating policies and organizations. With reference to the average age of board members, it is relevant to point out that in our dataset the average age is around 53 years old, lower than the average age of the managers of many sectors of the Italian economy, from banks to SOEs⁴⁹.

The effects of two strategic and operational features of firms (integration in a group with other utilities operating in water services and/or in related public services such as solid waste, environmental service, gas and electricity, and wholesale activities) were examined but these variables were not found to have a significant effect on efficiency.

Finally, the control variables SIZE and STF have a key role in pure technical efficiency. When production value increases, firms improve efficiency; conversely, the growth of staff members damages productivity. The first result is in line with evidence from prior DEA literature on water management, demonstrating that economies of scale characterize the industry. Recently, Guerrini and Romano (2014) have shown that economies of scale could really affect those water utilities that collect more than 50 million euros in revenues. Consequently, the capability to purchase and consume input grows with turnover.

CONCLUSION

This paper investigated whether the corporate governance of water utilities (i.e. their ownership, board size and board composition) affects firms' decisions and ultimately impacts the level of efficiency reached. The study used a database compiled from 255 observations of 85 Italian water utilities and over 1100 board members. It applied a two-stage method using DEA to determine the relative efficiency of utilities and panel regression to analyze the relationship between their efficiency and corporate governance (ownership, board size, and political connection, age, education and gender of board members) and strategic features (production value, number of employees, membership in a corporate group and provision of gross sale water service).

The results confirm the importance of the legal provisions in Italy that regulate the size and composition of the boards of the utilities owned, wholly or partly, by public shareholders by providing a threshold for full public ownership (no more than 5 board members) and mixed ownership (no limitations on board size but no more than 5 members appointed by the public shareholders) of utilities. Moreover, the law bans any politicians who have operated in the previous three years as administrators of a local authority that owns the utility (full public or mixed ownership). The present study highlights that the efficiency of water utilities is negatively affected as the size of their board and the presence of politically connected directors grow. Confirming prior evidence, we found that the presence of graduates on the board negatively affects efficiency, which could be explained by the fact that only half of the board members in the dataset have a degree and many members have degrees not strictly related to

water management. Ownership and demographic characteristics (gender representation and average age) did not affect efficiency. Finally, the effects of the control variables analyzed are contrasting: while group membership and wholesale activities do not have a significant effect on efficiency, production value and the number of employees confirm the existence of economies of scale in the industry.

To further analyze the effect of corporate governance on efficiency of water utility firms, the present study could be expanded to include in the dataset multi-sector utilities offering more than one public service, considering the scope of operation as a control variable to explain a firm's performance. The observation period could also be extended. Moreover, another limitation is the endogeneity problem, which impacts much of the board-related literature⁵⁰, considering that board composition may influence firm performance but the latter may in turn influence the selection of board members.

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49 Coldiretti/Gruppo, 2013.

50 Hermalin and Weisbach, 2003.

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