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Value Added and Productivity Determinants in the Water Industry: Panel Data Evidence from the West Region of Romania

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Abstract – This study compares the level of value added and productivity generated by the companies activating in the water and wastewater sector and investigates their determinants. To this end, we perform a panel data analysis over the period 2007 to 2014 using firm-level data. We include in our analysis nine public companies located in four counties inside the West Region of Romania, namely Arad, Caraș-Severin, Hunedoara and Timiș. We compare a classic Pooled OLS, a fixed effect and a random effect estimator. Our static analysis shows that the value added is mainly explained by the operating revenue, profit margin and liquidity ratio. While the size of the companies positively influences the level of value added, the consumers wealthy, measured in terms of GDP per capita, has no clear influence. It appears that regional operating companies perform better compared with small firms acting at local level. A similar result is recorded when we estimate the drivers of the productivity level, measured in terms of value added per employee. We conclude that the economies of scale recorded by companies located in the main cities of the region, and an adequate financial management of these companies, both contribute to enhancing their economic performances.

Keywords: value added, firms' productivity, water industry, regional study, panel data analysis.

I. INTRODUCTION

The efficiency of public companies is not enough debated in the economic literature. However, these companies continue to expand their activities and to invest more and more in R&D activities compared to private firms [14]. A narrow strand of the literature tries to explain the role of environmental factors and corporate governance in influencing companies' performances in terms of value-added creation [3], [10] and productivity [8]. Nevertheless, as far as we know, none of the previous works addresses the impact of financial performances and regional economic context on the level of value added and labor productivity for state-owned firms.

To fill in this gap, we focus on nine public companies activating in the water and wastewater industry from the West Region of Romania. We apply a panel data investigation using firm-level statistics for the period 2007 to 2014, to see how the financial performances and the regional economic context influence the value-added creation and the productivity of these companies.

Consequently, our contribution to the existing literature in fourfold. First, we focus on the role of financial management and regional context in explaining the value-added creation, using firm-level data for public companies. More precisely, we investigate to what extent the turnover, profitability and investment influence the value added generated by the companies located in four counties (Arad, Caraș-Severin, Hunedoara and Timiș – NUTS 3) from the West region (NUTS 2) of Romania. Second, we focus on the water and wastewater industry, performing a regional analysis. Indeed, [6] make a comparative study between public and private companies activating in the water and waste services in Italy and investigate the efficiency of these companies in terms of distance from the stochastic frontier of the production costs. However, our focus is on efficiency in terms of value-added creation and labor productivity. Third, we investigate in a comparative manner the performances of public companies that are not in direct competition, neither between them, nor with private firms. These companies are held by local municipalities and/or county councils, and present noteworthy efficiency discrepancies. These discrepancies might be explained by the local political context, which is reflected in the financial performances of companies, but also by the local economic context, in terms of market size and purchasing power. Therefore, our study reveals which

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elements make some companies more efficient than others. Finally, we use different panel specification for robustness purpose, comparing a Pooled Ordinary Least Square (POLS) specification, with a fixed effect and a random effect model. This is the first study that investigate the performances of the water and wastewater companies from Romania.

The rest of the paper is as follows. Section 2 presents the literature review and a comparative investigation in terms of value-added creation and productivity at regional level. Section 3 describes the data and the methodology. Sections 4 and 5 presents the results of the empirical estimation regarding the determinants of value-added level and productivity, respectively. The last section concludes.

II. LITERATURE REVIEW AND STYLYZED FACTS

2.1. Literature review

On the one hand, the analysis of value-added determinants is scarce in the financial management literature. Most of empirical works focus on the implications of economic value added [15], or on the value added generated by the level of exports [2]. The value added in the public sector is mainly analyzed from the perspective of education role in fostering the economic performances [16]. Little effort is paid to assess the factors generating higher value added for public company. As far as we know, there is no attempt so far to investigate the determinants of value added in the water industry.

On the other hand, there is a broad literature investigating firms' efficiency, with a focus on productivity level. First, the capacity of the firm to innovate (estimated in terms of R&D expenditures) is put forward by [12]; [7], [17]. Second, the role of corporate governance in enhancing the productivity is intensively investigated by [5] and [9]. Third, the relationship between the business performances and environmental practices is considered as a potential determinant of productivity, with mixed empirical evidence. The results depend on the participation to certain environmental program [11], and on the voluntarism of these environmental regulations [13].

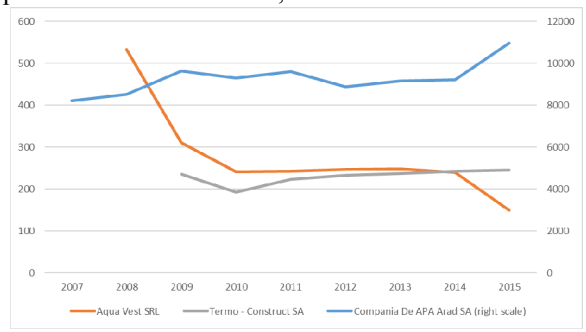
However, much attention is paid to firms' financial performances. In this line, the literature underlines the role of firms' size, profitability, and structure of investment [18], or the role of financial constraints [4]. Given the fact that the water companies are not necessarily financial constrained being public companies with important assets, we focus on the role of financial performances and structure of investment. In addition, we investigate the role of the regional economic context.

2.2. Stylized facts

In what follows we present some stylized facts about the water and wastewater sector from the West region of Romania. According to the Eurostat database, the gross value added recorded by the Romanian economy in 2014 is about 133,176.7 mil. EUR, out of which 17,309.6 mil. EUR are generated by the public sector (13%). If we look to the water and wastewater industry, we notice that according to the AMADEUS statistics, the value added in 2014 is about 407.5 mil EUR (0.3%). Indeed, data are not available for all 115 companies acting in this industry in Romania, but this sector has a marginal contribution to the total value added (or to the Romanian GDP).

In the four counties composing the region, we have three companies located in Arad county (Compania de APA Arad SA, Aqua Vest SRL, Termo - Construct SA), one company located in Caraș-Severin (Aquacaras SA), three located in Hunedoara (APA Prod SA, APA Serv Valea Jiului SA, Activitatea Goscom SA) and three in Timiș (Aquatim SA, Meridian 22 SA, Aqua Dumbrăvița SRL). However, for the small company Aqua Dumbrăvița SRL operating in the Timiș county, data are available starting with 2011 only. Therefore, we have excluded it from the analysis.

Fig. 1-4 present a comparison between the level of value added (a) and the level of productivity computed as ratio between the value added and the number of employees (b), for each county included in analysis. Fig. 1a shows that, for the water companies located in Arad county, the value added records different trends, while being considerably higher for the main company, which is also a regional operator – Compania de APA Arad SA. This company is located in the county seat, namely Arad city, and shows a higher level of productivity compared with other small firms acting in Arad county (Fig 2b).



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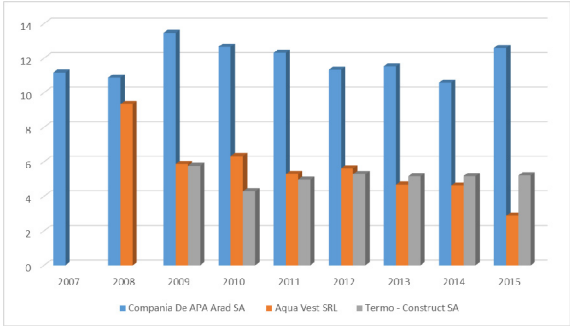

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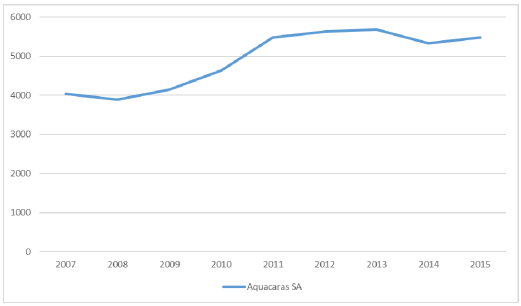
Fig. 1. Value added in th. EUR (a) and labor productivity (b) in the water industry from Arad county



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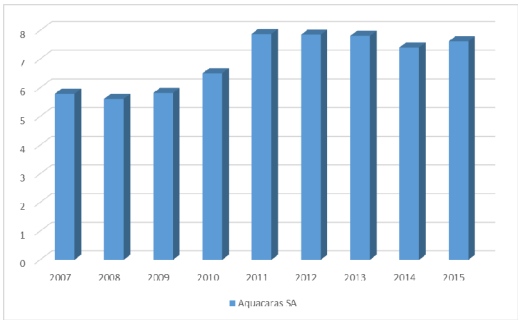

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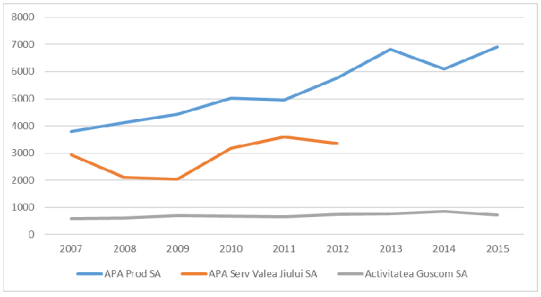
Fig. 2. Value added in th. EUR (a) and labor productivity (b) in the water industry from Caraș-Severin county



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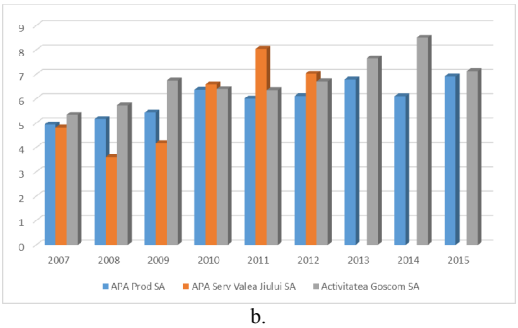

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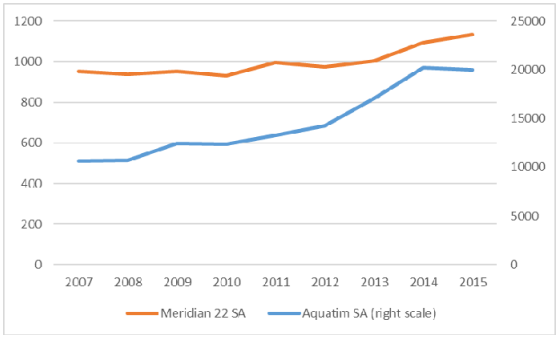
Fig. 3. Value added in th. EUR (a) and labor productivity (b) in the water industry from Hunedoara county



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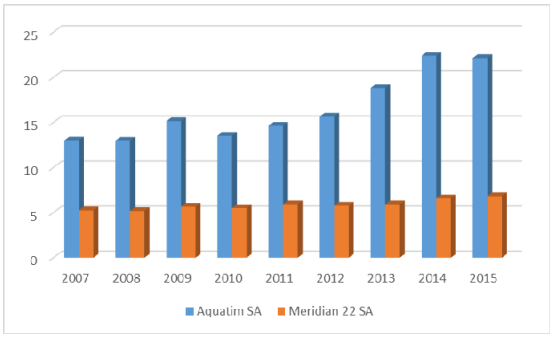

b.

Fig. 4. Value added in th. EUR and labor productivity in the water industry from Timiș county

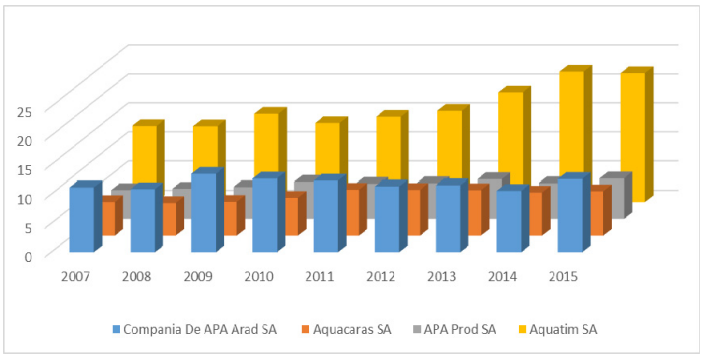

Fig. 5. Labor productivity for the regional operating companies from the West region of Romania

Fig. 2 shows that for the water company located in Caraș-Severin county (Aquacaras SA), both the level of value added, and labor productivity slightly increase during the analyzed period.

Fig. 3a presents the dynamics of the value added for the three companies located in Hunedoara county. For all these companies the value added is increasing, although for a higher extent for the regional operator APA Prod SA – the company established in the city of Deva, which is the Hunedoara county seat. A similar trend is recorded for the labor productivity, but no significant differences between the three companies can be noticed (Fig. 3b).

Finally, for the Timiș county there are important differences between the two companies settled here, both in terms of value-added dynamics (Fig. 4a) and in terms of productivity level (Fig. 4b). Although the level of value added recorded by the regional operator Aquatim SA is not surprising given its location in the city of Timișoara, the Timiș county seat, the

productivity level is clearly much higher, and the gap between the two companies continue to increases.
We also notice that the level of value added, as well as the productivity level, seem to be much higher for the regional operating companies. When we compare the regional operators' productivity level, we observe a higher productivity for Aquatim SA and Compania de APA Arad SA, the companies located in the most developed counties of the region. Nevertheless, only Aquatim SA records a continuous increase in the productivity level starting with 2012 (Fig. 5).

III. DATA AND METHODOLOGY

3.1. Data

Value-added data come from AMADEUS database (Bureau van Dijk) and were extracted in December 2016. Data cover the period 2006 to 2015. However, because the data were unavailable for a large set of explanatory variables in 2006 and 2015, the final time-span is from 2007 to 2014 (67 observations). The factors considered to have an influence on both the value added expressed in natural log (*lnva*) and labor productivity computed in terms of value added per employee (*ave*), are the operating revenues expressed in natural log (*lnor*), the profit margins (*pm*), the liquidity ratio (*lr*) and the level of investment, proxied by the fixed to total assets ratio (*fta*). We also check for the size effect, considering the role of total assets, also expressed in natural log (*lnta*). In addition, the economic context is included in the analysis, by assessing the role of consumers' welfare measured in terms of GDP per capita (*lngdp*), data extracted from Eurostat database. Finally, using dummy variables we test the regional operator effect and we award a value of 1 if the company acts in one of the county seats of the region and represents thus a regional operator, and 0 otherwise (*dummy1*). At the same time, we check for the role of Timiș country as leader in the region and we award the value 1 for the companies located in Timiș (which is the economic capital of the West region), and 0 otherwise (*dummy2*).

3.2. Methodology

The general POLS equation we test is:

$$y_{it} = \alpha + \beta x_{it} + \varepsilon_{it}, \quad (1)$$

where y_{it} are the dependent variables (the value added expressed in natural log and the labor productivity), α is the intercept, β represents the coefficients of explanatory variables, x_{it} is the set of explanatory variables and ε_{it} are the error terms.
The fixed effect model allows to avoid the omitted variable bias and addresses the disparities between companies. In this case the general equation becomes:

$$y_{it} = \alpha + \beta x_{it} + \gamma_i + \varepsilon_{it}, \quad (2)$$

where γ_i represents all the stable characteristics of companies.
Finally, because the fixed effect model does not, in fact, control for all stable covariates [1], we also test a random effect model:

$$y_{it} = \alpha + \beta x_{it} + \gamma_i + \mu_{it} + \varepsilon_{it}, \quad (3)$$

where μ_{it} are the between-entity errors and ε_{it} are the within-entity errors.
A Hausman test is afterwards performed to select the most appropriate model between the fixed and random effect model, while a Breusch–Pagan test helps us to choose between the random effect model and the classic POLS estimator. The F-test shows if the fixed effect model is recommended to the POLS model.

IV. VALUE ADDED DETERMINANTS

We first present the results of estimations that investigate the determinants of value added. Table 1 clearly shows that for all three specifications, the operating revenues (*lnor*) and the liquidity ratio (*lr*) have a positive influence on the level of value added, while the positive influence of the profit margin (*pm*) is observed only for the fixed-effect model.
Therefore, companies that record higher sales and practice higher prices unregister an increase in their value added, which is not surprising. At the same time, more liquid companies can negotiate better prices with their suppliers, and may reduce this way their production costs, with a positive effect on the value added. The size matters and large companies realize economies of scale increasing their value added.
The Breusch–Pagan test shows that there are no random effects in our estimation, while the Hausman and F-tests show that the fixed effect model is preferred. Overall, we conclude that the financial management of the companies activating in the water industry is important for their economic performances.
However, when we look to the regional economic context, our findings become less evident. On the one hand, the GDP per capita, a *proxy* for the consumers' wealth has either a negative, or a positive impact on the value added, depending on the estimated model. Thus, it is hard to affirm that the consumers from the wealthy counties are willing to pay a higher tariff for the water and wastewater services.
On the other hand, the fact that the companies are regional operators has no significant influence on the value added, contrary to our expectations. However, under the random effect model, we notice that the companies from the Timiș county have better performances.

These results may be influenced not only by the firm size measured in terms of total assets, but also by the number of employees of each company. These companies are owned by local municipalities and/or county councils and may be prone to political pressure to increase their number of employees, especially after financial turbulence episodes, as those recorded in 2008 and 2009 in Romania.

At the same time, more employees can generate more value added. Therefore, in order to see how important the financial management and the local economic context are for the companies' performances, we calculate the ratio between value added and the number of employees, a *proxy* for the productivity level.

V. LABOUR PRODUCTIVITY DRIVERS

The potential drivers of the productivity level we consider in this subset of estimations are the same as in the previous analysis. Table 2 presents the results of the estimations. Different from the previous case, there is no clear dominance of one model compared to the other.

The results are similar with those reported in Table 1. Both the financial management and the firms' size have a positive influence on the firms' performances, measured in terms of productivity. In this case, the GDP per capita has a positive influence. In addition, both POLS and random effect models show that the regional operators (*dummy1*) record a higher level of productivity. According to the random effect model, the companies located in Timiş (*dummy2*) perform better.

Table 1. Value added determinants

lnva	**POLS**	**Random effect**	**Fixed effect**
c	3.974	7.897***	1.153
lnor	0.878***	0.672***	0.171***
fta	0.001	-0.000	-0.005***
lnta	0.073	0.176**	0.189***
lr	0.063**	0.060**	0.006
pm	0.010	0.008	0.017***
lngdp	-0.515*	-0.888***	0.410**
dummy1	0.101	0.272	-
dummy2	-0.172	0.298***	-
R^2	0.948	0.950	0.813
Breusch–Pagan (recommended)	Prob>chibar2 = 1.000 (POLS)		
Hausman test (recommended)	Prob>chi = 0.000 (Fixed)		
F-test (fixed effects)	Prob > F = 0.000 (Fixed)		
*Note: *, **, ***, mean significance at 10%, 5%, 1%.*			

Table 2. Labor productivity determinants

ave	**POLS**	**Random effect**	**Fixed effect**
c	-54.89***	-46.37***	-12.79
lnor	1.882***	0.778	1.186**
fta	0.007	-0.011	-0.039**
lnta	0.082	0.525*	1.240***
lr	0.414***	0.353***	0.081
pm	0.158***	0.156***	0.143***
lngdp	5.144***	4.822***	0.115
dummy1	2.460***	1.345*	-
dummy2	0.519	1.913***	-
R^2	0.876	0.897	0.621
Breusch–Pagan (recommended)	Prob>chibar2 = 1.000 (POLS)		
Hausman test (recommended)	Prob>chi = 0.351 (Random)		
F-test (fixed effects)	Prob > F = 0.000 (Fixed)		
*Note: *, **, ***, mean significance at 10%, 5%, 1%.*			

VI. CONCLUSIONS

We have analyzed the economic performances of public companies from the West region of Romania, activating in the water and wastewater industry. For this purpose, we have performed a panel data analysis comparing a POLS, a fixed effect and a random effect model, and we have used firm-level data for the period 2007 to 2014 (nine companies located in the four counties of the region were included in our analysis).

Our findings first show that the level of value added is positively influenced by the operating revenue, profit margin and liquidity ratio. In addition, the size of the companies is positively correlated with the size of the value added, as expected. However, the status of regional operator has no significant influence on the level of value added.

The productivity drivers are considered to be the same as the value-added determinants. On the one hand, the performances of the companies' financial management (e.g. profitability, liquidity), have a positive impact on the productivity level. On the other hand, the regional economic context matters. Firms perform better in wealthy counties, and if they act as regional operators.

Our findings should, however, be interpreted with caution, given the limitation of our empirical exercise. Our sample is very small and does not allow for additional robustness analyses. In addition, the endogeneity of our variables is not considered (i.e. the firms' productivity also influences their profitability level). Finally, a multicollinearity bias may exist when we consider both the firm size and turnover size for example. A possible way to deal with these drawbacks is to extend the analysis at national level.

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