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# *Performance of the Italian Water Sector*

# *Service Quality and Cost Efficiency*

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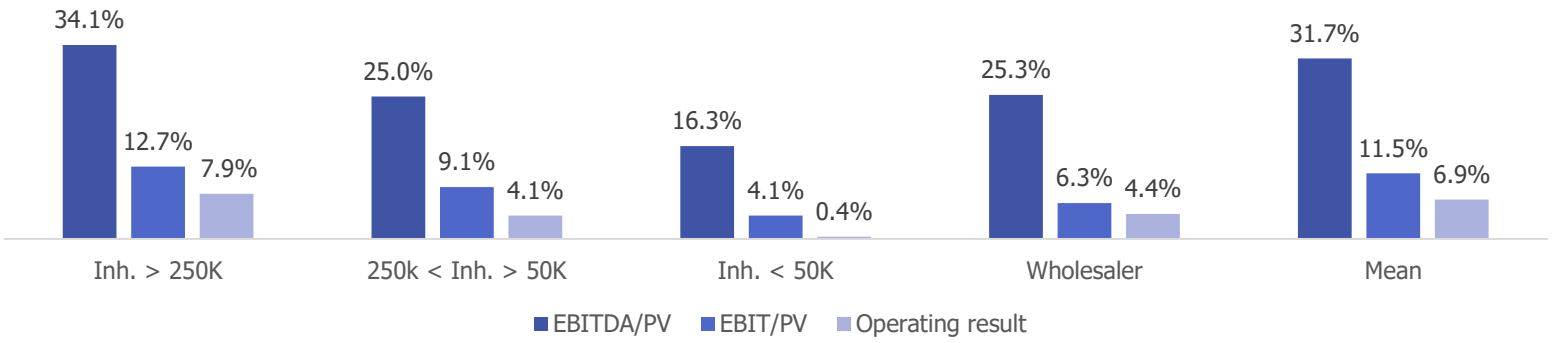
# Context

- In 2012 ARERA has started to regulate the water sector (SII): since then the investments made recorded a constant growth. This path is mainly driven by the stability of the tariff discipline and by the incentive system recently introduced by ARERA known as "regulation of technical quality".
  - ARERA has set performance improvement targets on certain parameters such as, for example: the level of losses, water quality, etc. based on which the operators have been allocated in merit classes;
  - ARERA has also set mechanisms of cost efficiency for operating expenditures (Opex) in the current regulatory period (2016-2019) and launched a Stochastic frontier analysis to further efficiency the operating cost in the next regulatory period (2020-2023)

# Economic and financial sustainability

- The operators of the Italian water sector in 2017 registered € 8 billion. corresponding to 0.5% of GDP. The sector employs over 29 thousand employees directly.
- The sector is still fragmented with several operators active in a single segment of the supply chain and small operators. who in terms of turnover represent a residual part of the sector.
- In terms of economic and financial results. large companies have better margins than small companies. In the period 2011-2017 we observe the maintenance of the economic and financial balance of the companies and a consolidation of the level of capitalization found. Of the total sources of financing. the weight of debts goes from 55% in 2011 to 48% in 2017. while the incidence of Net Equity grows from 33% to 36%.

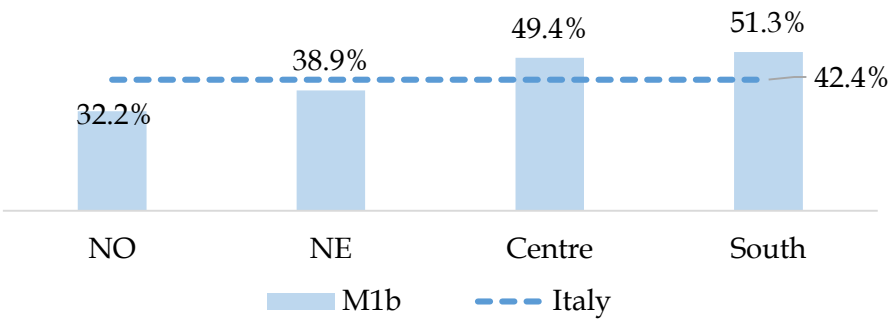
**Operating margin [2017] – water company sample-**



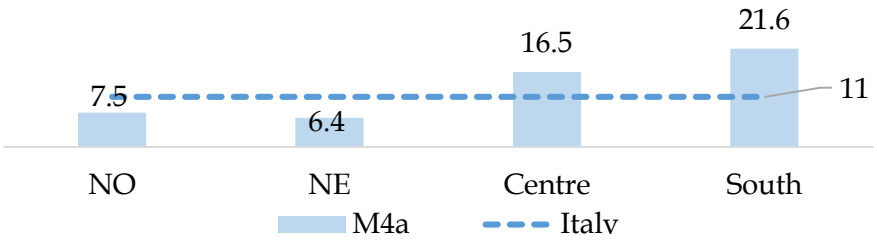

Source: Utilitatis on data AIDA BvD

# Infrastructure – current situation

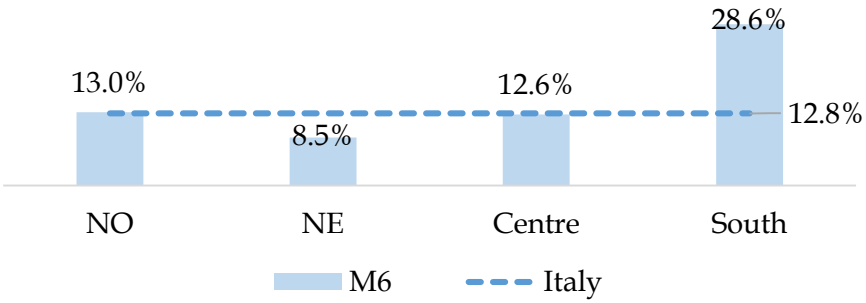
**M1b – Water losses**




**M4a – Flooding episodes from mixed and white sewage [N./100km]**




**M6 - % sample exceeding one or more concentration limits of polluting parameters**




- Main problems of the infrastructure due to old-fashioned networks and high levels of water losses
- Geographical differences in the service quality: the southern regions show the worst performances.

Source: ARERA. Relazione annuale 2019

# Quality indicators

- ARERA has introduced the regulation of the technical quality of the service Del 917/2017 / R / Idr (RQTI): the infrastructure is assessed with 6 Macro Indicators.
- For each indicator a class is associated to which improvement objectives are associated (or maintenance in the case of the highest Class). The operator is encouraged to improve through structured systems of incentives and penalties

**M1 - Classes**

| *Water losses [%]* \ *Linear water losses (mc/km/day)* | M1a <15 | 15≤ M1a <25 | 25≤ M1a <40 | 40≤ M1a <60 | M1a ≥60 |
|---|---|---|---|---|---|
| M1b <25% | A | | | | |
| 25%≤ M1b <35% | | B | | | |
| 35%≤ M1b <45% | | | C | | |
| 45%≤ M1b <55% | | | | D | |
| M1b ≥55% | | | | | E |

**Annual target**

| *Indicator* | Categoria tariffaria | *Class* | *Target* |
|---|---|---|---|
| *M1a – Linear water losses [mc/km/day]* *M1b – Water losses [%]* | RES | A | Mantenimento |
| | | B | -2% di M1a annuo |
| | | C | -4% di M1a annuo |
| | | D | -5% di M1a annuo |
| | | E | -6% di M1a annuo |

- An ad hoc survey by Utilitatis made it possible to estimate the evolution of the main macro indicators in 2017 and 2018. The trend is positive for all the indicators.

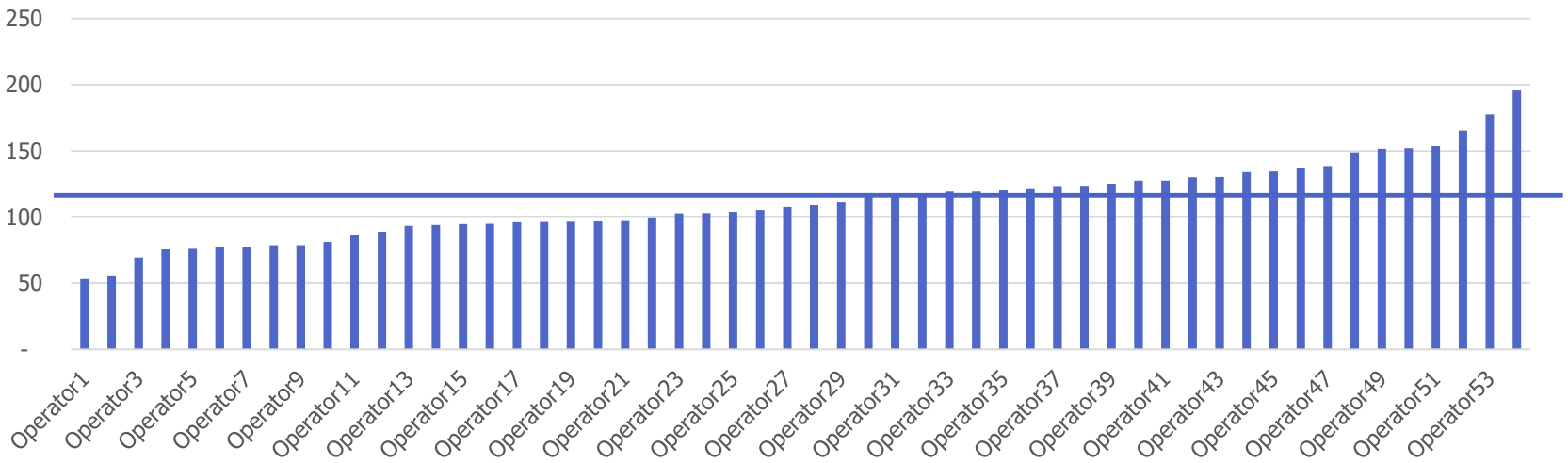
| | | ARERA 2016 | Utilitatis 2018 | Trend |
|---|---|---|---|---|
| M1a | Linear water losses [mc/km/day] | 23.1 | 22.9 | + |
| M1b | Water losses [%] | 42.4% | 40.8% | + |
| M3b | Drinking water quality (1-M3b) [%] | 96.1% | 98.0% | + |
| M5 | Sludge in landfills [%] | 19.4% | 16.6% | + |
| M6 | Purified water quality [%] | 87.2% | 95.4% | + |

# Regulatory incentives – opex per capita

- The regulation set price limit that depends on two variables:
  - The level of opex per capita with respect to the level OPM
  - The level of investments on RAB with respect to the level **ω**

| INVESTEMNT | $\frac{Opex^{2014}}{pop} \le OPM$ | $\frac{Opex^{2014}}{pop} > OPM$ |
|---|---|---|
| $\frac{\sum_{2016}^{2019} IP_t^{exp}}{RAB_{MTI}} \le \omega$ | SCHEMA I<br>Limite di prezzo:<br>$\frac{\vartheta^a}{\vartheta^{a-1}} \le (1 + rpi + K - X)$ | SCHEMA II<br>Limite di prezzo:<br>$\frac{\vartheta^a}{\vartheta^{a-1}} \le (1 + rpi + K - 2X)$ |
| $\frac{\sum_{2016}^{2019} IP_t^{exp}}{RAB_{MTI}} > \omega$ | SCHEMA IV<br>Limite di prezzo:<br>$\frac{\vartheta^a}{\vartheta^{a-1}} \le (1 + rpi + 1{,}5 * K - X)$ | SCHEMA V<br>Limite di prezzo:<br>$\frac{\vartheta^a}{\vartheta^{a-1}} \le (1 + rpi + 1{,}5 * K - 2X)$ |

***Opex per Capita distribution - Sample***



# Cost efficiency – rolling cap

- The total opex recognised in the allowed cost to the water service operator are the sum of two classes of opex:
  - Endogenous opex: subject to efficiency
  - Other opex: not subject to efficiency

$$VRG^a = Capex^a + Opex^a + FoNI^a + ERC^a + Rc^a_{TOT}$$

$$Opex^a = Opex^a_{end} + Opex^a_{al}$$

$$Opex^a_{end} = \frac{(Op^{2013} + COeff^{2013})}{2} * \prod_{t=2014}^{a} (1 + I^t)$$

**In the next regulatory period the endogenous opex are subject to further efficiency**

# Cost efficiency – SFA (1/2)

- ARERA through the last consultation document for the third regulatory period on water service regulation illustrates its general guidelines.
- The DCO confirms the architecture of the current regulatory system, such as the duration of the regulatory period, the declination of tariff rules, the general structure of the revenue restriction and the tariff multiplier.
- The main new aspect concerns the efficiency of operating costs: ARERA proposes the use of a Stochastic Frontier Analysis model to identify the "frontier cost function", which indicates the minimum operating cost given the level of output and the prices of the inputs of each management.
- In addition to the classical input and output quantities, the model is characterized by the inclusion of variables related to technical quality such as the presence / absence of the prerequisites identified by the authority and the value of the M1a indicator of linear water losses.
- The dependent variable is the total operating cost, this is estimated on the basis of the data referring to 2016 and subsequently transformed into an operating cost per capita.

$$\ln\left(CO_{TOT}^{S}\right) = 3{,}2766 + 1{,}0315 \cdot \ln(1 + PE) + 0{,}2817 \cdot \ln(1 + PL) + 0{,}7841 \cdot \ln(1 + WS) + 0{,}2263 \cdot \ln(V) + 0{,}1455 \cdot \ln(L) + 0{,}4685 \cdot \ln(Pa) + 0{,}1418 \cdot \ln(AE) - 0{,}0753 \cdot PREQ1\_4 - 0{,}0611 \cdot PREQ3 + 0{,}0281 \cdot \ln(M1a)$$

# Cost efficiency – SFA (2/2)

- Starting from the result obtained. the Authority declines the rules for calculating endogenous operating costs (that can be made efficient) on the basis of a clustering of operators based on the estimated operating per capita cost and the per capita level (referred to 2016) of the cost total operating costs incurred by the operator. calculated as the difference between production costs and adjustment items
- Depending on the cluster in which the operator is positioned. the Authority provides for the assignment of a specific efficiency coefficient. associated on the basis of the per capita operating cost borne by the operator and the estimated per capita operating cost. The greater the value of the coefficient the lower the efficiency to which the operator is subject. This coefficient affects the amount of the component to be deducted from the value of the current cost for the purpose of calculating endogenous operating costs.
- To investigate this aspect: the reference matrix of the efficiency coefficient matrix was reproduced for each operator. The analyzed sample is composed of 56 operators, with a total resident population served by the aqueduct service amounting to about 34 million. 68% of the sample belongs to the Northern geographical area. 21% to the Center and 11% to the South and Islands.

| Efficiency parameter | Companies | % inhabitants | Decreased ammitted cost in tariff |
|---|---|---|---|
| -9/10 | 20 | 19% | 11% |
| -7/8 | 21 | 24% | 10% |
| -5/6 | 29 | 40% | 58% |
| -3/4 | 21 | 12% | 19% |
| -1/2 | 7 | 5% | 0% |
| 0 | 2 | 1% | 1% |

# Concluding Remarks

- The quality standard requirements set by the Authority are crucially important: the cost efficiency mechanisms needs to balance the trade off between level of service quality and costs
- The Stochastic Frontier Analysis can have limitations to identify efficient costs for tariff purposes due to the high risk of biases in the estimates. The main aspects to be considered:
  - The functional forms;
  - The specifications of the model;
  - Omitted variables problem.
- The application of the SFA has been discussed in other regulated sectors in Italy, potentially useful insights from other experiences