Exploring the linkage between efficiency and quality for measuring performance of water utilities

A survey on 146 Italian firms

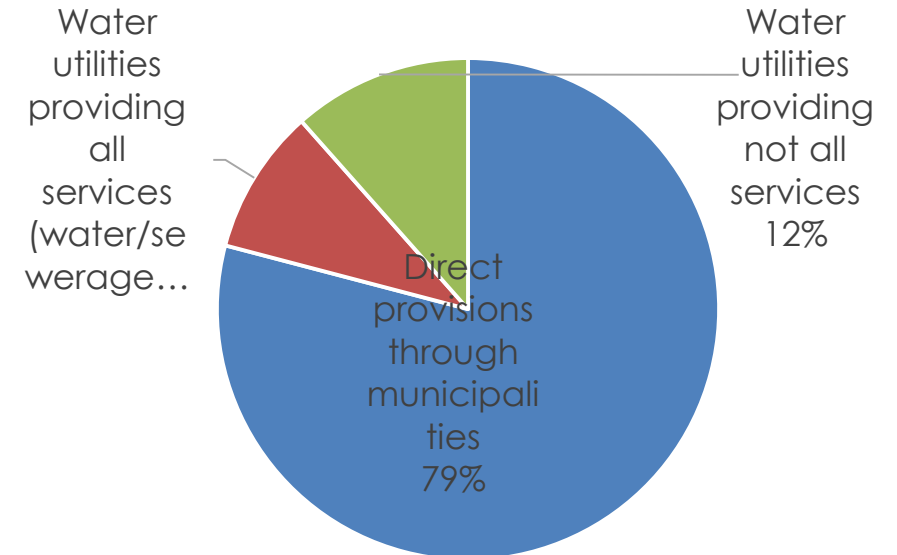Andrea Guerrini, Giulia Romano, Sara Moggi*, Chiara Leardini

Key figures for the Italian Water Sector

1,750 entities are actually providing water services in the country, according to the AEEGSI data set

Where 1.384 are municipalities (17% of all Italian municipalities) and 366 independent firms

Among 366 firms only 164 where entrusted to manage the so called integrated water service

Among 164 firms we selected 146 utilities for which are available financial statements, standard of services, and measures related to operational characteristics (governance, size, population density, geographical localization, etc.)

Water utilities providing all services (water/se werage…

Water utilities providing not all services 12%

Direct provisions through municipali ties 79%

The main features of the «vertically integrated» 146 water utilities

- **GEOGRAPHICAL LOCALIZATION**
  - North: 91
  - Centre: 27
  - South: 25
  - Multi-region: 2

- **OWNERSHIP STRUCTURE**
  - 65% PWC;
  - 29% PPPWC & 6% PrWC

- **SIZE**
  - 33% small (revenues < 10 MIL €)
  - 44% medium (10<x<50 MIL €)
  - 23% large (>50 MIL €)

- **DIVERSIFICATION**
  - 71% mono-utility
  - 29% multi-utility

Regulation of quality and efficiency in Italy

QUALITY

AEEGSI provides standards for the quality of services which will come in force the next 1 July 2016 (deliberation 655/2015)

Up to date, the quality of services was set through self-regulation, since each water utility publishes its own standards in the so called «chart of service»

EFFICIENCY

Until 2011 OPEX had to be annually reduced to achieve a modelled cost curve, developed through a parametric function (Normalized Tariff Method – MTN D.M. 01/08/96);

From 2012 up to date the cost saving mechanism on OPEX provided by MTN is mitigated with the so called Water Tariff Method (MTI);

CAPEX is not controlled, since both MTN and MTI incentivize the realization of investments through a rate of return mechanism

Research aims and methods (1)

RESEARCH AIM NR.1

Measuring the quality of services as obtained with self regulation and identification of quality drivers among several exogenous variables for 146 water utilities

First step: identification of 4 main measures of quality, collected from the charts of service;

Second step: Standardization of quality measures and sum of them to obtain an overall quality index

Third step: Regressing the overall quality index obtained with exogenous variables, as ownership structure, density, localization, degree of diversification, annual expenditure for water per households, firm's size, and amount of refunds allocated by companies to compensate citizens in case of poor quality of services

Research aims and methods (2)

<u>RESEARCH AIM NR.2</u>

Measuring the drivers of cost efficiency for 87 water utilities

The exclusion of multi-utility was done to avoid the effects of other businesses (as waste collection, energy, etc.) on the performance scores estimated

Fists step: determination of economic efficiency through a ratio of OPEX+CAPEX to production value;

Second step: Regressing the economic efficiency with exogenous variables, as ownership structure, density, localization, degree of diversification, annual expenditure for water per households, firm's size, and weight of CAPEX to total costs

Research aims and methods (3)

<u>RESEARCH AIM NR.3</u>

Measuring the overall performance of water sector, trough a linkage between efficiency and quality and identification of the main performance drivers for 87 mono-utility

The exclusion of multi-utility was done to avoid the effects of other businesses (as waste collection, energy, etc.) on the performance scores estimated

Fists step: identification of 2 input and 2 output measures and estimation

Second step: processing these data with a DEA double bootstrapped procedures, according to Simar and Wilson (2004, 2007)

Production value

OPEX & Depreciation

Overall quality index
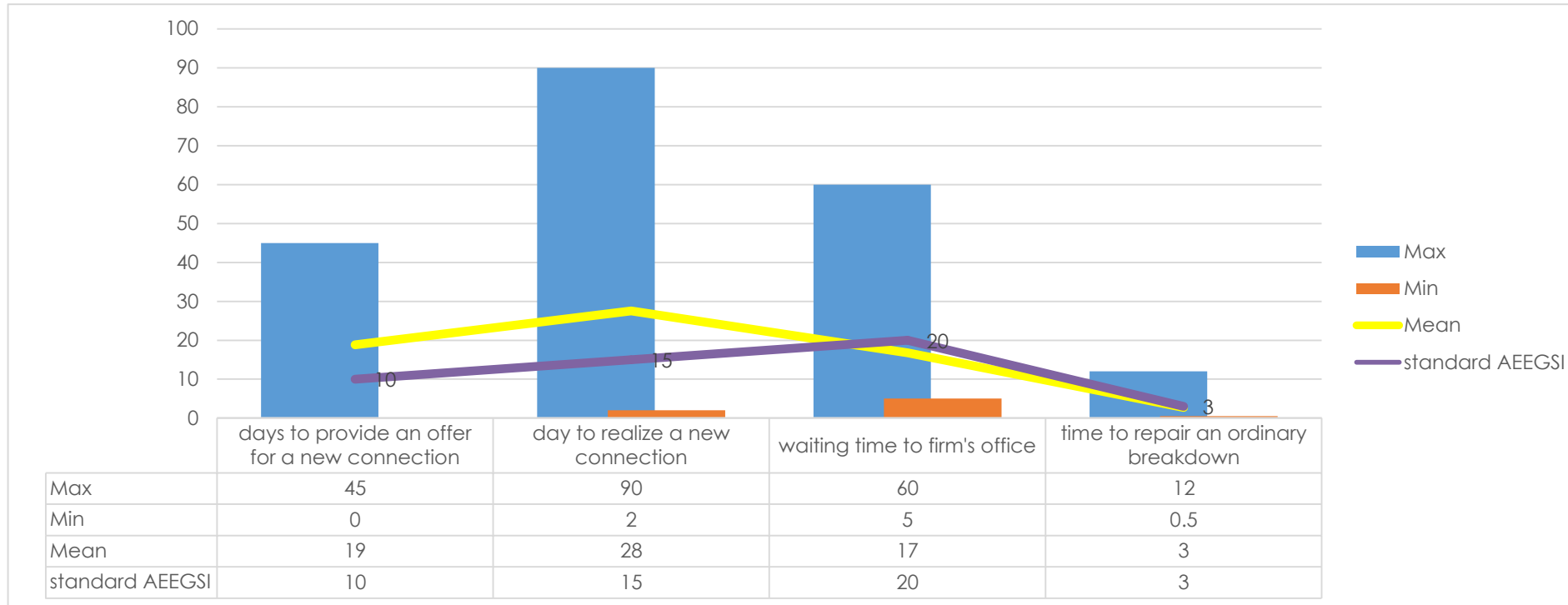
OPI
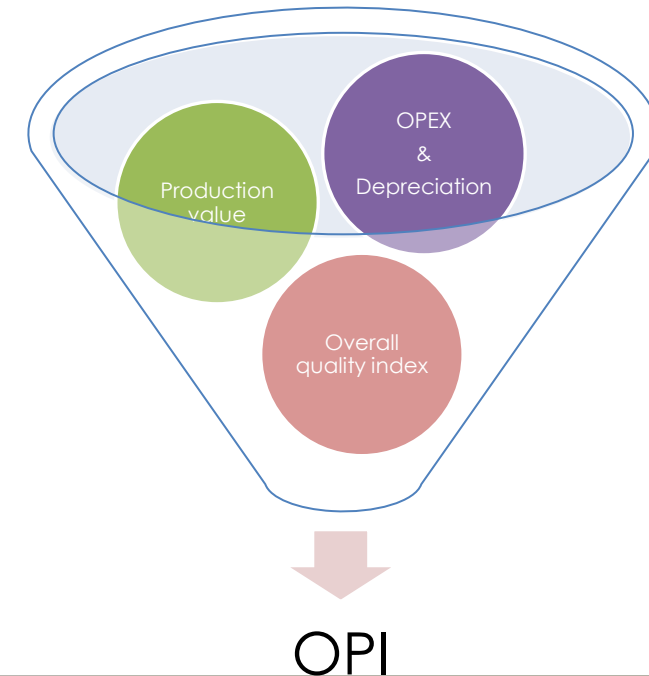
What we have measured for quality

1. Time to provide a quotation for a new connection;
2. Time to realize a new connection;
3. Waiting time at the firm's front office;
4. Time to repair ordinary breakdowns

The overall quality measures is obtained from the standardization of these indexes, then summed.

- The charts of service include only standard values an not actual!
- Standards are chosen freely by the water utilities, until 1 of July 2016
- If the company does not achieve the declared standards customers have the right to be refunded

Descriptive statistics for the standards of quality

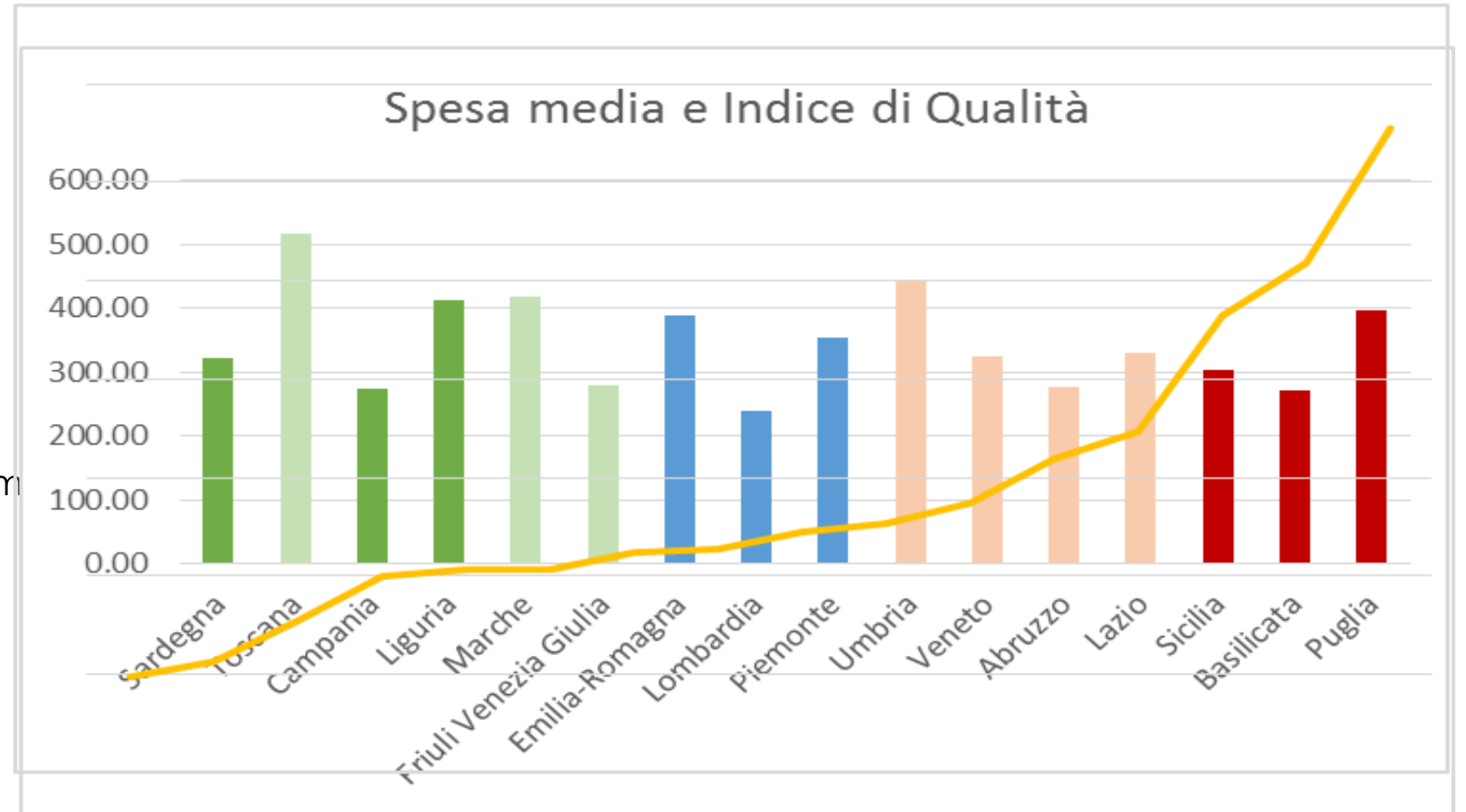|	days to provide an offer for a new connection	day to realize a new connection	waiting time to firm's office	time to repair an ordinary breakdown
Max	45	90	60	12
Min	0	2	5	0.5
Mean	19	28	17	3
standard AEEGSI	10	15	20	3

- AEEGSI provides the new standards which will come in force the 1 of July 2016 with 655/2015
- AEEGSI has the task to make inspection for controlling the real achievement of standards
- In case of poor performance the refund will be automatic
- The performance achieved will be reflected on tariffs (MTI 2016-2019)

The level of quality for the Italian regions

Household's annual expenditure for 192 m
of water consumed

— index of overall quality*

Spesa media e Indice di Qualità

600.00	
500.00	
400.00	
300.00	
200.00	
100.00	
0.00	

Sardegna, Toscana, Campania, Liguria, Marche, Friuli Venezia Giulia, Emilia-Romagna, Lombardia, Piemonte, Umbria, Veneto, Abruzzo, Lazio, Sicilia, Basilicata, Puglia

* When the index grows quality decreases and vice versa

The Ranking – *top & bottom 5*

rank	firm	region	Overall quality index	Ownership structure	Time for offer	Time for realization	Waiting time	Time for repairs
1	Secam spa	Lombardia	-4.38	Public	8	8	5	2
2	Acque Toscane spa	Toscana	-3.62	Private o PPP	5	20	10	1
3	Azienda gardesana servizi spa	Veneto	-3.10	Public	5	20	15	0.5
4	Acque veronesi sc a rl	Veneto	-3.10	Public	5	20	15	0.5
5	Asa - azienda servizi ambientali spa	Toscana	-2.96	Private o PPP	5	20	15	1
6	Acque spa	Toscana	-2.96	Private o PPP	5	20	15	1

142	Gransasso acqua spa	Abruzzo	8.02	Public	45	60	40	2
143	Acquedotto pugliese spa	Puglia	8.73	Public	40	90	40	2
144	Acoset	Sicilia	8.85	Public			15	12
145	Hidrogest spa	Lombardia	12.08	Public	20	35		
146	Sidra spa	Sicilia	14.71	Public	30	60		

The main drivers of service quality

Overall quality index	Estimator	Impact
Ownership		
- PPP o private	-1.41**	A private investor allows the achievements of better standars of quality
Density	0.001	
Refund	-0.036**	The amount of refunds is directly proportional to the quality of services
Localization		
- North	-0.36	
- Multi-regions	-49.07***	The firms operating in more than one regions provide a better services
- South	0.4045	
Diversification		
- mono-utility	0.285	
Annual expenditure for water	-0.004	
Size	0.000***	Diseconomies of scale exist if the quality of service is considered

The economic efficiency of water utilities

(OPEX+CAPEX)/Production Value	Estimator	Impact
Ownership structure		
- PPP o private	-0.031	
Density	0.000	
Localization		
- North	0.003	
- South	0.086**	The firms located in the south show the worst efficiency
Annual capital expenditure	-0.000	
Size	-0.000**	Strong economies of scale exist if cost efficiency is considered
CAPEX/(OPEX+CAPEX)	0.022	

The drivers of Overall performance (efficiency + quality)

OPI	Estimator	Impact
Ownership		
- PPP o private	0.035*	The private investors allow the achievement of better overall performance than public ones
Density	- 0.000	
Localization		
- North	0.15	
- South	-0.028	
Annual expenditure for water	0.000	
Size	0.000***	The size positively affects OPI through a positive effect exerted on efficiency and despite the negative influence on quality
CAPEX/(OPEX+CAPEX)	0.860***	The realization of high investments allows to improve cost efficiency and quality, so that OPI is improved too

Conclusions

1. The <u>fragmentation</u> of the Italian water sector is still high, with many firms of small size. <u>An aggregation process should be enhanced by law</u> for promoting economies of scale

2. The <u>scale of operation</u> exert two opposite forces on performance

   - Decreasing quality
   - Improving efficiency
   - Improving the OPI

3. The presence of private investors assures better quality of services and better OPI

   - A limit of this ownership structure is the higher costs incurred by customers (around 60€/year – Guerrini & Romano, 2016)

4. The realization of investments is a relevant tool to improve performance

Further steps

Qualitative research on:

- Efficiency drivers that enhance the quality in the public sector and private companies
- Influence of the local stakeholders and community context in the definition of strategies

Thank you for you attention

Andrea Guerrini : andrea.guerrini@univr.it

Giulia Romano : giulia.romano@unipi.it

Sara Moggi : sara.moggi@univr.it

Chiara Leardini : chiara.leardini@univr.it