On Analyzing Drinking Water Monopolies by Robust Non-Parametric Efficiency Estimations

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Research question

1. How to estimate efficiency?
2. Which incentives are effective?

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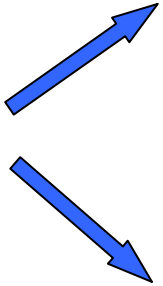
Part 1: Theoretical Foundations

Chapter 1: Measuring productive efficiency

Chapter 2: Capturing the environment

Chapter 3: An outlier detection model



Part 2: Explaining Productive Efficiency in the Drinking Water Sector

Chapter 4: Designing incentives in local public utilities

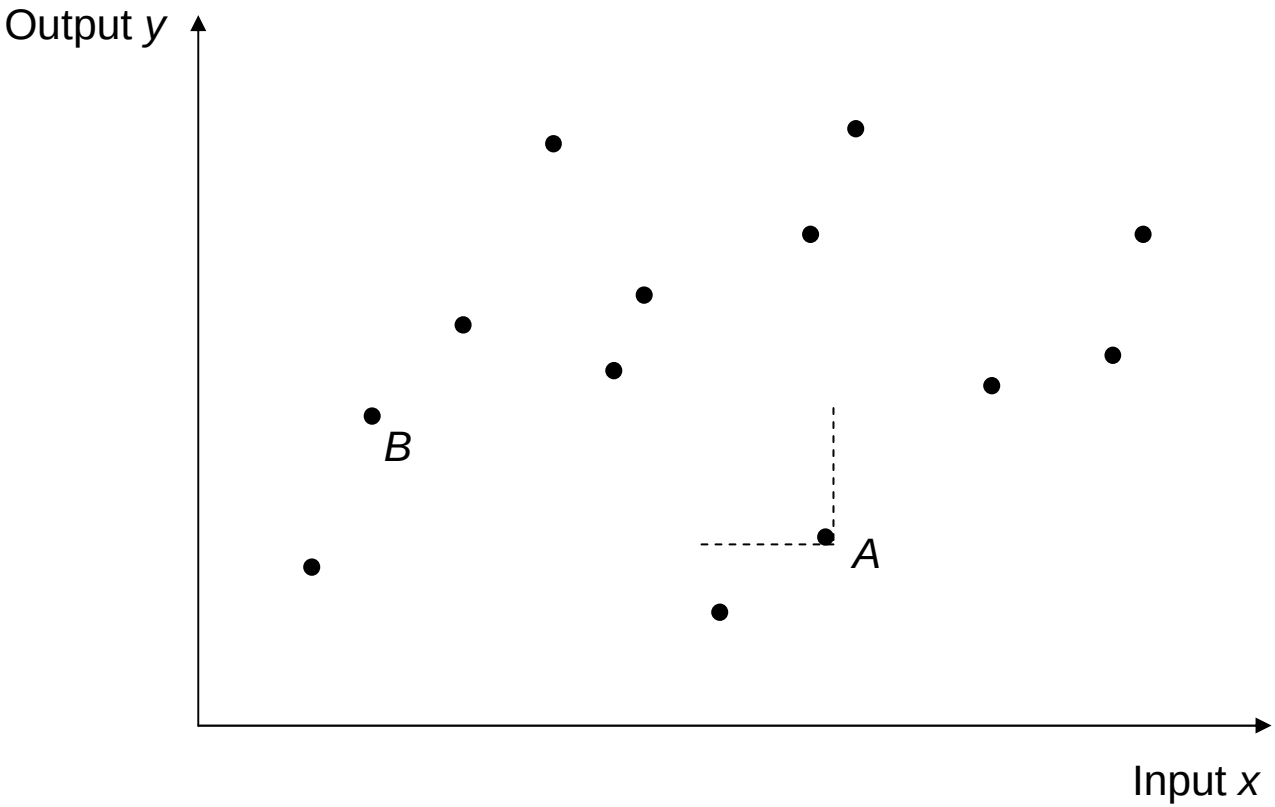
Chapter 5: Big and Beautiful? On scale and merger economies

Chapter 6: Blaming the regulator? On analyzing profits, productivity and prices

Measuring productive efficiency

Some intuitive ideas

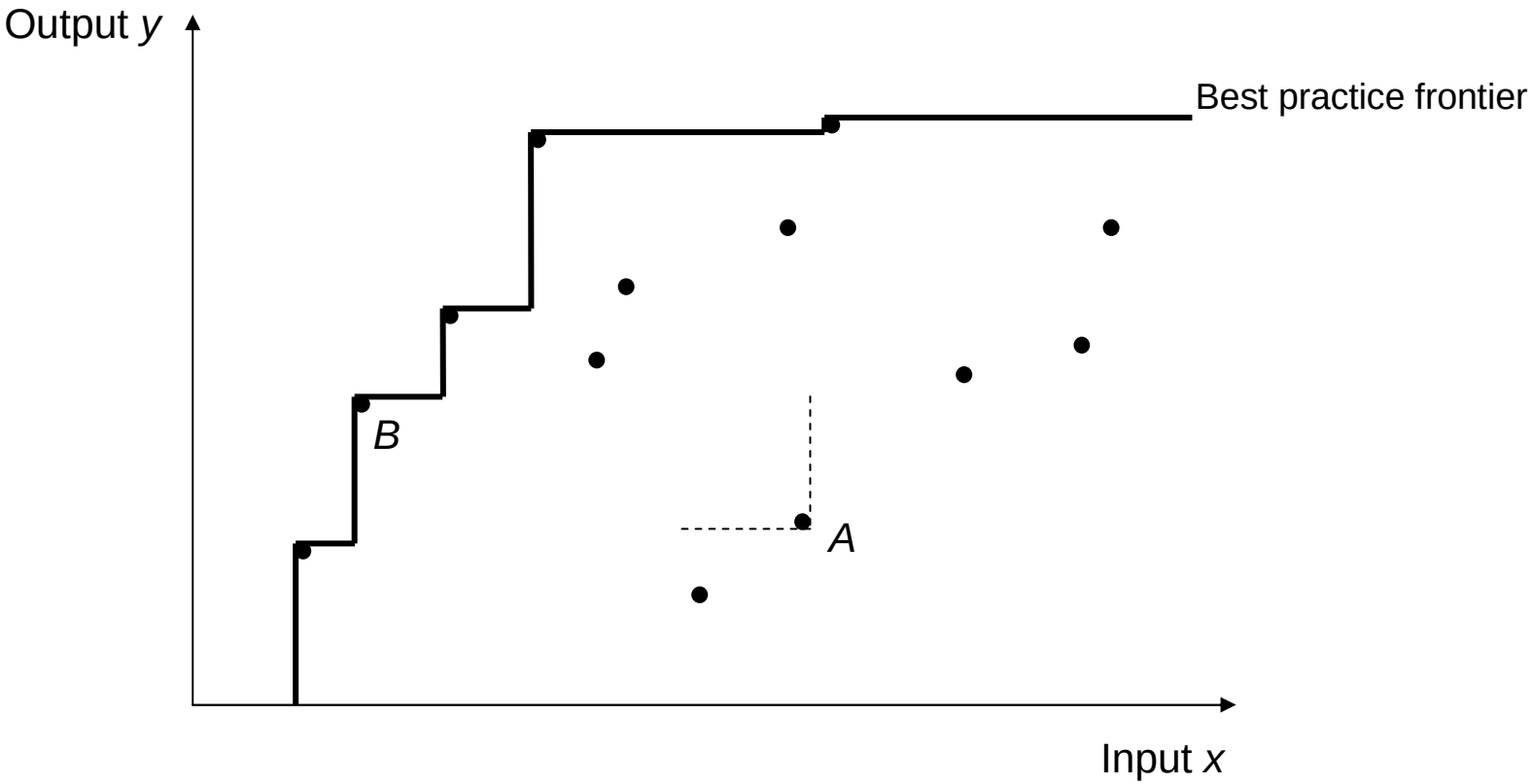
"*Variation in productivity is a measure of our ignorance*"



Measuring productive efficiency

Some intuitive ideas

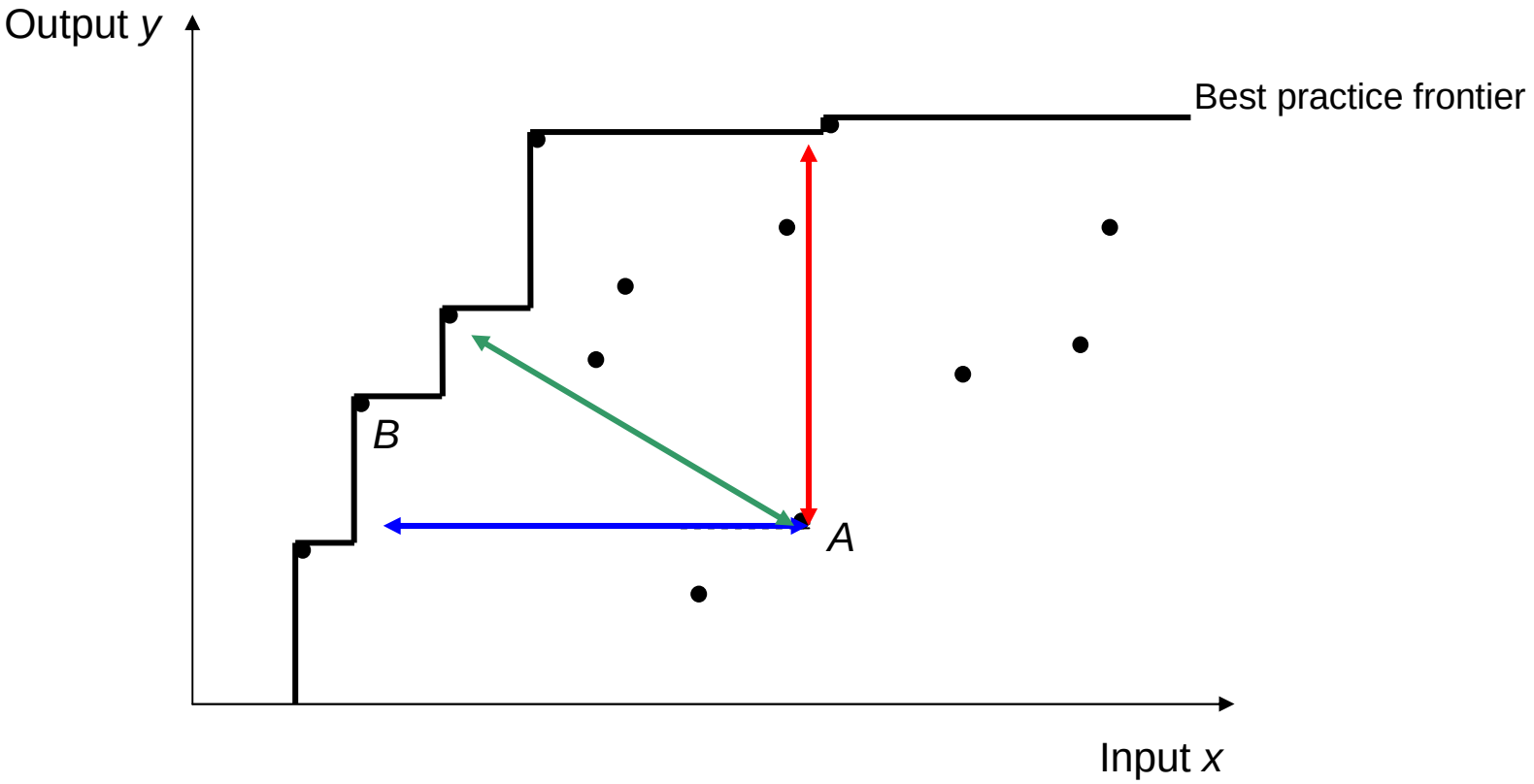
- The Free Disposal Hull model



Measuring productive efficiency

Some intuitive ideas

- The Free Disposal Hull model



Measuring productive efficiency

Some intuitive ideas

➡ Toolbox for regulators / public utlities / sector organizations / …

- How to estimate performance?
- How to allow for exogenous influences?
- How to reduce the impact of a-typical reference observations?
- How to improve your performance?

Contents

Chapter 4: Designing incentives

Problem setting

"*The best of all monopoly profits is a quiet life*"

Merits of competition

↕

Natural monopoly →
- Quiet life (Hicks, 1935)
- *X*-inefficiencies (Leibenstein, 1966)
- excess profits

↓

Solution: A regulatory framework
→ e.g. benchmarking

↓

(1) Yardstick competition: price or revenue cap regulation
(2) Sunshine regulation: 'embarrass' the utilities

➡ This chapter: which incentives foster the performance of water utilities?

Chapter 4: Designing incentives

International benchmarking

➡ Idea: Compare the incentive mechanisms in:

- The Netherlands — sunshine regulation
- England and Wales — yardstick competition
- Australia — corporatization and sustainability
- Portugal — sunshine regulation for private sector
- Belgium — no formal incentives

➡ Procedure:

International benchmarking by combining the data sets

Chapter 4: Designing incentives

Second stage bootstrap

→ Results

Dependent variable ($\delta \geq 1$)	Model 1
Intercept	4.2216 ***
	(0.000)
Leakage (%)	-0.02258 ***
	(0.000)
Industry water / household delivery	0.02396 ***
	(0.000)
Groundwater extraction (%)	-0.0001359
	(0.150)
Gross regional product (PPP/capita)	-6.879 E-5 ***
	(0.000)
log(GRP)	
Consumption per capita	5.716 E-5 ***
	(0.000)
log(consumption per capita)	
Water unique activity (=1)	-0.2644 ***
	(0.000)
Corporatization (=1)	1.2254 ***
	(0.000)
Delivery in one municipality (=1)	-1.3448 ***
	(0.000)
Regulator (=1)	-0.9637 ***
	(0.000)
Benchmarking (=1)	-0.1198 ***
	(0.000)

Scale and scope have effect on performance:
→ Explored in Chapter 5

Regulation improves performance
→ Explored in Chapter 6

Contents

Chapter 5: Big and beautiful?

Problem setting

"*Managers have incentives to cause their firms to grow beyond the optimal size*"

This chapter analyses scale economies for large (i.e. Dutch) and small (i.e. Portuguese) water utilities.

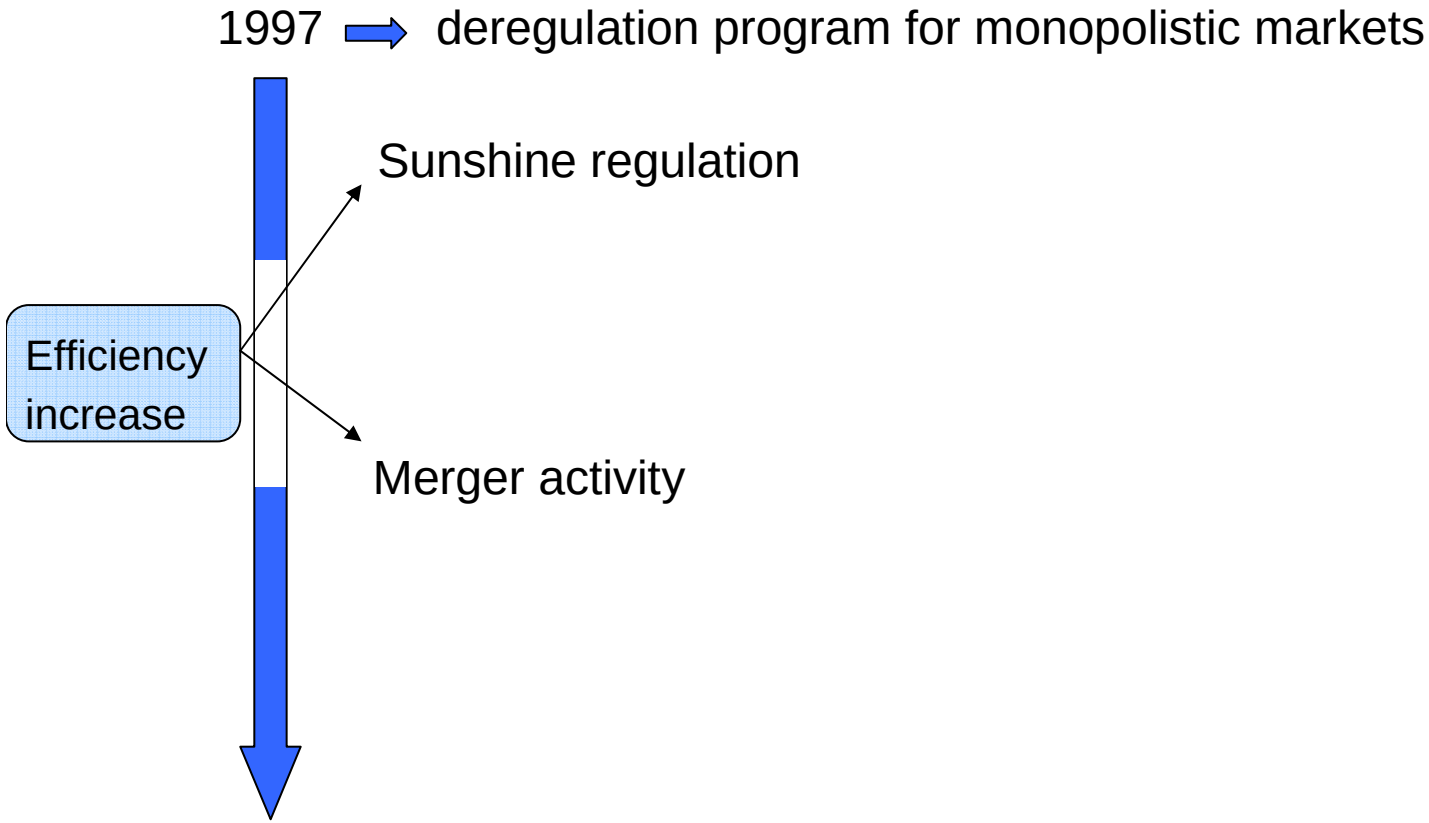
In doing so, we examine also the relationship between:

1. Scale economies ~ merger economies for large utilities
2. Scale economies ~ scope economies for small utilities

Chapter 5: Big and beautiful?

Scale in large utilities: the Netherlands

The Dutch drinking water sector in a nutshell:

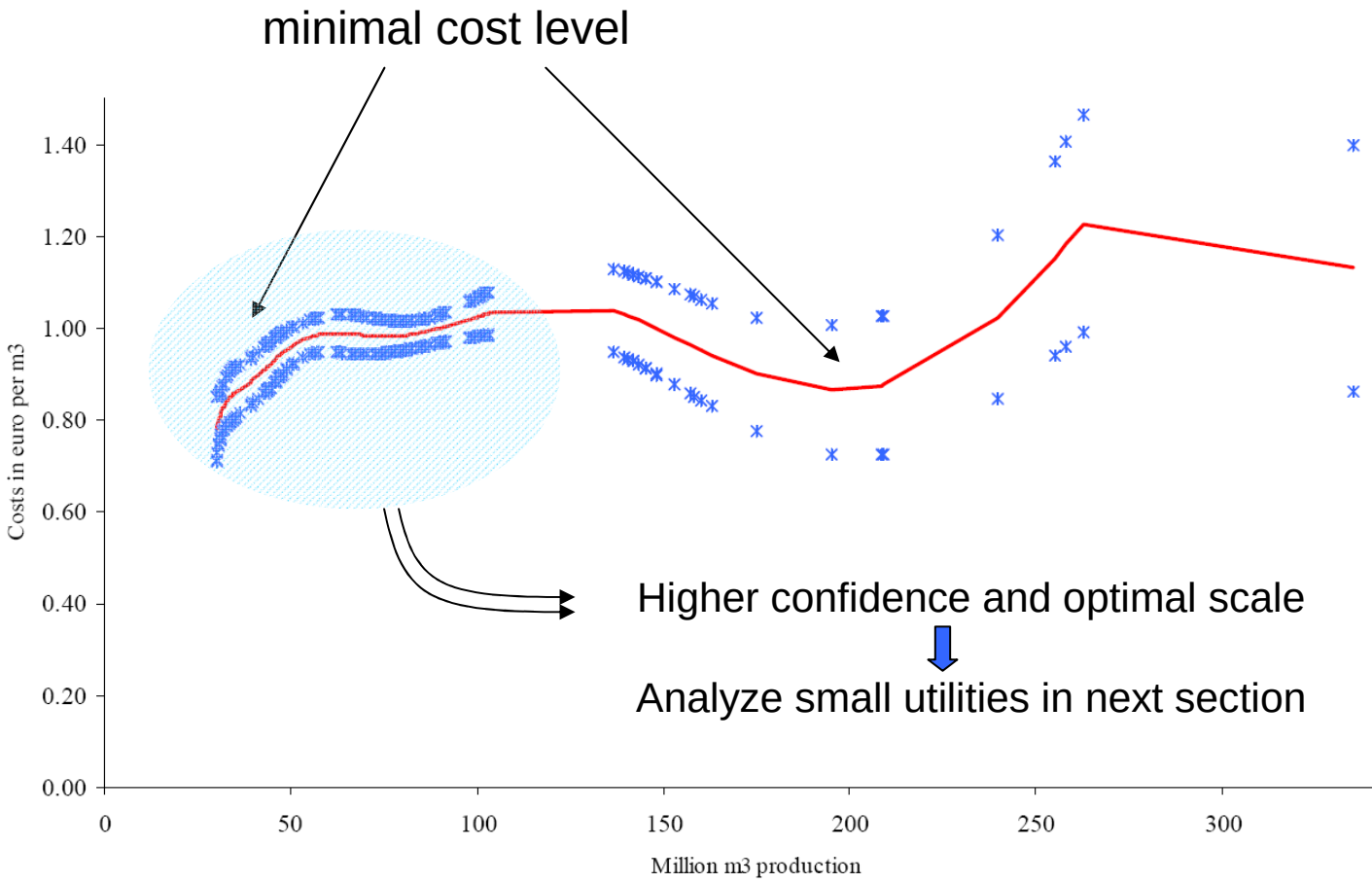


Chapter 5: Big and beautiful?

Results

➡ Sign and scale economies differ for different values of Q

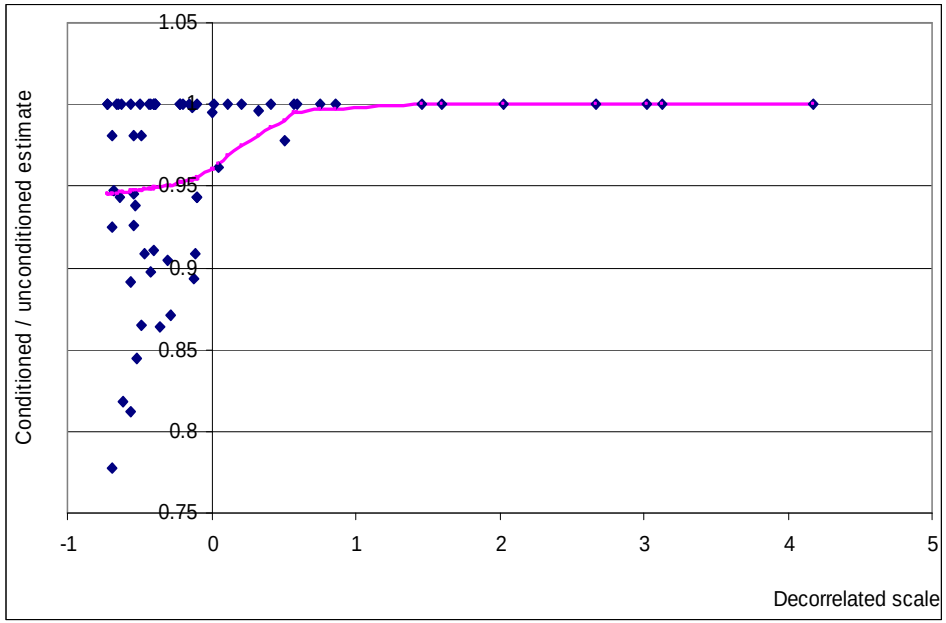
→ the average estimated cost per m³ for each scale level by the use of a Fourier function (parametric) with various exogenous variables.

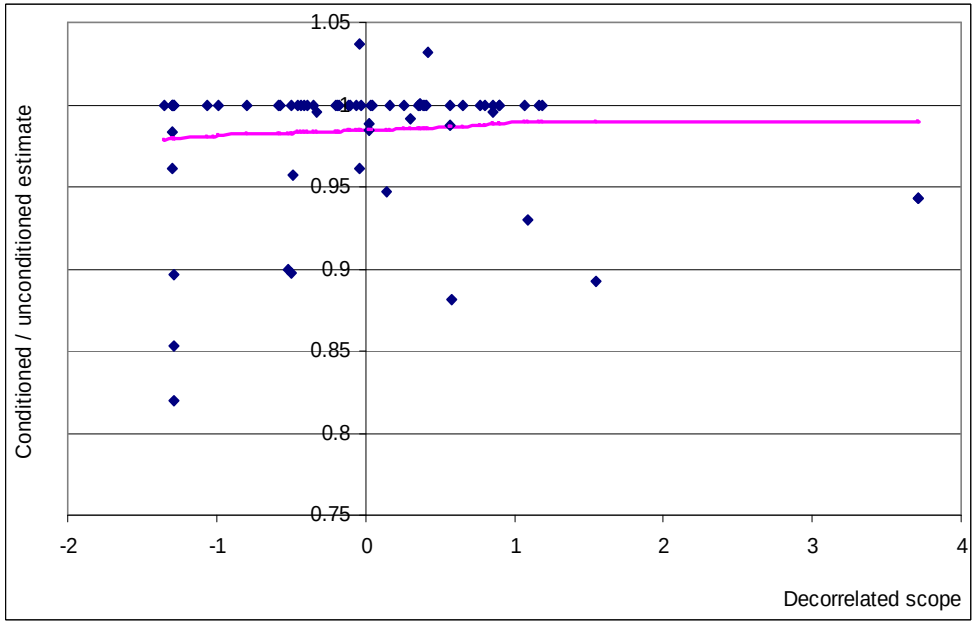


Chapter 5: Big and beautiful?

Results

➡ The existence of scale and scope economies in Portugal





Scale economies for small utilities

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In line with literature

No scope economies

↓

Not in line with literature

➡ Intuitive reason: scale and scope increase the complexity of networks and organization

Difficult to manage

Chapter 5: Big and beautiful?

Conclusion

- Scale economies for small utilities, but not for larger utilities

- Absence of merger economies in the Netherlands
- Absence of scope economies in the Portuguese water sector

↓

Be cautious with respect to factors which undermine the effectiveness of incentive regulation

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Chapter 6: Blaming the regulator

Research questions

➡ Research questions:

1. What are the consequences in terms of price and quantity effects from regulatory uncertainty?

2. Is soft regulation of public utilities effective?

   Hence, could it in practice provide an effective alternative to strict regulation (e.g. yardstick competition of privatized utilities)?

Chapter 6: Blaming the regulator

Decomposing economic profit

➡ Decompose the economic profit change between *t* and *t+1*:

(cfr. Grifell-Tatjé and Lovell, 1999, 2008)

profit in *t* = sum of total revenues – sum of total costs

$$\pi^t = \sum_{m=1}^{q} p_m^t y_m^t - \sum_{l=1}^{p} w_l^t x_l^t$$

by adding and rearranging terms: profit change

$$\pi^{t+1} - \pi^t = \left[(y^{t+1} - y^t) p^t - (x^{t+1} - x^t) w^t \right] + \left[(p^{t+1} - p^t) y^{t+1} - (w^{t+1} - w^t) x^{t+1} \right]$$

quantity effect for fixed prices

price effect for fixed quantities

Chapter 6: Blaming the regulator

Profit drivers

➡ Further decomposition is possible…

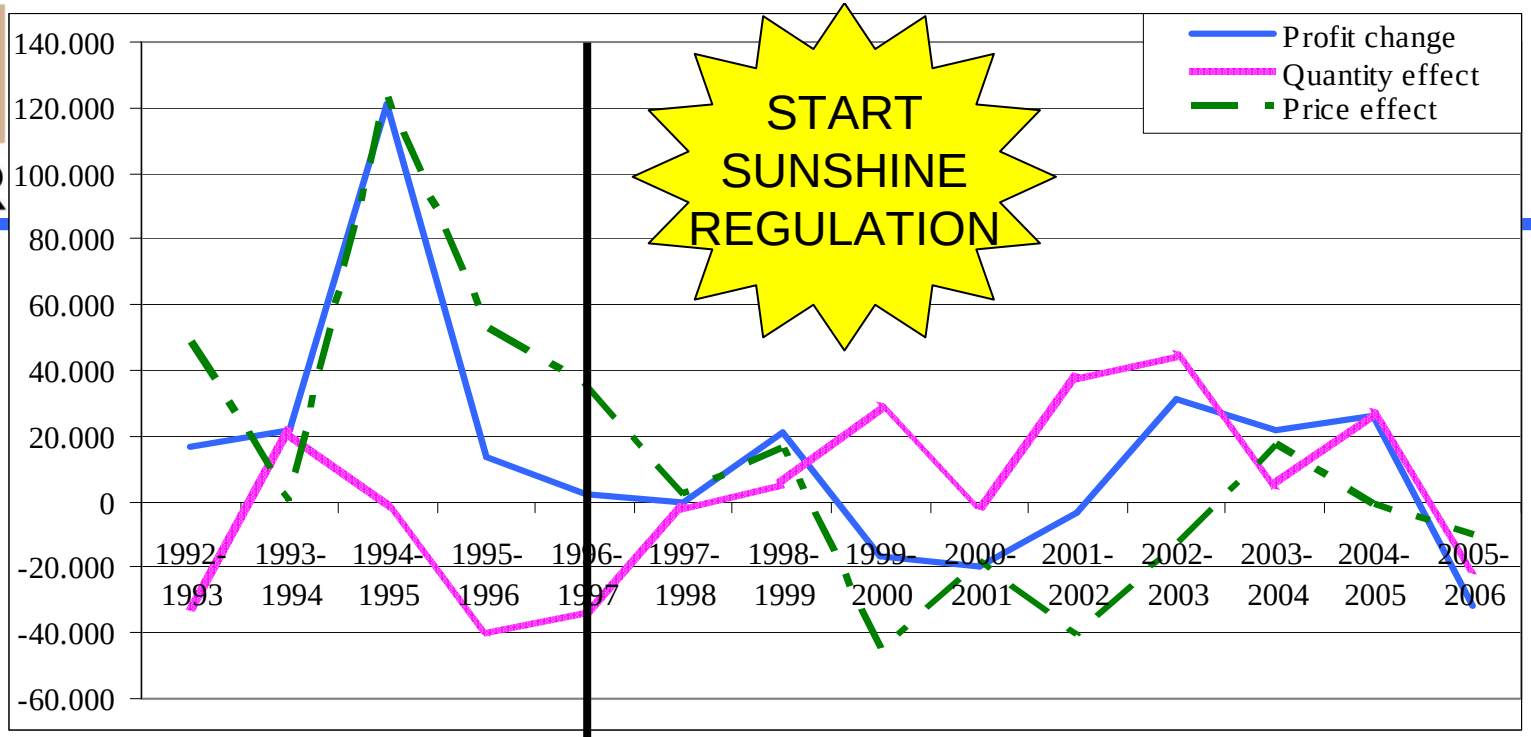
➡ Finally, we obtain 7 profit drivers

Changes in profit

- A. Price effects
  - (1) output price (domestic and non-domestic)
  - (2) input price (for labor, capital and other inputs)
- B. Quantity effects
  - (3) technical progress and regress
  - (4) catching-up effect of inefficient observations
  - (5) scale economies
  - (6) improved resource mix
  - (7) improved product mix

⇩

Relate the profit change and the change in its drivers to the regulatory framework


START
SUNSHINE
REGULATION
Profit change
Quantity effect
Price effect
140.000
120.000
100.000
80.000
60.000
40.000
20.000
0
-20.000
-40.000
-60.000
1992-1993
1993-1994
1994-1995
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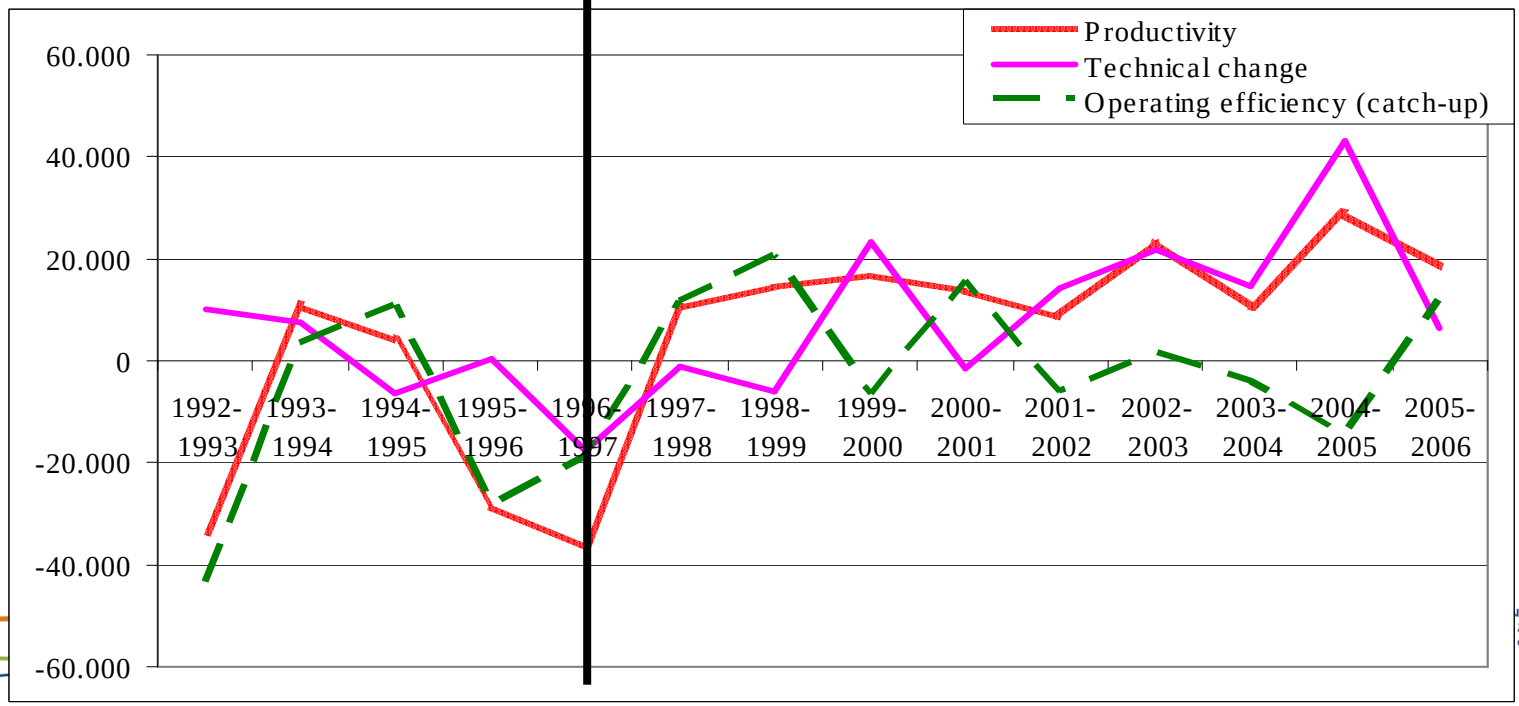
2000-2001
2001-2002
2002-2003
2003-2004
2004-2005
2005-2006


Productivity
Technical change
Operating efficiency (catch-up)
60.000
40.000
20.000
0
-20.000
-40.000
-60.000
1992-1993
1993-1994
1994-1995
1995-1996
1996-1997
1997-1998
1998-1999
1999-2000
2000-2001
2001-2002
2002-2003
2003-2004
2004-2005
2005-2006

Chapter 6: Blaming the regulator

Conclusion

- The light-handed sunshine regulatory model shifted the behavior of the utilities and it significantly incentivized the utilities

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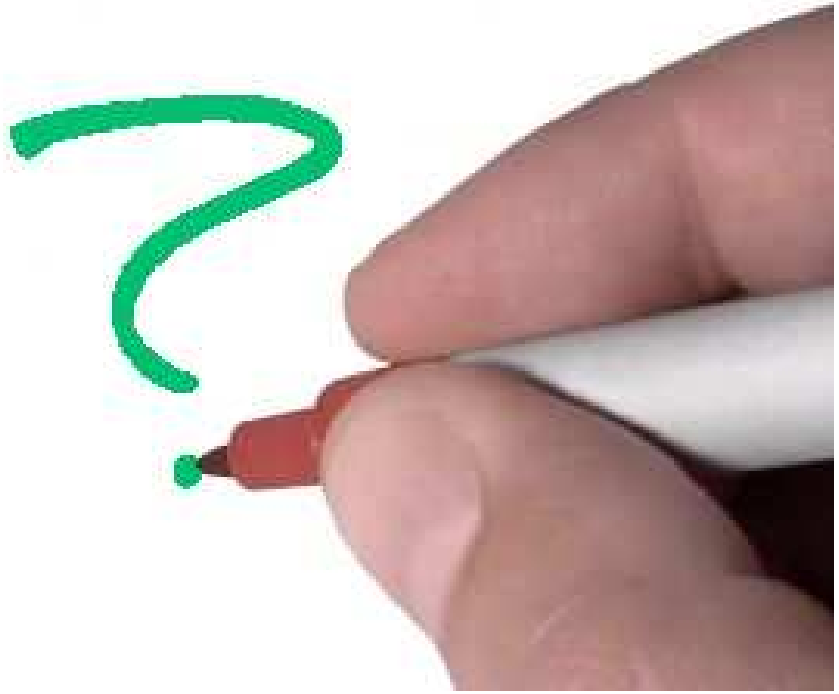

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