From incentive regulation to yardstick competition

Per AGRELL, University of Louvain
Peter BOGETOFT, Yale & CBS

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Outline

Regulation
DEA and incentive theory
Extensions
Summary
REGULATION
Why regulate

Network (distribution) DSOs are natural monopolies
  › Single network for electricity, water, gas etc
  › No near substitute services
  › High economic barrier to market entry

Consequences
  › No competition on the market
  › Too high cost and prices, too low supply, ..

Remedies
  › Competition against a model (on the market)
  › Competition for the market
Regulator acts like proxy buyer

Regulator

Services $y$

Contract $R(y,t)$

Operator

Effort $e$

Cost $C(y,e)$
The “real” model

Legal mandate for regulation

Political Principal

Set of regimes

Court

Ruling

Regulator

Services Y

Contract R(y,t)

Operator

Appeal
Mechanism design is delicate

Multi-task
  › Solves one problem – e.g. high rents
  › Creates new problems – e.g. lower quality and no consolidation

Interaction with other incentives /crowding out
  › Other regulation
  › Professional pride – engineers vs economists
  › Social capital, trust, endogenous institutions
  › Owners (share holder, coop members, voters..)
  › Past, present and future incentives
Mechanism design is delicate (2)

System wide and dynamic effects
› Structural development (scale, scope, take-overs,..)
› Change of power structure inside firms
› Speed of adaptation

Needs a systematic approach
› A decision theoretic approach
› A multiple criteria approach
Regulatory instruments

Instruments

› Cost recovery regimes (cost plus, rate of return etc)
› Lighthanded
› CPI-X
› Concession auctions
› Menu
› Constrained negotiations
› Technical norm models
› Yardstick
German regulation

Looks complicated:

\[ R^k(t) = C_{nc}^k(t) + (C_{inc}^k(0) + (1 - V(t))C_c^k(0)) \left( \frac{RPI(t)}{RPI(0)} - x(t) \right) ExFa(t) + Q(t) \]

\[ ExFa^k_j(t) = 1 + \max \left( \frac{L_j^k(t) - L_j^k(0)}{L_j^k(0)}, 0 \right) \]

But essentially a CPI-X model
Ex ante CPI-X Scheme

Predicted future costs sets allowed future revenue

Historical costs lowered according to ex ante plan

E.g.: \( R(t) = C(0)(1-x-x_i)^t \) for \( t = 1, \ldots, T \)
Revenue scheme

Controllable cost

2013  2015  2016  2017  2018

Incumbent inefficiency, $X_i$

Real terms - subject to adjustment for inflation and volume changes each year
Some CPI-X problems

- Bankruptcy of good firms with too high $X$
- Excessive rents by all firms with too low $X$
- Ratchet effect when updating $X$
- Arbitrariness of the PI or CPI measure
- Arbitrariness of the $X$ parameter
- Inability to include changing output profiles

A possible solution: Yardstick competition
Ex post Yardstick scheme

Actual future costs of "competitors" determines allowed future revenue. E.g. average model

\[ R_i(t) = \frac{1}{n-1} \sum_{j \neq i} C_i(t) \text{ for } t = 1, 2, \ldots \]
DEA based yardstick scheme

Re revenue = Actual Costs + \( \rho \) (DEA-est. cost savings)

\[ R(y_t) = C(t) + \rho \cdot (C^{DEA,t}(y_t) - C(t)) \]
Regulatory life-cycle

- 0. Cost-recovery
  Pre IEM 1996

- 1. Incentive regulation (Cost)
  IEM 1996

- 2. Incentive regulation (Cost, Quality)
  IEM 2003

- 3. Yardstick regulation
  IEM 2009-

Incentive power vs. Time (Market development)
Pros and cons of yardstick regime

Advantages

› DSOs insured against all general risk factors
› No risk of excessive rents or bankruptcy from under- or over- evaluated X
› No Ratchet effects at the end of regulation period
› No need to include arbitrary inflation indices
› No need to for arbitrary expansion factors
› No problem adjusting DSO scopes, include new task or eliminate old tasks
› Mistakes in data and models only have one period impact
Pros and cons of yardstick regime

Disadvantages

› Detailed data to be delivered every year
› Models need to be reestimated every year
› Major revision of model structure and cost drivers can still be done every five year
› Financial accounting may be more difficult since liabilities and assets only knows with delay of approx one year.
DEA AND INCENTIVE THEORY
What we know

Under certain reasonable conditions…..

\[ B^{*k} = B^k(x^k, y^k, C^{DEA}(\cdot | x^{-k}, y^{-k})) \]

Optimal compensation = \( B^k \) (Own production, DEA model based on others)

Crucial to rely on super-efficiency (95)

› Using super efficiency, one can support the implementation of most plans.
What we know (2)

DEA based yardstick competition optimal (Bogetoft 97,00)

\[ B^* (y^k) = b^k + C^{DEA} (y^k | x^{-k}, y^{-k}) \]

Optimal compensation = Lump sum + DEA cost norm ex ante

› Verifiable cost x

\[ B^* (x^k, y^k) = b^k + x^k + \rho^k (C^{DEA} (y^k; x^{-k}, y^{-k}) - x^k) \]

Optimal compensation = Lump sum payment
  + Actual costs
  + \rho^k (DEA estimated cost savings)
What we know (3)

DEA incentives may support innovation (02)
DEA based dynamic yardstick competition (05)

\[ B_i^{*k}(x_i^k, y_i^k) = b_i^k + x_i^k + \rho^k(C^{DEA}(y_i^k | x_{1-i}^{-k}, y_{1-i}^{-k}) - x_i^k) \]

Optimal compensation = Lump sum payment
+ Actual costs
+ \rho^k (DEA estimated cost savings)
What we know (4)

Rational inefficiency (03, 09a-c, 11)

› Estimate revealed preferences for slack
› Planning with slack incentives in the case of multiple inputs and outputs
EXTENSIONS
Menu

Sub-optimal to treat different firms and consumers similarly

Possible to make better trade-offs of costs and benefits by having multiple regulations.

Like a restaurant serving multiple courses
Menu examples

Implicit

› NO og DE: Best-of wrt capital evaluations – book values or replacement values
› DE: Best-of wrt benchmark method

Explicit

› DE: Choice between model based or 8% requirement
Negotiations

Direct negotiations with regulator
  › Cost plus
  › UK and US system

Constrained bargaining
  › Establish purchasing groups
  › Regulator limits the negotiation space
  › NL and Florida
Structural efficiency

\[ \mathbf{x}^1 + \mathbf{x}^2 \]

\[ \mathbf{y}^1 + \mathbf{y}^2 \]
Simple scale effect

\[ \text{Input} \times 1 \times 1 + \text{Input} \times 2 = E(\text{Input}_1 + \text{Input}_2) \]

Output

\[ y_1 + y_2 \]

\[ y_2 \]

\[ y_1 \]

\[ A + B \]

Farrell

\[ x^1 \]

\[ x^2 \]

\[ E(x^1 + x^2) \]

\[ x^1 + x^2 \]
Mix (Scope, Harmony)
Examined 2729 potential mergers
Regulatory adjustments

Norway
› Norwegian DSOs under yardstick revenue cap
› 10 years of harmony gains as windfall gains – then sharing gains with consumers

Netherlands
› Evaluate mergers
› Only scale gains count
› Learning and scope effects can be obtained without full scale merger
SUMMARY
Conclusions 1

Large amount of research on regulation and on benchmarking

Some research that link the two

› But we need much more

State-of-the-art applied regulation

› Is based on incentive (agency) theory
› Is model based
› Use frontier methods like DEA and SFA
› Is cautious since mechanism design is delicate
Conclusions 2

Some topics for further research

› How combine formal agency theory and DEA
› How efficient are different regulations?
› How fast can firms really adjust?
› How to use menu of regulations?
› How include quality incentives?
› How ensure structural and dynamic efficiency?
› How support learning?