



Evolutionary Regulation: From CPI-X towards contestability

ENCORE Workshop

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About us

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Managerial Economics:
– Decision Theory (MCDM), Efficiency Evaluation (DEA) and
Incentive Theory (Agency, Contracts)

Regulation in the electricity sector
– SE, NO, DA, NL, BE, AU



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Outline

- Regulatory objectives and approaches
- Dynamic regulation
- CPI-x
- Yardstick Competition
- Towards Contestability
- Menus of regulation
- Future work

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Regulatory objectives and approaches

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Three general objectives

Coordination: ensure that the right services are produced at the right time and place.

Motivation: ensure that the parties have individual incentives to make coordinated decisions.

Transaction costs: ensure that coordination and motivation are provided at the lowest possible cost

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Two general alternatives



Market fails when

- Externalities
- Public goods
- Natural monopolies
-

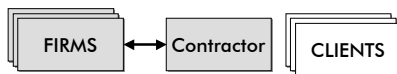
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Two different regulatory roles

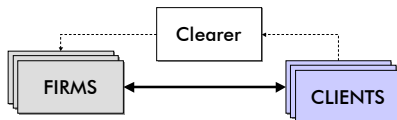
EX ANTE

Revenue generator
Proxy contractor
Market engine
.....



EX POST

Market monitor
Surveillance
Structurer
.....



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Contractor or Clearer

Contractor ex ante

- The Regulator acts on behalf of captive clients to sign a service contract. Regulator defines service and conditions, monitors moral hazard in the quality of the service.

Ex post clearing

- The firms contract freely with the clients. The Regulator enforces that the ex post settlement is at "competitive" terms using a yardstick and monitors collusion

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Towards rational regulation

Design of contracts and incentive regulation is delicate

- Solves one problem – e.g. high rents
- Creates two new problems – e.g. reduce quality and encourage coalitions

A holistic and decision theoretic approach is needed

- Alternatives
- Objectives
- Context

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Alternatives

Classics

- Cost plus
- Rate of return
- CPI-X
- Yardstick
- Contestability

Elements

- ex ante versus ex post
- high powered versus low powered
- light handed versus heavy handed
- pure versus mixed
- central versus delegated (self regulation)

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Objectives

Coordination

- Short run
 - Cost minimization
 - Risk sharing
- Long Run
 - Learning and innovation
 - Structural development
 - Investments in specific assets

Motivation

- Individual incentives
- Group and coalition incentives

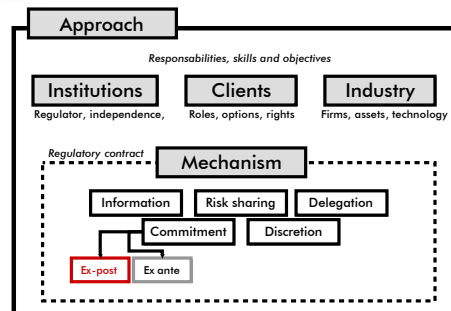
Transaction costs

- Regulator
- Firm

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Context



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What can we accomplish ?

Less optimistic theorist – more optimistic practitioner ?

- 80': Optimistic agency theorists, reluctant practitioners
- 90': Cautious theorists (multi-task), eager practitioners

What about:

- Reputation and reputation
- Trust, social capital
- Endogenous institutions and firms
- Change of power structure inside firms

Dynamics regulation takes us part of the way

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Electricity distribution

Country	Regime	Information	Model	Operation
Sweden	Lighthanded	Ex post	DEA/ideal grid	1996-
Norway	Revenue cap	Ex ante	DEA	1992-
Finland	Lighthanded	Ex post	DEA	1998-
Denmark	Revenue cap	Ex ante	COLS	2000-
Netherlands	Revenue cap	Ex ante	DEA/cost	1999-
Austria	Revenue cap	Ex post	DEA/Ideal	2003-
Spain	Revenue cap	Ex ante	Ideal grid	2000-
Chile	Price cap	Ex ante	Ideal grid	1982-
New Zealand	Revenue cap	Ex ante	DEA	199x-

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Options in DK stock companies

År	All companies	Top-100-companies	KFX-companies
1996	3%	5%	0%
1997	7%	14%	5%
1998	18%	29%	38%
1999	27%	43%	55%
2000	41%	59%	68%
2001	49%	63%	74%

Source: Ken Bechmann and Peter Løchte Jørgensen (2002)

Note: KFX is the Copenhagen Stock Exchange's leading share index

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Dynamic Regulation

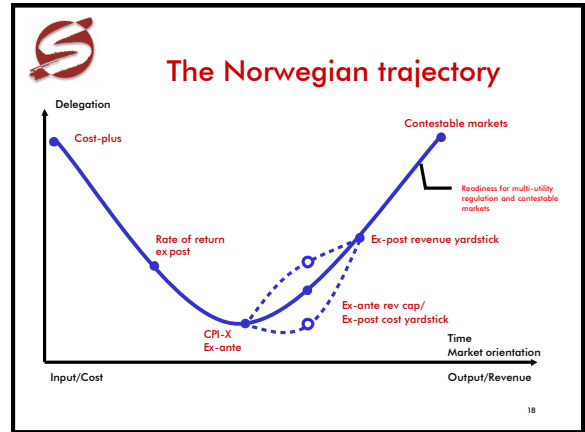
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S Motivation

Electricity distribution etc is a long-run engagement
 Regulation is a long-run game
 Behavior is a response to

- past
- current
- anticipated regulation

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S We only start to learn

What determines

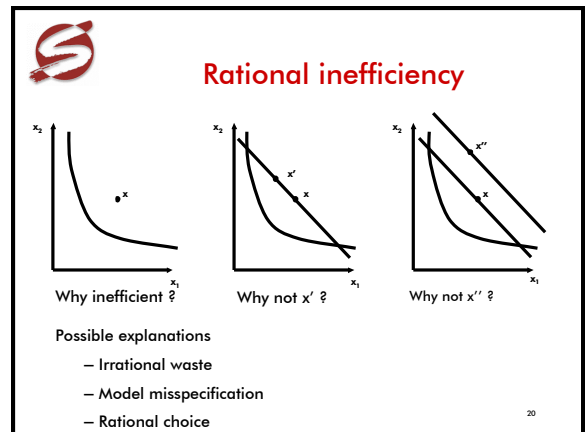
- Technological development
- Time to adapt and restructure
- Endogenous preferences

We know little about dynamics!

Fundamental questions:

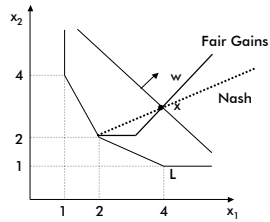
- Why do we see inefficiency ?
- Irrational or rational ?
- How does it change ?
- How is it affected by regulation ?

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Rational dynamics



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CPI-X Regulation

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CPI-X Scheme

$$R(t) = C(0)(1 - x - x_i)^t \text{ for } t = 1, \dots, T$$



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The Norwegian Scheme (I)

Cost Model:

- DEA cost model to estimate individual inefficiencies and general productivity development

Payment Scheme:

- Revenue cap with rate-of-return restrictions and an efficiency incentive.
- 2 year review period
- 5 year regulation period
- Deviations (+/-) accounted for in next regulation period

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The Norwegian Scheme (II)

Core of the regulatory scheme:

$$R_t = PI_{t,t-1} \cdot QI_{t,t-1} \cdot (1 - \pi - \eta) \cdot G_t \cdot R_{t-1}$$

$$c_t + \gamma^{\min} \cdot X_t \leq R_t \leq c_t + \gamma^{\max} \cdot X_t$$

where

R revenue

c costs

PI price index

QI quantity index

G truncated DEA efficiency $\min\{(1 - E_0)/(1 - E^{\text{low}}), 1\}$

π general productivity improvement (1,5%, Malmquist based)

η catch up coefficient (max 38.24% eliminated in 4 years)

γ rate-of-return bounds (2%-15%)

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Some CPI-X problems

Some well-known problems with CPI-X:

- 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 CPI/RPI/?PI measure(s)
- Arbitrariness of the X parameter
- Inability to include changing output profiles

A possible solution: Yardstick competition

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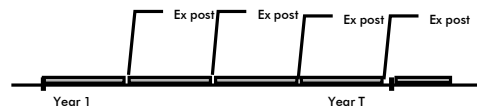
Yardstick Regulation

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Traditional yardstick scheme

$$R_t(i) = \left(\frac{1}{n-1} \sum_{j \neq i} \right) R_t(j) \quad \text{for } t = 1, \dots, T$$



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Multiple dimensional yardstick

Use frontier model

- like DEA

Use super-efficiency

- i.e. evaluate performance relative to $C^{DEA-i}(y)$

Useful in general when

- Complex underlying technology / cost structure
- Limited noise

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DEA based yardstick scheme

Situation

- Technological uncertainty,
- Risk neutral DMU maximizes {Profit + ρ *slack} where $0 < \rho < 1$ is the relative value of slack

Result:

- Optimal revenue cap with verifiable costs:

$$k + c + \rho * (C^{DEA}(y) - c)$$

Constant + Actual Costs + ρ of DEA-est. cost savings

Extensions:

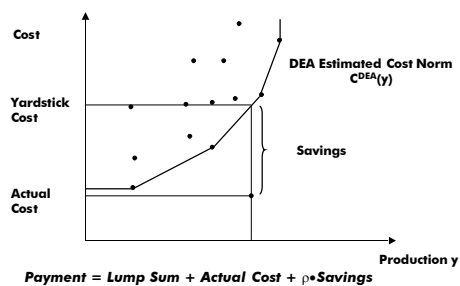
- Similar schemes work under varying demand assumptions, genuine social benefit function, etc.

- Hence: DEA based ex post regulation provides an optimal revenue cap

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Illustration



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Sequential yardstick

Additional dynamic issues

- Accumulate and use new information
- Avoid ratchet effect

Result:

$$k + c_i + \rho * (C_{i-1}^{DEA-i}(y) - c)$$

Constant + Actual Costs + ρ of DEA-Est. Cost Savings

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Applied yardstick scheme

- Situation:
 - Limited catch-up capability
- Result:
 - Optimal revenue cap with limited catch-up capability:

$$k + c_t + \rho \cdot ((1 - \delta)(1 - E_0)) \cdot C_{1,t}^{DEA}(y) / E_0 - c_t$$

Constant + Actual Costs + ρ of adjusted DEA-est. cost savings

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Structural Developments

- Final concerns:
 - Scale adaptation
 - Scope adaptation
 - through incentives and concession granting
- Mergers:
 - Adjust DEA based yardstick to share scale and scope gains
- Auctions:
 - DEA based yardstick to aggregate multi-dimensional bids, cf. below

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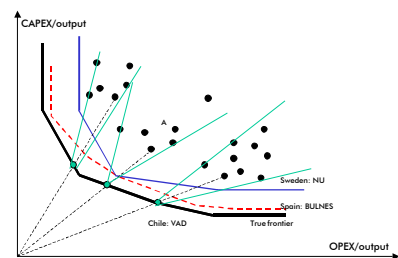
Technical Yardsticks

- Chile
 - Yardstick and ideal nets
- Spain
 - Ideal networks
- Sweden
 - Network utility model

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Technical norm yardsticks



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Empirical significance

1. Revenue cap CPI-X
Based on 96/97 productivity estimates
2. Norwegian DEA system (uncapped)
3. Norwegian DEA system (capped)
4. DEA Yardstick

$$b_t^A(y_t) = c_t + R_0 - c_0 + \rho(c_t^o E_t^{sr} - c_t^o)$$

actual cost cost sharing
allowance initial profit

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Results

	Year					Losses: $b_t(\cdot) < c_t$		
	1997	1998	1999	2000	Total	Freq #	2000	Total
$R_0 - c_t$	4,267	4,395	4,038	4,106	12,540	19	66	103
$b_t^A(y_t) - c_t$		3,523	2,470	1,609	7,602	103	406	664
$b_t^N(y_t) - c_t$		3,770	3,120	2,708	9,598	74	263	435
$b_t^C(y_t) - c_t$		3,816	3,246	2,971	10,033	0	0	0
$b_t^A(y_t) - c_t$		3,535	3,246	2,898	9,679	71	169	553

TABLE 7. Information rents regulation regimes R, N, A 1998-2000.

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Illustrations

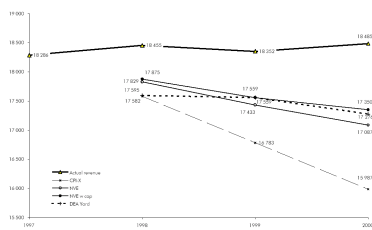


FIGURE 4. Actual costs c_t and reimbursement norms b_t^A , b_t^N , b_t^C , with or without cap, b_t^C .

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Towards contestability

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Natural next step

INPUT-based

- Cost-oriented
- Process defined
- Service fuzzy

OUTPUT-based

- Revenue-oriented
- Process irrelevant
- Service defined

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The future

Structural and technology change
will finally neutralize the yardstick mechanism

Solutions

- Few, large firms: anti-trust, light-handed regulation
- Many, small firms: franchising type regulation

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DEA based auctions

DEA based yardstick schemes:

- Use historical or future data to monitor and motivate agents to proper action

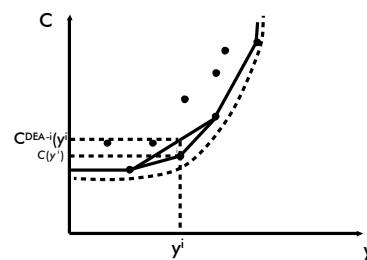
DEA based yardstick auctions:

- Evaluate non-realized multidimensional bids – oppose to realized production plans
- *Procurement mode as opposed to a control*

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DEA based concession auctions



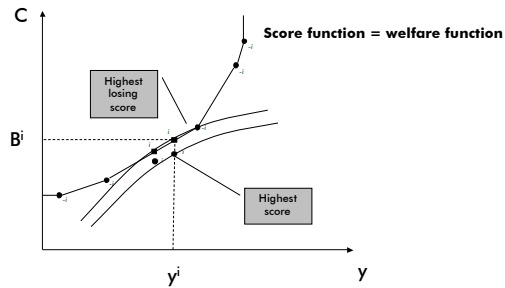
Like (generalized) second price auctions

Like yardstick competition with non-verifiable costs!

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DEA based score auction



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Menus of regulation

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Basic Ideas

Create social welfare gains by better adaptation of costs and benefits

Sub-optimal to treat all areas equally

Gains generated by exploiting differences on the supply and demand sides

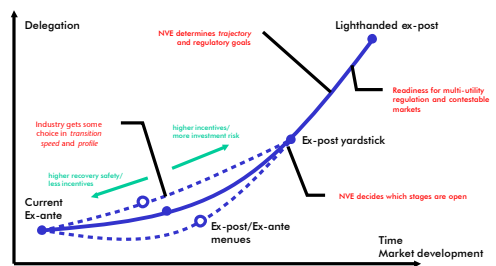
Instead of trying to make everyone happy by the same product, we differentiate the product to take advantage of local demand and cost conditions

Minor point: May have to forego some social welfare to ensure an appropriate division of the gains (the social welfare cake)

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Path menu



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Example: CPI-X vs Yardstick Menu

CPI-X Contract

Your revenue cap is developing according to the formula $R(t) = C(0)(1-x)^t$ for $t = 1, \dots, T$

Yardstick Contract

Your revenue cap is developing according to the formula $R(t) = C(t) + \rho(C^*(t) - C(t))$ for $t = 1, \dots, T$

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Analysis

Choice between them depends crucially on

- Historical slack in the firm: $C = C_{\min} (1+s)$
- Stipulated productivity : x
- Expected productivity: y
- Planning period: T

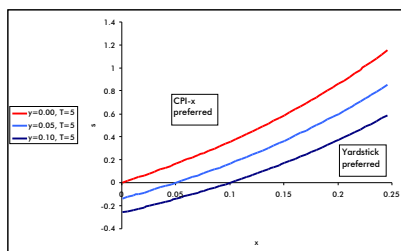
The Yardstick scheme is more

- Competitive
- Protective against unrealistic stipulations / projections
- Protective against industry wide effects

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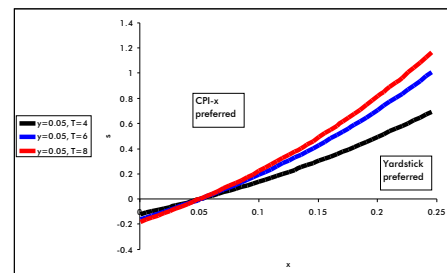
Choice and x, y and s



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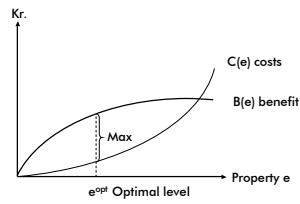
Choice and T



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Optimal level of a property

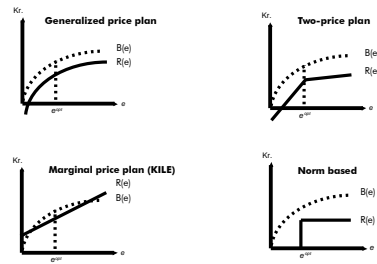


e = quality, reliability, capacity, consumer coverage, response time, environmental protection etc.

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Steering mechanisms

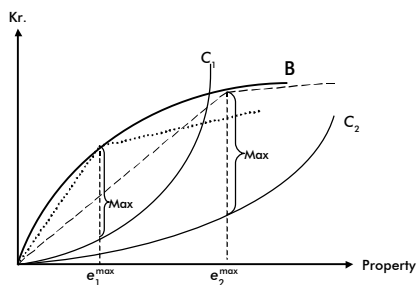


Requires different information to regulator
Share to consumers may vary

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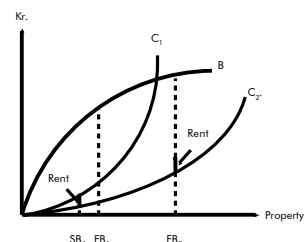
Differences between companies



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Second Best



To motivate:
Give more rent to Firm 2 – or reduce output from Firm 1

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Future Work

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Research Topics

Rational inefficiency

- Why are firms inefficient?
- How do they adapt to regulation?

Endogenous institutions

- How do technology adapt to regulation?
- How do preferences adapt to regulation?

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