A plea for innovative and fair remuneration of distribution grids:

A tale of sticks and carrots

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Ein Unternehmen der EnBW

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Agenda

1. **Types of regulation in a nutshell**
   - Cost plus regulation
   - Incentive regulation
   - Incentive regulation with yardstick
   - German regulation incentive scheme
2. **Current discussions around the German incentive regulation scheme**
   - Future reimbursement of past capital expenditure
   - Disincentives caused by unequal treatment of OPEX and CAPEX
   - Appropriate level of sectorwide X-factor
   - Appropriate level of individual X-factor
3. **Conclusions**

Economics of regulation

Why is regulation needed ? (Baumol et al., 1988)

- Natural monopoly due to sunk investments (e.g., tubes, pipes, cables)
- Overpricing can result in welfare losses
- Waste of resources („quiet life hypothesis“, Hicks, 1935)

Why is regulation difficult ? (Laffont and Tirole, 1993)

- Asymmetric/private information: incentive rules that trade off informational rent extraction and cost-saving inducement
- Participation constraint: to ensure investments in grids, at least (efficient) costs need to be reimbursed ($\pi \geq 0$)
- Commitment problem of regulators due to sunk investments

Stylized model of an optimal regulation scheme

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Incentives: informational rent extraction

Cost control: cost cutting requirements

Commitment: Do not take carrot away once the donkey reaches it

Participation constraint: Do not forget to feed the donkey

Types of regulation: cost plus regulation

reimbursement based on actual cost

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Revenue equals cost (including fair rate of return on equity)

$$Rev_t = Cost_t$$

Advantage: budget constraint automatically satisfied

Disadvantage: waste of resources

- Allocative inefficiency (AVERCH & JOHNSON, 1962): excessive amounts of capital accumulation, gold-plating
- X-inefficiency (Leibenstein, 1966): lack of competition makes it possible to use inefficient production techniques, but still stay in business
- Transaction costs: cost control is very costly for firms and regulator

No carrot, little stick.

Types of regulation: incentive regulation
reimbursement based on a cost budget

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Revenue cap regulation: reimbursement based on cost budget

$$Rev_t = Cost_0 \times (CPI - X)$$

Advantage:

- Budget constraint satisfied (if X is set correctly)
- Dynamic incentives to lower costs over time
- Lower transaction costs

Disadvantage:

- Ratched effect (base year ralley)
- Requires stable markets (no change of supply task of the DSO)

Carrot, but very little stick.

Types of regulation: incentive regulation with yardstick
reimbursement based on an "efficient" cost budget

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Revenue cap regulation: reimbursement based on "efficient" cost budget

$$Rev_t = X_{ind} \times Cost_0 \times (CPI - X)$$

Advantage:

- Budget constraint satisfied (if X is set correctly)
- Dynamic incentives to lower costs over time
- Lower transaction costs
- Punishment for the ratchet effect

Disadvantage:

- Best you can get is reimbursement of "efficient" cost ($\pi \leq 0$ rather than $\pi \geq 0$)
- Requires stable markets (no change of supply task of the DSO)

Very little carrot and a lot of stick, high risk due to reversal of participation constraint.

German incentive regulation
mixture of all schemes

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Revenue cap regulation (simplified formula):

$$Rev_t = Cost_t^{nc} + X_{ind} \times (OPEX_0 + CAPEX_0) \times (CPI - X) + CAPEX_t$$

Non-controllable OPEX: cost-pass-through

OPEX:

- Minimum of base year OPEX or average OPEX past regulatory period
- Limits incentives for base year ralley

CAPEX:

- Cost-pass-through (beginning with third regulatory period)
- "Energiewende" causes substantial investments, reimbursement of CAPEX not guaranteed by previous regulatory system
- Base-year CAPEX exposed to efficiency benchmark

Right balance between carrot and stick?

Regulatory promises and regulatory hold up

Amendment of the German incentive regulation directive

- Policy change for CAPEX: from budget approach to cost plus
- Leads to devaluation of capital assets
- Investments between 2007 and 2016 are not fully reimbursed

Transitional arrangement

- Continuance of budget principle for investments 2007 - 2016 for one regulatory period
- Still not enough to achieve full reimbursement of past investment

Took away the carrot before donkey reached it.

Classical commitment failure: The right of continuance period should be prolonged to ensure trust in regulation.

Regulator´s fear: Distortions because of unequal treatment of OPEX and CAPEX

Outline of the problem

- OPEX is reimbursed on a fixed budget that is exposed to an efficiency benchmark
- CAPEX is yearly adjusted on cost-plus basis, base year CAPEX exposed to efficiency benchmark

fear that firms overinvest (Averch-Johnson-Effect light)

Necessary condition for Averch-Johnson-Effect:

- Substitution possibilities between production factors
- Regulated return on equity is set too high

reality check 

Reality check: How much substitution is possible?

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Remember: We transport and distribute electricity using grids.

How much capital can we substitute ?

Distortions due to unequal treatment of OPEX and CAPEX: reality check

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Necessary condition for Averch-Johnson-Effect:

- Regulated return on equity is set too high
- Enough substitution possibilities between production factors

Reality check:

- 1000 DSO filed appeal against decision on regulated rate of return

  ⇒ and won in the first instance!

- only limited substitution possibilities between production factors

Keep in mind:

- Investments are sunk, long-lasting (> 40 years) and exposed to benchmarking. Would a rational investor really risk 40 years of inefficiency?

The general X-factor is a „correction factor“ for CPI
(SAPPINGTON & BERNSTEIN, 1999)

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Incentive regulation allows price inflation over time („nothing gets cheaper“):

- CPI reflects private consumer price changes (food, housing or clothing)
- X-factor corrects CPI so that CPI-X corresponds to expected future cost changes in network industry

X-factor can have any sign (empirical question):

- **= 0**: true costs development in network industry like CPI
- **> 0**: true costs development in network industry less than CPI
- **< 0**: true costs development in network industry higher than CPI

The X-factor imposes no incentive (carrot), but participation constraint could be violated if X is set too high (too much stick).

Past level of general X-factor was far too high

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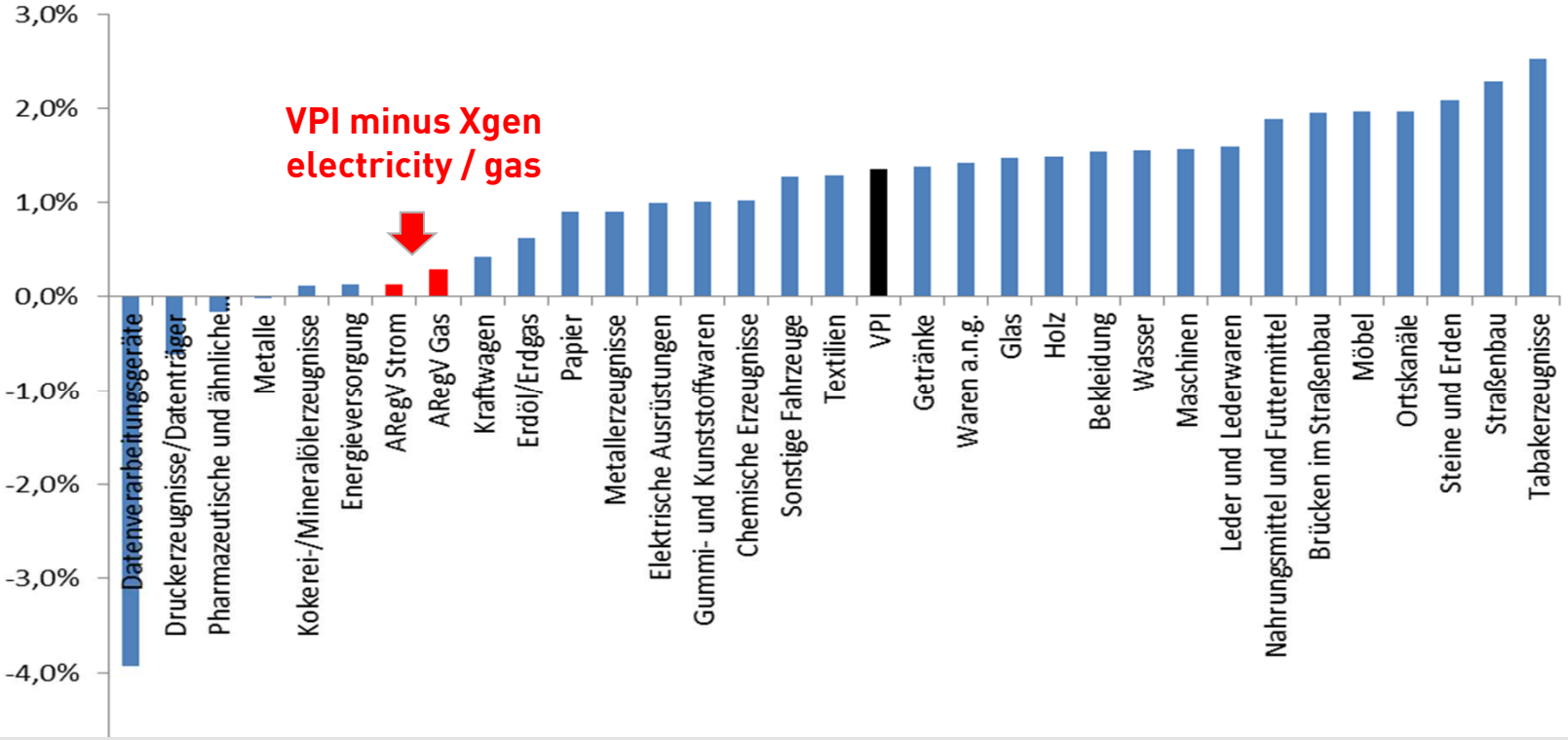
Average yearly price increases for different industries compared to regulatory allowed price increase for DSOs between 2007 and 2016



Only computer, pharmaceutical, oil, steel industry with lower price increases in period under consideration.

Setting the general X-factor for the future is extremely challenging

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Incentive regulation allows price inflation over time („nothing gets cheaper“):

- Regulator sets X-factor for gas DSO/TSO equal to 0,48 % for third regulatory period, process still ongoing for electricity DSO/TSO

Economic reasoning

- True X-factor could well be zero or even less than zero
  - network industry is an old, established industry with low productivity gains
  - high capital intensity with long lasting sunk assets (> 40 years)

Empirical evidence

- Results from different methods and time periods are inconclusive
- Estimates range from -2% to 3%

Setting the X-factor equal to zero is just enough stick!

The efficiency benchmark can be a stick or a carrot

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Benchmark based on the efficient cost frontier

- Places high weight on consumer surplus
- Simulates a market equilibrium
- "All you have to do is to imitate the efficient firms"
- Budget constraint for an efficient firm: $\pi = 0$ (else $\pi < 0$)

YardSTICK !

Benchmark based on an average cost frontier (SHLEIFER, 1985)

- Reduces risks to the producers, overachievement possible
- Allows an endogenous adjustment process
- Provides incentives to push the cost frontier by keeping extra-profits
- Budget constraint for an efficient firm: $\pi > 0$ (other firms: $\pi \leqslant 0$)

Carrot!

German framework: benchmark based on efficient cost frontier

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Efficient frontier methods

- DEA (non-parametric but deterministic) and SFA (parametric but stochastic)
- TOTEX benchmark using two different CAPEX-definitions

New legislation

- Incentive bonus based on super efficiency score, but same super efficiency score to identify outliers

True carrot for efficiency or bonus for being different?

New: transparency (previously: black box), regulator publishes data

margin-of-error considerations

- Applies best of four, with minimum value of 60 %
- Exogenous adjustment path over five years

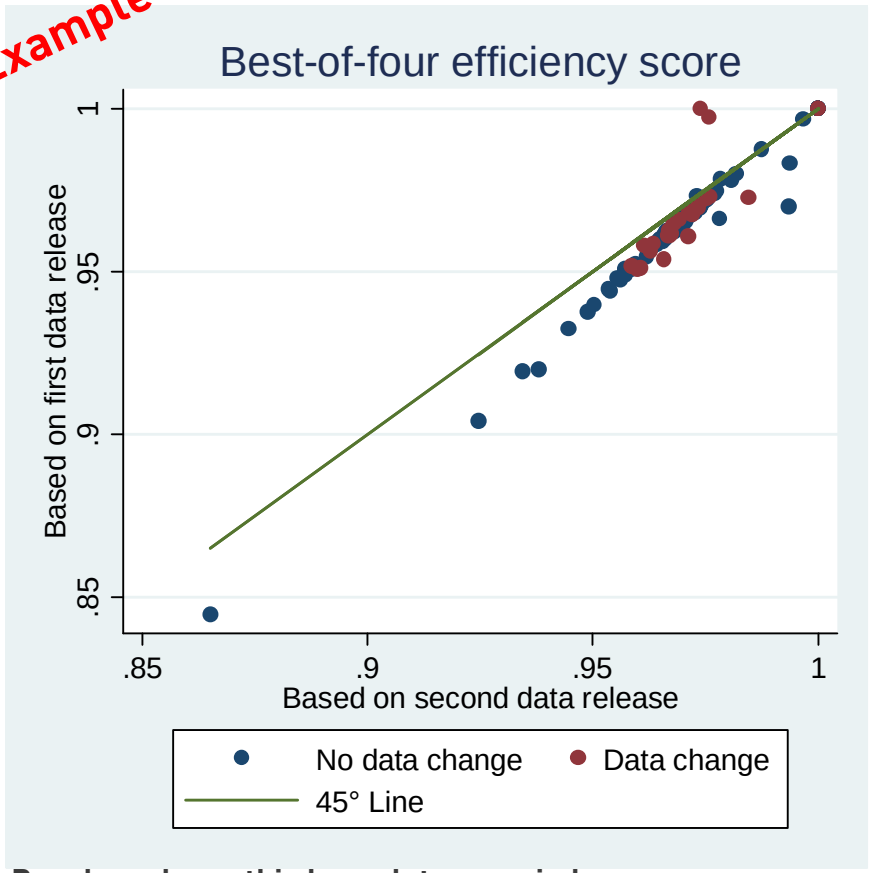
Sufficient risk protection or heavy stick?

Practical problems of German benchmarking: data collection

Data collection

- BNetzA collects more than 800 different variables!
  - many of them are difficult to measure precisely
  - most of them are not needed anyway (e.g: six different definitions of supply area)
- with new transparency, a lot of data errors became visible

Example



Benchmark gas third regulatory period

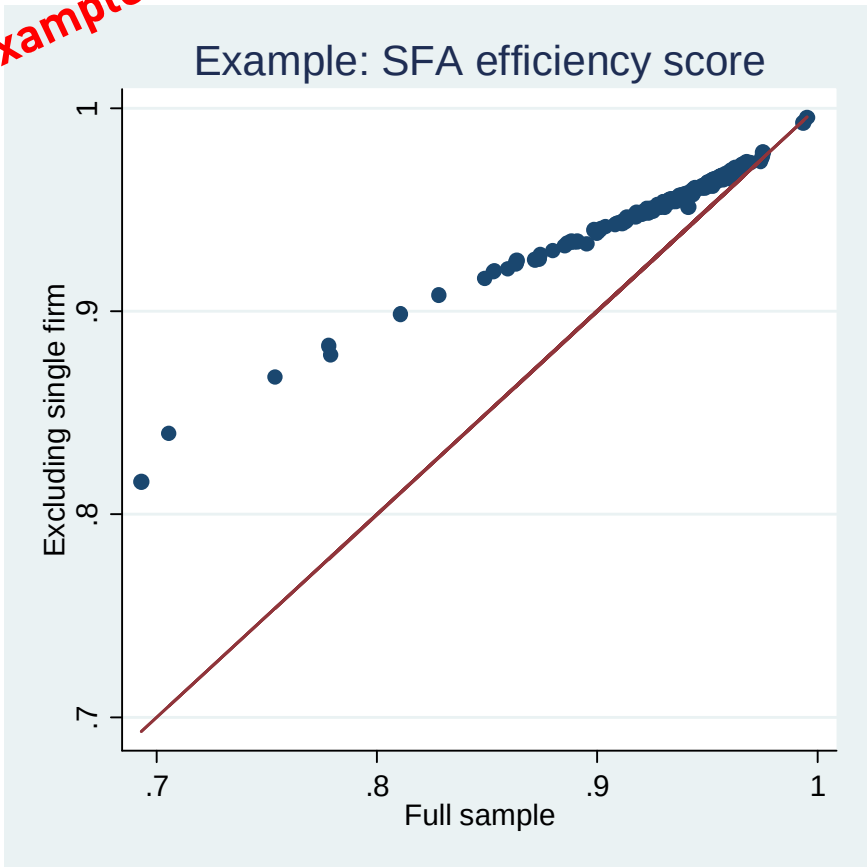
Data validation is important!

Practical problems of German benchmarking: sample selection

Sample selection

- German DSO are extremely heterogeneous
- Sample ranges from very tiny municipal network operators to very big networks operating in large areas
- Very different supply task: distribution and regional transmission (FNB)

Example



Benchmark gas third regulatory period

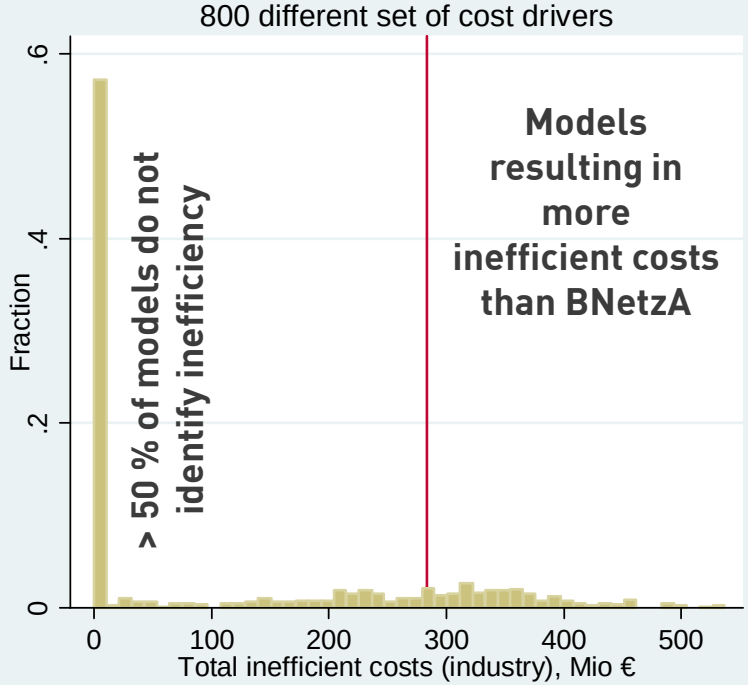
What a difference a single DSO can make!

Practical problems of German benchmarking: model selection

Model selection

- BNetzA selects a single set of cost drivers
- Other combinations possible and equally plausible
- All possible combinations of cost drivers considered by BNetzA in the past (ca. 800 modells)
- Results are not robust: monetary risk is substantial

Money at risk: distribution of inefficient costs



Benchmark gas third regulatory period

Money at risk depends on model selection: range of inefficient cost between 0 and 700 Mio. € (only gas DSO).

Conclusions

Reimbursement of past capital cost

Regaining confidence in regulation by prolonging transition rule

Treatment of CAPEX and OPEX

Incentives work, currently no need for regulatory change

Setting the general X-factor

No empirical evidence that X-factor > 0

Future of benchmarking

Regain trust in benchmarking:

- Transparency in data and codes
- Closer cooperation between industry and regulator to improve data collection and model specification
- Independent and transparent review process

Future of benchmarking:

- If incentives work, inefficiencies should vanish over time. Implementation of a stop rule or change to average frontier may be needed.