

Market Power Analysis of the German Tertiary Control Market

Christian Growitsch
Felix Höffler
Matthias Wissner

Institute for Energy Economics (EWI)
at the University of Cologne
christian.growitsch@uni-koeln.de
ewi.uni-koeln.de

Infraday 2010

Outline

- Introduction and problem definition
- Institutional framework
- Economic theory
- Empirical analysis
- Conclusions

Introduction and problem definition

- Economics of the power reserves market
 - Possible disadvantages for consumers: balancing energy costs passed to consumers via network charges
 - Potential barriers to entry for the energy market: new / small providers may be discriminated by integrated incumbents
- Research question:
 - Has market power been exercised on the German tertiary control market in 2008?

Institutional framework

Balancing Energy

- Electricity storage possibilities are limited.
- Deviations from energy supply and demand due to frequency fluctuations (varying demand, blackouts, feed-in of wind energy)
- Different qualities of balancing energy used by TSOs:
 - Primary control power
 - Secondary control power
 - Tertiary reserves

Institutional framework

Bidding process

- Since December 2006: joint and standardised tender auction for tertiary reserves energy by transmission system operators.
- Processing via internet platform „www.regelleistung.net“
- Standardisation of time, time slots and the minimum quantity bid.
- Bids include a capacity rate (MW), energy rate (MWh) and quantity.
- Two-step process:
 - Acceptance of bid depending on capacity rate
 - Power request depending on energy rate
- Discriminatory auction (pay as bid).

Institutional framework

Market environment

- The reserves market is preceding the wholesale spot market.
- Balancing energy suppliers can also participate in the wholesale market.
- There are four large and many small bidders in the balancing energy market.
- The large suppliers are vertically integrated (for the analysed period): generators and TSOs are affiliated.
- Foreign providers are almost irrelevant.

Economic theory

Market power – Definition

- Market power = Ability to act independently of competitors
- Standard definition: Ability to realise prices above a competitive level.
- Standard benchmark: mark-up on marginal cost (Lerner Index)
- Legal definition in Germany: „Marktbeherrschung“ (market dominance):
 - if a company has no or no significant competitor
(§ 19 (2) Nr. 1 GWB)
 - if a company has a dominant market position
(§ 19 (2) Nr. 2 GWB)

Economic theory

Strategic considerations

- Expected bidding behaviour of competitors on reserves market: expected stop out price.
- Marginal generation costs.
- Expected spot market price.

Empirical analysis

Research focus

- We concentrate on capacity rates
- Positive minutes reserve:
 - Per time slot / product annual average capacity demand:
1.1 Mio. MW
 - Per time slot / product annual average capacity called:
4,138 MWh (0.35%)
- Negative minutes reserves:
 - Per time slot / product annual average capacity demand:
0.73 Mio. MW
 - Per time slot / product annual average capacity called:
7,211 MWh (0.98%)

Empirical analysis

Data

- Complete data set for the year 2008
 - All individual bid functions (anonymised)
 - 12 products
(1 product is the capacity for a time slot of 4 hours: 6 x 4h positive minutes reserve, 6 x 4h negative minutes reserve)

Empirical analysis

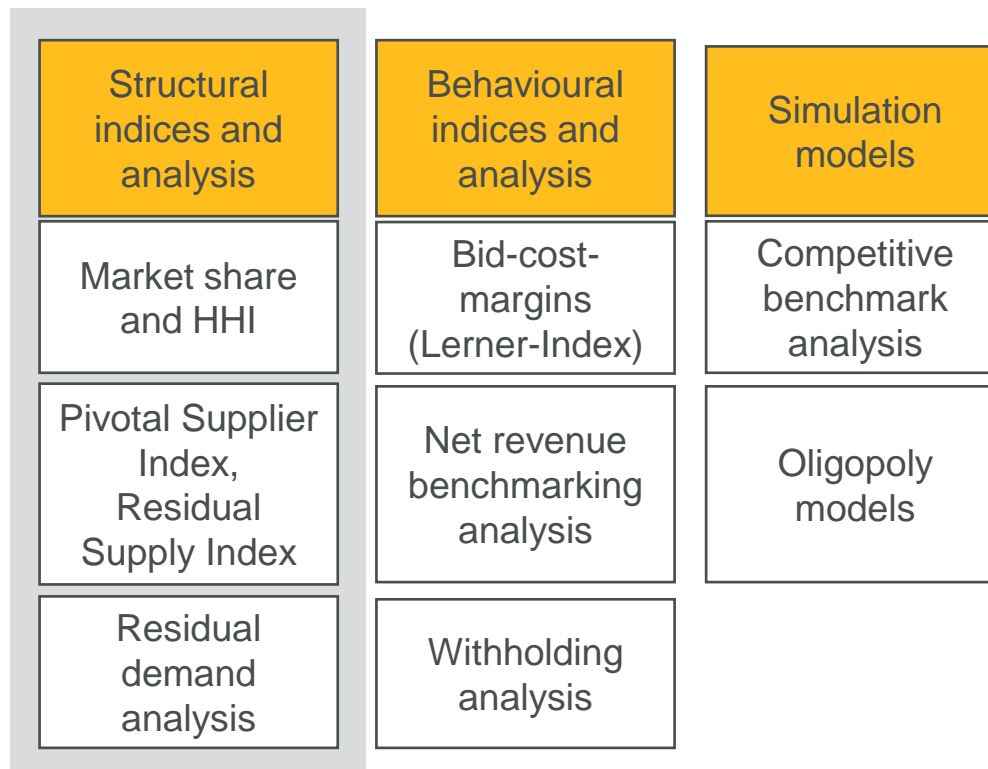
Descriptive statistics

Product	Ø supply (MW/day)	Ø demand (MW/day)	Ø capacity rate accepted	Ø daily revenue
1	3,459	2,016	28.58 €	57,617 €
2	3,445	2,021	29.34 €	59,296 €
3	3,705	1,981	1.50 €	2,971 €
4	3,757	1,985	1.39 €	2,759 €
5	3,927	1,980	1.39 €	2,752 €
6	3,879	2,063	1.96 €	4,043 €
7	4,978	3,249	4.23 €	13,743 €
8	4,939	3,271	12.85 €	42,032 €
9	5,016	3,308	40.34 €	133,444 €
10	5,055	3,309	28.34 €	93,777 €
11	5,055	3,289	29.46 €	96,893 €
12	4,935	3,279	13.12 €	43,020 €

Empirical analysis

Empirical strategy

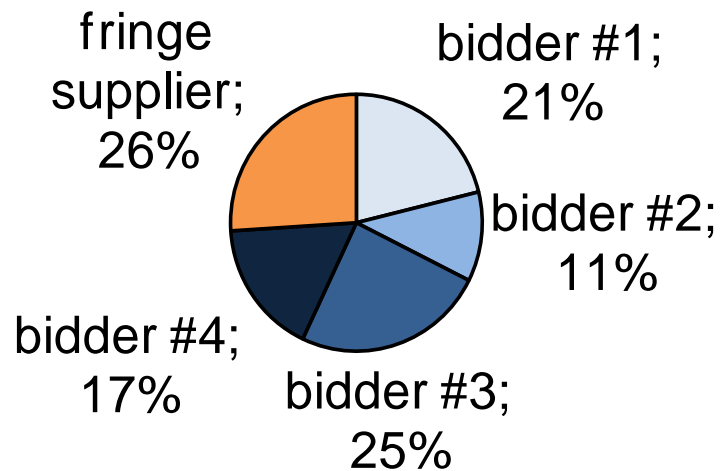
- Focus on market structure indicators



Empirical analysis

Market shares, overall

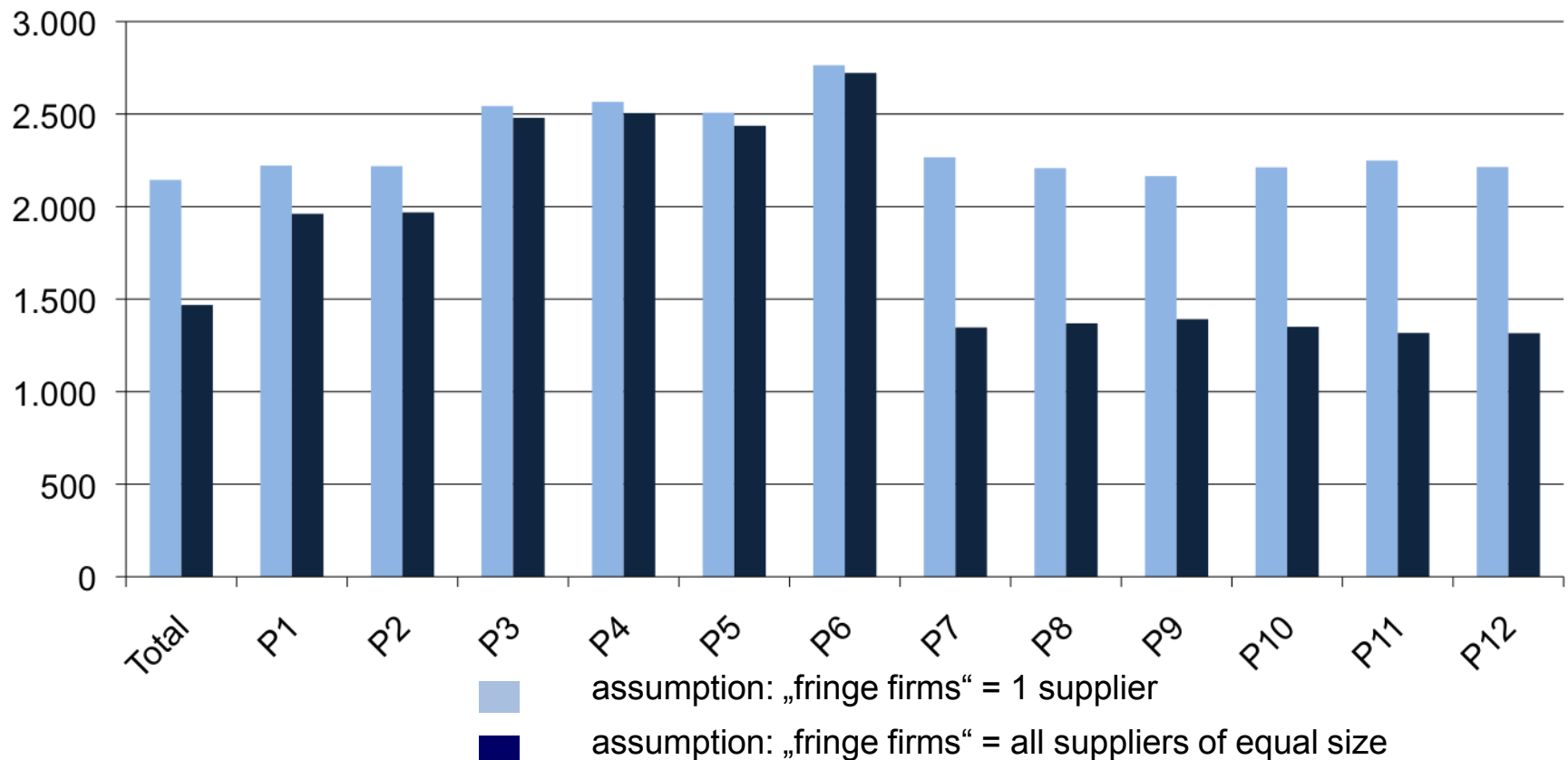
- The largest bidder's market share exhibits 25%. According to German cartel law the largest three suppliers have a dominant market position.



Empirical analysis

Herfindahl-Hirschmann-Index

- HHI (revenues) between 1,468 and 2,144 indicating market power due to US Merger Guideline (HHI > 1.800)



Empirical analysis

Pivotal Supplier Index & Residual Supply Index

- Pivotal Supplier Index (PSI)

$$\text{PSI} = \begin{cases} 0 & \text{if } C_{\text{tot}} - D_{\text{tot}} \geq C_i \\ 1 & \text{if } C_{\text{tot}} - D_{\text{tot}} < C_i \end{cases}$$

- Residual Supply Index (RSI)

$$\text{RSI}_i = (C_{\text{tot}} - C_i) / D_{\text{tot}}$$

with C_{tot} : total capacity (supply) on the market
 C_i : capacity (supply) of bidder i
 D_{tot} : total demand

Empirical analysis

Pivotal Supplier Index

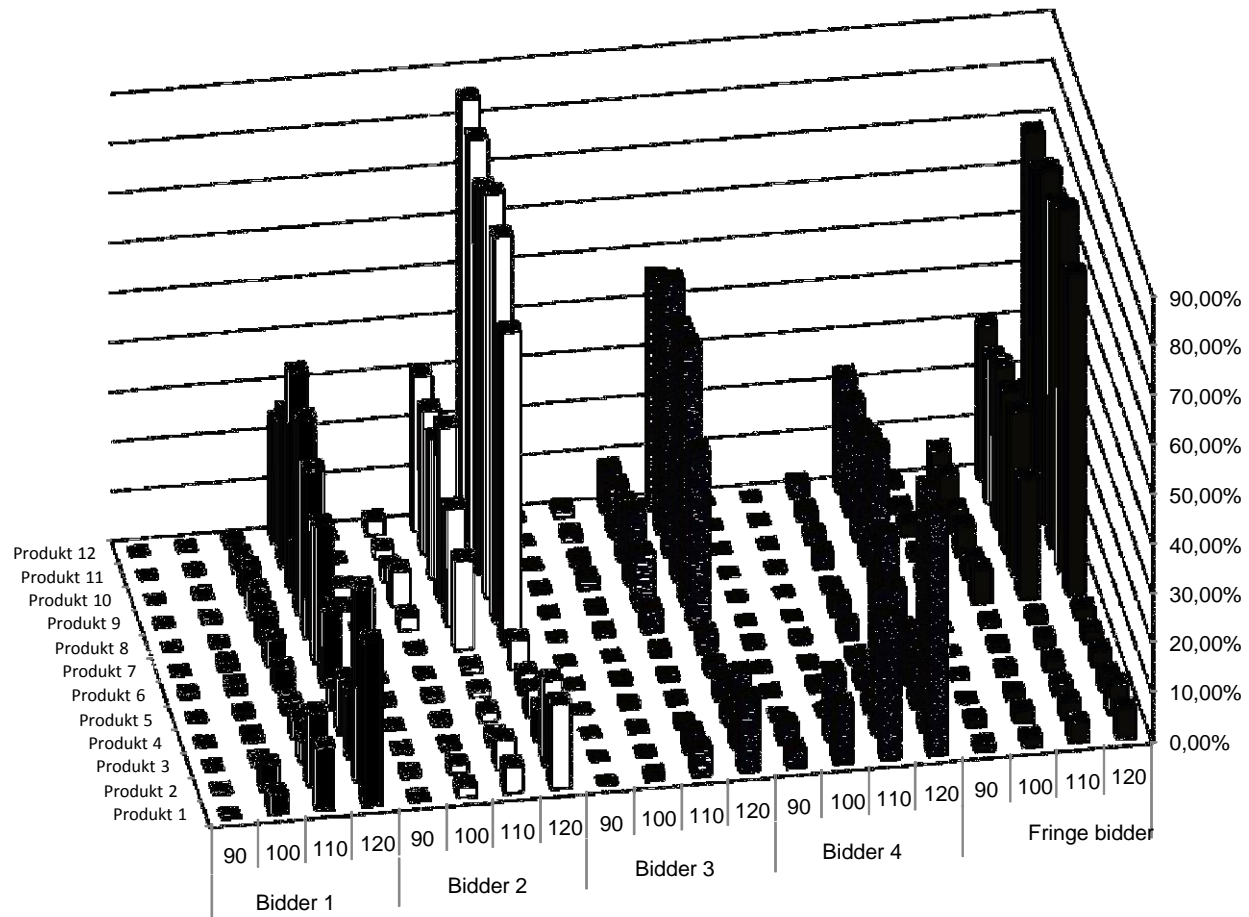
- Some suppliers seem to have price setting power for certain products (figures in percent of annual days, highlighted if > 5%)

	Anbieter 1	Anbieter 2	Anbieter 3	Anbieter 4	Fringe
P1	4.10%	2.19%	1.09%	12.02%	1.91%
P2	5.19%	1.91%	0.27%	13.66%	2.46%
P3	1.37%	0.82%	0.55%	0.82%	1.37%
P4	1.37%	0.82%	0.82%	1.37%	1.37%
P5	1.09%	0.82%	0.82%	0.82%	1.09%
P6	1.91%	0.27%	0.27%	1.09%	1.09%
P7	1.64%	0.55%	1.09%	0.00%	6.83%
P8	0.27%	2.73%	0.82%	0.00%	4.37%
P9	0.55%	7.10%	2.46%	0.27%	6.01%
P10	0.55%	3.28%	1.37%	0.27%	4.64%
P11	0.55%	1.91%	1.64%	0.27%	6.56%
P12	0.27%	3.01%	1.91%	0.00%	6.83%

Empirical analysis

Residual Supply Index

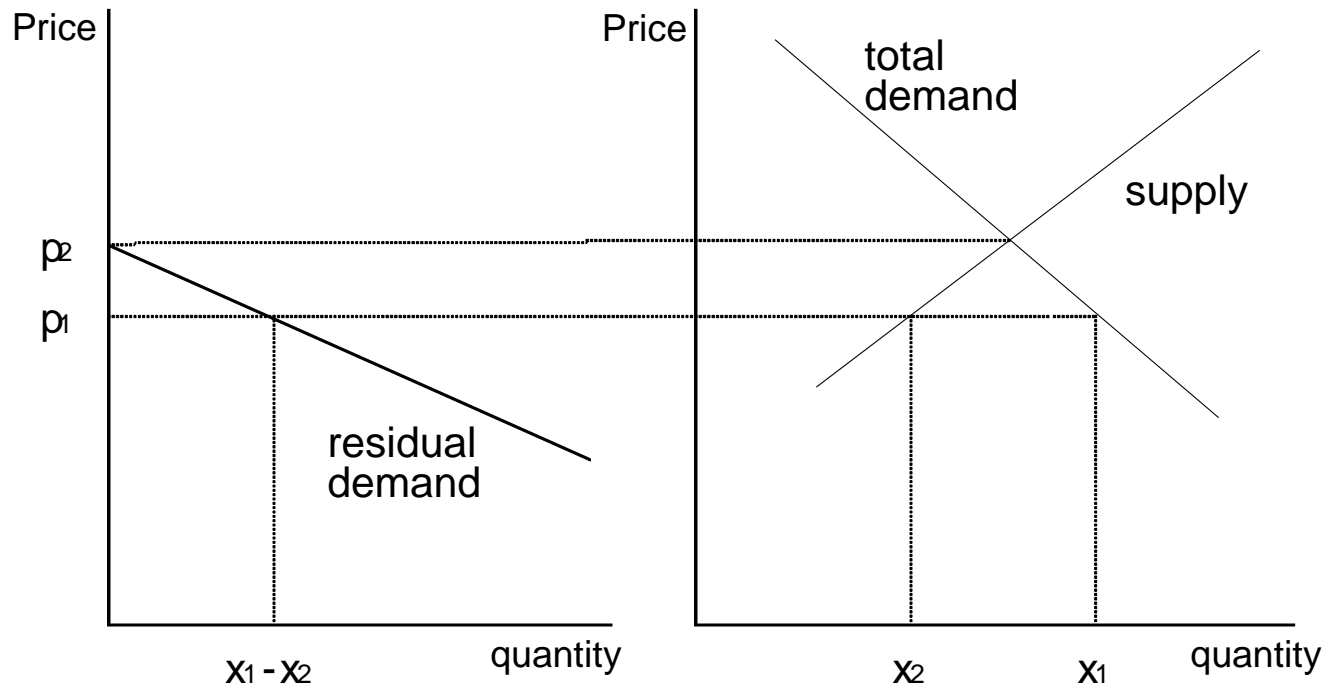
- PSI results confirm RSI results



Empirical analysis

Residual Demand Analysis

- The residual demand is – for any price p – the difference between total demand and the competitors' realised supply.
- The more elastic the residual demand the lower the market power.



Empirical analysis

Residual Demand Analysis

- Empirical model:

$$D_{res,i} = d_i + \beta_i p_i + \varepsilon_i$$

- Residual demand and prices in logs
- No endogeneity bias due to perfectly inelastic demand

Empirical analysis

Residual Demand Analysis

- Bidder 1 / the fringe suppliers show the lowest elasticity of residual demand for the negative / positive minutes reserve products.

	Bidder 1	Bidder 2	Bidder 3	Bidder 4	Fringe
Product 1	-3.03	-8.61	-5.05	-8.00	-5.70
Product 2	-2.88	-8.45	-4.94	-7.66	-5.59
Product 3	-2.75	-9.40	-4.80	-7.11	-6.84
Product 4	-2.83	-8.84	-4.81	-7.16	-6.82
Product 5	-3.04	-9.46	-5.12	-7.22	-7.26
Product 6	-2.29	-7.64	-4.23	-6.20	-6.59
Product 7	-3.49	-6.64	-4.58	-5.18	-3.16
Product 8	-4.49	-8.08	-5.11	-6.15	-3.72
Product 9	-4.39	-7.63	-4.94	-6.22	-3.61
Product 10	-4.42	-8.21	-4.98	-6.33	-3.55
Product 11	-4.47	-7.48	-4.74	-5.96	-3.34
Product 12	-4.22	-6.81	-4.72	-5.41	-3.22

Conclusions

- Different methods of market share and market power analysis cannot prove specific market power
- There is a tight oligopoly with joint market dominance
- Large suppliers seem to realise higher average revenues than the fringe suppliers.
- Abuse of market power difficult to prove since we lack a competitive benchmark.
- Further analyses necessary.

Institute for Energy Economics (EWI)
at the University of Cologne
christian.growitsch@uni-koeln.de
ewi.uni-koeln.de