Regulating Electricity to ensure efficient competition

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CEPR/ESRC I-O Workshop
The Political Economy of Regulation

www.econ.cam.ac.uk/dae/research/regulate.htm
Equilibrium structure pre-1990

• universal service obligation in exchange for franchise monopoly
• vertically integrated
• final prices controlled: ‘just and reasonable’

⇒ regulation or state ownership
• both under cost-of-service regulation
Historical contrasts: US vs UK

- US: \textit{evolved} cost-of-service regulation
- deregulation, not privatisation
- default is regulation
- UK: privatisation for many motives
- recognise need for price control
- \textit{designed} to avoid US inefficiency
- default is reference to MMC/CC
Example of US Electricity

- Federal Power Act 1935 requires prices that are ‘just and reasonable’
- Selling at market-related prices requires:
  - utility and affiliates do not have market power
  - competitive prices are just and reasonable
  - can withdraw right if there is market power
  - can re-impose cost-based prices caps
Vertical integration under attack

• liberalisation creates tensions
  – unsustainable cross subsidies (AT&T)
  – access problems motivate unbundling
• easy at privatisation, harder if private
  – US gas, BG, painfully dismembered
  – CEGB unbundled at privatisation
Evolution of UK policy

• Licenses define rights and powers
• Needed for regulatory credibility
  – for sale, to ensure private investment
• competition not privatisation for efficiency
• RPI-X as transition from incumbency
⇒ incentive regulation of natural monopoly
Impetus for ESI reform in EU

• UK (and Norway) considered successes
• Single market requires unbundling
• Electricity markets seen as unproblematic
• Reasons for institutional solutions ignored
• Little guidance given to member states
• Two years to enact Electricity Directive
Politically acceptable liberalisation requires:

- A regulator who can credibly ensure:
  - sustainable competitive outcomes
  - absence of abusive market manipulation
  - efficient free entry and investment

*These challenges remain unmet in EU*
Lessons from UK ESI

• England+Wales unbundled, Scotland not
  – social benefits: 6% p.a. E+W; 0 in Scotland
  = 100% return on CEGB sales value
  – consumers lose, generators win
  ⇒ regulatory pressure to increase competition
  – tough price controls to pass through cost fall
⇒ E+W model for EU Electricity Directive
Productivity of CEGB and successor companies compared to UK manufacturing industry

Financial years April-March

Index numbers 1989/90=100 (log scale)

- Industry
- CEGB
- NP
- PG
- NE
- NGC
Generation in England and Wales by fuel type

- **Nuclear**
- **Coal**
- **other steam**
- **CCGT**
- **hydro+other**
- **imports**
Generation in England and Wales
Performance of other ESIs

• Scotland: vertical integration
  – small gains offset by costs
  – little competition, lower price fall

• N Ireland: Single buyer model
  – large efficiency gains: 3 times CEGB
  – hard to transfer to consumers because of PPAs
  – UK Govt. subsidises electricity prices
Electricity prices by town
3,300 kWh at 2000 prices excl VAT
A Single European Electricity Market?

Lars Bergman, Geert Brunekreeft, Chris Doyle, David Newbery, Michael Pollitt, Pierre Regibeau, Nils von der Fehr

www.cepr.org

Published London: CEPR, 1999
Lessons from EU Study

• authorisation preferable to tendering
• **access** is key to creating single market
  – press for rTPA
  – require transparency
  – charge depend only on connection point
• require ownership separation of G & T/D
• strong sector-specific regulation needed
EU response

• Lisbon 2000 European Council asks CEC to work to complete single ESI market
• CEC reaches same conclusion as CEPR
• Stockholm 2001 CEC presents
  – analysis: working papers
  – Press Release: ‘California not a problem’
  – proposed amendments to Gas+Elec Directives
1995 = 100

Source: Eurostat.

Note: Prices exclude energy taxes and VAT and prices have been deflated. “Industry” is defined as annual electricity consumption of 2 GWh.
Average electricity prices in € cents per kWh for industrial consumers (VAT and energy taxes excluded)

Source: Eurostat. In Member States where there is more than one observation, an arithmetic average has been calculated.

Note: Industry is here defined as an annual electricity consumption of 2 GWh
Proposed New Directive

- for electricity and gas
- only rTPA, tariffs published *ex ante*
- sector-specific regulator
- legal (but not ownership) unbundling G&T
- no SBM, no tendering (except reserve)
- 1.1.2005 all gas + elec markets fully open
Stockholm, March 2001

- CEC claims reforms will avoid California problems caused by “inadequate legal framework and .. capacity”
- France opposes new Directive: not convinced of liberalisation
- Germany opposes need for regulator
  - also has nTPA and vertical integration
What happened in California?

1996: cost of new power < regulated price
– buy out stranded generation assets
• Price cap until then, expect price fall, but
• average 2000 wholesale price 3 x 1999
• Jan-Apr 2001 prices 10 x 1999
• distribution companies bankrupted
• State steps in at huge cost
What Explains the High Prices?

Prices above competitive levels were due to both higher production cost and higher mark-up from market power.
Causes of the Californian debacle

- Under-investment + cheap hydro from NW
- high demand growth in WSCC
- Huge swing in hydro supply (=12 nukes)
- Gas price rise, NO\textsubscript{x} permits double cost,
- Regulatory disapproval of contracts
- Price caps imposed with perverse effects
  - High Western prices $\Rightarrow$ bankruptcy
Lessons from California

- Inelastic demand + tight market ⇒ large market power
- Unbundling ⇒ price risks - need hedging
- Discouraging contracts ⇒ market power
- Capacity - public good in federal system
- Local intervention in interconnected system problematic
Theory of electricity pricing

- Supply Function Equilibria
  - Green and Newbery (1992) *JPE*
- Cournot (by hour of day)
- Auctions: pay-bid vs Pool
- Commercial software
  - captures non-convexities

*Agree on general form of equilibrium*
Feasible Supply Functions
Duopoly and Quintopoly

\[ \text{Marginal Cost} \]

\[ \text{Maximum Demand} \]

\[ \text{2-firm range} \]

\[ \text{5-firm range} \]

Calibrated for England 1990
Supply function equilibria

• Spare capacity ⇒ Bertrand competition
• Tight capacity ⇒ Cournot competition
• Spot competition for uncontracted output
• Entry determines average price
• Peak price depends on capacity
• Capacity depends on $p-c$ for least-run plant
Scarcity or Market Power?


July 17, 2001

Anjali Sheffrin, California ISO
Wholesale prices depend on:

- Number of competitive generators
- Short-run elasticity of demand
- Capacity
- Contract coverage
- Entry conditions
- Demand uncertainty
Market power in networks

- peak price increases as \( 1/\{(n+1)\epsilon\} \)
- peak price decreases with contract cover
- demand elasticity \( \epsilon \) very low
- transmission constraints fragment market
  - reduce effective number of generators, \( n \)
- generators can exploit constraints
Dealing with market power

• desirable to reduce concentration
  – trend is in other direction
• encourage contracting
• desirable to increase spare generation
  – hard to sustain in liberalised market
• desirable to maximise extent of market
  – regulate for “excess” transmission - but how?
• Should TO’s take account of market power?
Capacity constraints but no contracts
Without entry threats Gencos may

- Merge (c.f. Germany)
- Reduce spare capacity (Germany)

Contract cover demand driven $\Rightarrow$ expensive
  $\Rightarrow$ reduces cover $\Rightarrow$ market power

$\Rightarrow$ Critical to minimise barriers to entry
- ownership unbundling of G & T
With contracts to deter contestable entry

Supply function equilibrium
varying number of generators
Entry and predictable demand

- Contracts reduce av. price to deter entry
- More competitors $\Rightarrow$ less volatility

$\Rightarrow$ Expect actions to impede entry, e.g.
- pay-bid, opaque markets, vertical integration (NETA?)
Preconditions for liberalisation

- rTPA + ownership unbundling: CEC ✔
- adequate and secure supply: CEC ✔
  - network adequate and reliable
  - production capacity adequate
  - security of supply of primary fuel
- power to regulate competition: CEC ✗
Competition policy for utilities

“competition where possible, regulate where not”

• Leave markets to competition legislation?
  – *Ex post*, penalties ⇒ legalistic, slow
  – dominance ~ 40+% of market
  – information collected only for case

⇒ need *ex ante* regulatory powers
British regulatory experience

• 2000: Market Abuse Licence Condition
  – refers to bidding in Pool
  – not accepted by AES, British Energy
  ⇒ referred to Competition Commission
  ⇒ not “against public interest” if unmodified
• Pool to be replaced by NETA 2001
Lessons from Britain

• generator licence restrains market behaviour
• can be modified after reference to CC
• market power possible with HHI < 1800
  – electricity cannot be stored
  – transmission constraints fragment market
  – supply must be matched to demand by second
  – demand inelastic in short run
⇒ volatile prices: £11-1100/MWh over 24 hrs
Contrast EU with US

- US has long history of price regulation
- markets *may* achieve better outcome
  - if not, fall back on regulation
- EU assumes market *will* be better
  - no fall-back option
Californian debate

• Dec 15, 2000 FERC
  – deems prices ‘unjust and unreasonable’
  – imposes soft price-caps on spot prices
  ⇒ perverse effects, ‘MW laundering’

• June 2001 FERC order extended to WSCC
  – must offer to spot market

• contrast with CA MSC mitigation plan
MSC’s mitigation plan

- IOUs sell at cost
- consumers can buy 85% at 2000 price
- right to market pricing only if
  - sell 75% capacity as 2-year contracts at ‘competitive price’ ($54/MWh)
  - file annual outage plan, must bid otherwise
  - no cap on spot, AS markets
  - otherwise face cost-based price regulation
Contrast approaches

- both attack capacity withdrawal
- FERC caps spot prices of whole region  
  ⇒ to avoid market power contagion
- CA MSC operates on contract price  
  ⇒ leaves spot price to signal scarcity
  ⇒ rights to regulated contracts prices
  ⇒ avoids costly long-term lock-in
Attractions of contracts

• market power falls as contract cover rises
• confine price regulation to contracts
  – leaves spot price to signal scarcity
  – ‘dual pricing’ prevents large rent transfers
  – sustained by legacy contracts in short-run
  – long run requires franchise?
Contrast with Europe

- no prior legislated cost-based regulation
- no concept of ‘just and reasonable’ prices
- little power to control wholesale prices
- often limited power to get information
  ⇒ weak market surveillance
- competitive tests derive from other markets
Competition problems in EU ESI

- dominant incumbents (Fr, Be, It)
- merger wave (EdF, E-on, RWE)
- inadequate interconnect transmission
- illiquid or absent wholesale markets
- under-staffed or no regulator
- access to information patchy
- lack of regulatory enforcement power
Arbitrage profit weekdays May - July 2001

Euros/MWh

Average, Av - 1 SE, Av+1 SE
Competition concerns

• vertical integration ⇒ recover fixed costs via access charges to grid?
⇒ low spot prices, entry deterrence, merger
e.g Germany (Brunekreeft)

• Electrabel: 95% of Be, 30% of NL
  – vertically integrated in Be, no spot market
  – low cost but interconnector zero price
Possible scenarios - 1

• lack of markets + domestic franchise ⇒ contracts necessary
  – reduces short-run market power, hedges spikes
  – yardstick regulation of PPAs countervails
• opaque markets & asym info deter entry
  ⇒ horizontal, vertical integration ⇒
old German-style equilibrium: safe but costly?
Possible scenarios - 2

• new Directive ends franchise
  ⇒ generators integrate into supply
• remove counterparties to entry contracts
  ⇒ reduce spare capacity
• limited interconnector ⇒ market power in national markets
• ESI now 400 bn euros, high prices costly
Solutions

• increase interconnect capacity rapidly
  – ‘excess’ T is public good
  – dilutes market power in short run
  ⇒ reduces need for regulation
  ⇒ long run EU-wide shortages?

• Maximise contracts, also for capacity
  – G capacity is public good

• ⇒ keep franchise as counterparty?