Electricity regulation in UK and Europe

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Outline

• **Why** regulate?
  – Public vs private ownership and interstate trade

• **Objectives and challenges of regulation**
  – credibility and institutional requirements

• **Unbundling electricity - what to regulate?**

• **How** to regulate:
  – US rate-of-return vs UK price cap regulation

• the UK model: incentive regulation

• European regulation and cross-border challenges
Why regulate?

- **Networks are natural monopolies**
  - investors and consumers need protection under private ownership

- **Why privatise?**
  - Separate competitive services from network
    - competition reduces costs, transfers gains
  - Competition difficult under public ownership

- **Cross-border trade: public and private utilities**
  - regulation + restrictions on state aid to avoid distortions

- **Regulation to protect against subsidy**
The regulatory trap

- sunk investment risks regulatory opportunism
- hold down prices to benefit consumers
  \[\Rightarrow\text{utility may underinvest}\]
  \[\Rightarrow\text{underinvestment precipitates nationalisation}\]

*Inability to restrain regulatory opportunism may make state ownership only solution*
Problems with public ownership

• State’s tax powers can finance investment
• State concerned to meet demands
• State subject to strong interest groups
⇒ undermines ability to penalise poor performance, leads to financing problems

Hard to ensure adequate prices and finance efficient and prudent investment
Regulation: the challenge

• Regulator represents community
  – grants access rights, franchise
  – wants guaranteed supply at low prices

• Utility makes sunk investments
  – wants secure future profit
  – has huge potential market power
  – will not invest without assurance
Curbing opportunism

• both want investment $\Rightarrow$ cooperate
• both want rents $\Rightarrow$ conflict

How to restrain opportunism?

Regulation/public ownership evolves to finance investment and distribute rent
Regulation

• Transfer efficiency gains to consumer
  \[ R = bR + (1-b)C \]
• conflict between incentives and transfers
• \( b \) is power of incentive
• high power = strong efficiency incentive
• low power for rent transfer

Applies for public ownership and regulation
Rate of return regulation

• US Constitution entitles utility to ‘fair return upon the value of that which it employs for the public convenience’ (1898)

• rate of return will be adequate to attract new investment if it is ‘used and useful’ and not ‘imprudent’

low powered regulation
Contrast RPI-X regulation

- intended to mimic competitive market
- originally designed for BT to improve incentives (by Littlechild)
- high powered if $R$ independent of $C$ in
  \[ R = bR + (1-b)C \]

but is it credible?
Incentives vs credibility

- **Rate-of-return** or cost-of-service regulation
- either party can request a rate review
- limits excess profits and losses
- **Price-caps** set for 5 years
  - sometimes with appeal if costs rise > 10%
- variability of profits larger => windfall taxes?

*Better incentives at expense of reduced credibility*
What makes regulation credible?

• Ideally self-enforcing: if cost of breaking regulatory compact high:
  – cost of losing confidence of utility high because
    • high need for future investment (rapid demand growth)
    • investment requires private management/finance
    • high cost of poor service (few alternatives)

• External enforcement: but needs institutions
  – regulatory independence, legal enforcement

• Regulatory compact threatened if
  – technical progress - alternatives cheaper (AT&T)
  – investment needs fall (US electricity)
Restraining opportunism

**US system:**
- Constitutional guarantees
- Separation of powers: DoJ, FCC, PUCs
- Administrative law to challenge regulatory discretion

**UK problem:** Parliament sovereign
- need to restrain Government

=> licences upheld by courts
Licenses and Legislation in UK

• Primary legislation contains framework
  – duties of regulator, requirement for licences
  – dispute resolution
• Details contained in licences
  – like contracts, upheld by courts
• Licence modification by consent or reference to Competition Commission

⇒ Costly for either party to deviate
Creating credibility in UK

• Regulator has a duty to ensure that investment can be financed

• Price controls reset every 5 years
  – but changed only if “in the public interest”

• Utility can appeal against new price control
  – appeal considered by Competition Commission
  – and subject to Judicial Review
  – disputes costly for both parties
The British model

- Legislation defines duties
- Licences to provide credibility
- Regulator to insulate from politics
- RPI-X for incentives and inflation
- Periodic review for rent transfer
- Dispute resolution: Competition Commission
Regulatory equilibrium

- regulation reflects balance of interest groups
- conflicts lead to inefficiencies
  - cross-subsidy, costly investment, costly coal
- normally remarkably stable, hard to reform
- technical change may alter balance
  - new entry (telecoms); loss of scale economies
  $\Rightarrow$ may precipitate new structure

*privatisation changes balance of power*

*particularly if utility restructured*
What to regulate

The case for unbundling
Structural remedies

• conduct remedies ineffective
• structural reforms disturb interest groups:
• regulation inefficient $\Rightarrow$ reduce where possible

*Competition where feasible,*

*regulation to mimic competition where not*

$\Rightarrow$ regulate natural monopoly of network

$\Rightarrow$ competition for services over network
Competition

- prices set by competitors
- increased profits requires cost cuts
- competition transfers gains to consumers
- innovation rewarded, not impeded
- incompatible with central state ownership
Vertically integrated
generation
transmission
supply
c

Generating companies
transmission
distribution
supply companies
consumers

Regulated
Supply companies
unbundled
British electricity privatisation

• 1989 CEGB unbundled
• 1990 CEGB privatised (England and Wales)
  – 2 fossil gencos, 10 regional elec cos (RECs) + national grid sold, nuclear remains public
• 1990 Scottish industry privatised as 2 vertically integrated companies
• 1995 Nuclear electric sold, grid separated
• 1999 electricity franchise ends
Privatising and regulating the RECs

- One-third of turnover of ESI
- 12 RECs privatised Mar 31 1990
- Price control 1 Apr 1990 to Mar 31 1995
- Regional monopoly on distribution
- Prices periodically reset: benchmarking used
Figure 5
Labour Productivity in E&W ESI and UK Industries 1985-6 to 1997-8
Performance of RECs

• Little productivity gain first period
• Charges fall 25% 1995-1999
• take-overs allowed 1995 => big efficiency gains
• Efficiency gains to 2000: £5.4 bn @ 6%
• Restructuring costs £1.1 bn
How to regulate

Various models
Accounting for the utility’s cost

• Full cost $C$ is operating expenditure, $O$, plus return on and of capital

• Regulatory Asset Base (RAB) = $B_t$
\[ B_{t+1} = B_t + I_t - D_t \] where $D_t$ is depreciation
  (for each asset $j \sum_t d_{jt} = k_j$, its initial cost)
\[ C_t = O_t + rB_t + D_t, \] $r$ is cost of capital
Rate-of-return regulation

- PUC sets all prices to cover costs,
- PUC determines fair rate of return, $f > r$
  - RAB normally written down book value
- Utility meets demands $q_i$ at these prices $p_i$
  \[ \Sigma p_i q_i = R = O_t + fB_t + D_t, \] fixed by PUC
- Utility decides how to produce output

*Incentive to over-invest and gold-plate*
Price-cap regulation

• Designed by Littlechild for BT
  – mimics effect of competition

• Regulator collects data from utility
  – forecast efficient operating costs $O_t^*$
  – asset value, investment plans $\Rightarrow B_t$
  – demand forecasts
  – calculates wted av. cost of capital $WACC = r$

• Determines revenue required:

$$R_t = O_t^* + rB_t + D_t$$
Correcting for inflation

- UK model: RPI-X
  - RPI corrects for inflation,
  - X for predicted/required efficiency gain

=> prices can increase by inflation less X

- measure assets at constant prices
- WACC, $r$, real
- Interpret prices as real prices: deflated by RPI
Price caps and baskets

Utility chooses $p_i$ s.t. Laspeyre’s index does not increase

$$\sum_{i=1}^{n} p_i q_i^{t-1} \leq \sum_{l}^{n} p^{t-1}_i q^{t-1}_i$$

$$\sum_{i=1}^{n} p_i q_i^{t-1} \leq (1 - X) \sum_{l}^{n} p^{t-1}_i q^{t-1}_i$$
Effects of different baskets

- Laspeyre’s price reductions are welfare improving
- Far-sighted utility maximising PDV of profits converges on Ramsey pricing
- Revenue cap can lead to *inverse* Ramsey pricing

*Design of basket has important welfare effects*
Yardstick regulation

• Need: set of comparable companies
  – e.g. 12 RECs
• estimate average unit costs of other firms $c_j$
• price cap for firm $j$ is $p_j = (1-b) c_j + bc_{-j}$
• power of yardstick is $b$

What if other companies face different costs?
Benchmarking

- objective: to set $R = \text{efficient costs}$
- Need: set of comparable companies, and enough data to identify important cost drivers
- Identify efficiency frontier
- determine distance of company from frontier
- $X_i$ set to catch up frontier
- predict rate of movement of frontier
Illustration of Methods

**DEA**

- DEA efficiency scores:
  - Point A: OA’/OA
  - Point B: OB’/OB

**COLS**

- COLS Efficiency scores:
  - Point A: 100%
  - Point B: EF/BF
CRS vs. VRS DEA

![Diagram showing CRS and VRS frontiers with points labeled P, Piv, Pov, Pic, R, and A on an X-Y axis.]

CRS Frontier

VRS Frontier

A

R

P

Piv

Pov

Pic
## Eff. scores - UK vs. Japanese DISCOs

<table>
<thead>
<tr>
<th>1997-8</th>
<th>DEA-CRS</th>
<th>DEA-VRS</th>
<th>OFGEM-COLS</th>
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<tr>
<td>Eastern</td>
<td>81.1%</td>
<td>100.0%</td>
<td>103%</td>
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<tr>
<td>East Midlands</td>
<td>58.3%</td>
<td>58.8%</td>
<td>77%</td>
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<tr>
<td>London</td>
<td>67.4%</td>
<td>78.8%</td>
<td>82%</td>
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<td>Manweb</td>
<td>65.6%</td>
<td>84.3%</td>
<td>80%</td>
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<tr>
<td>Midlands</td>
<td>63.9%</td>
<td>67.7%</td>
<td>64%</td>
</tr>
<tr>
<td>Northern</td>
<td>51.5%</td>
<td>65.9%</td>
<td>71%</td>
</tr>
<tr>
<td>NORWEB</td>
<td>56.3%</td>
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<td>64%</td>
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<td>84.5%</td>
<td>98.3%</td>
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<tr>
<td>Southern</td>
<td>100.0%</td>
<td>100.0%</td>
<td>103%</td>
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<tr>
<td>SWALEC</td>
<td>49.5%</td>
<td>82.4%</td>
<td>82%</td>
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<tr>
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<td>100.0%</td>
<td>73%</td>
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<td>82.6%</td>
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<td>JP9</td>
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<td>Avg. UK</td>
<td>70.5%</td>
<td>81.7%</td>
<td>77.17%</td>
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<td>Avg. Japan</td>
<td>54.5%</td>
<td>76.2%</td>
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Water and Sewerage in England & Wales
Comparison of operating costs in constant prices 1989 - 2003

Source: Ofwat
Incentives for investment

• benchmarking used for opex, hard for capital
• Investment plans ⇒ RAB_{t+i} ⇒ price path
  – e.g. use of K factors for water
⇒ Utility overstates investment plans
  – delay investment until end of price control period
  – if RAB updated ⇒ rate-of-return regulation?
  – If RAB based on benchmarks ⇒ under-invest?

Need to monitor quality with price caps
Transmission adequacy

• National Grid has incentives for reliability and investment
  – To reduce the cost of ancillary services
  – To reduce interruptions and increase availability
  – has invested £3.5 billion since 1990
  – distribution+transmission investment = £16 billion
Network investment looks fine but generation falls with price

- Source: JESS Report Nov 2003
Transmission & Distribution Reliability

Average Transmission System Availability (%)
Source: National Grid

DNOs supply interruptions (min/year)
Source: OFGEM

Average Transmssion System Availability (%)
Source: National Grid

DNOs supply interruptions (min/year)
Source: OFGEM

Average Security
Average Availability
Summary of UK experience

• trade-off between rent capture and incentives:
  \[ R = bR + (1-b)C \]
• Rate-of-return regulation \( \Rightarrow \) over-investment
• Price-caps \( \Rightarrow \) risk of under-investment
• good price-cap baskets \( \Rightarrow \) allocative efficiency
• Regulating natural monopolies requires good information about efficient costs \( R \)
  – benchmarking useful
European experience

Driven by the European Commission
EU Energy Directives

- Electricity 96/92/EC due Feb 1999
- Gas 98/30/EC due Aug 2000
  - justified by experience in UK, Norway, Chile
  - increased role of Commission
  - de-politicise national energy policy
  - energy policy to be market friendly

*aim: create competitive single energy market*
Security of supply

- SoS critical as cannot store electricity
- spare capacity aids liberalisation
- encourages competition ⇒ low prices
- early liberalisers had spare capacity
  ⇒ gives time to learn how to regulate
- Britain developed regulation, licences
- Continent unprepared for Energy Directives?
Proposed New Directive 2000

- for electricity *and* gas
- regulated not negotiated access,
  - tariffs *published* *ex ante*
- sector-specific regulator
- legal (but not ownership) unbundling G&T
- no single buyer model
- 2005 all gas + elec markets fully open

*then California goes into melt-down*
What Explains the High Prices?

Prices above competitive levels were due to both higher production cost and higher mark-up from market power.
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 negotiated access and vertical integration
Agreement on New Directive in 11/02

- for electricity *and* gas
- tariff *or* methodology to be published
- requires regulatory authority
- legal (but not ownership) unbundling G&T
- no single buyer model
- 2006: review experience before decision to open all gas + elec markets by 1.1.2007

*markets opened in 2007*
Many markets still concentrated
Share of dominant generator in peak demand

- Greece
- Belgium
- France
- Portugal
- Italy
- Spain
- Netherlands
- Germany
- Switzerland
- Austria

- dominant gen/peak
- import/peak
- reserve margin
Preconditions for ESI 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 ✗

*Prices rise, Energy Sector Inquiry launched*
Rising prices prompt Inquiry

Year ahead base-load

Sector inquiry launched

Source: information received within the scope of the Sector Inquiry from Argus Media, Platts, and Nord Pool.
Sector Inquiry calls for action

Key areas calling for action:

1) effective unbundling
2) deal with cross-border regulatory gaps
3) address market concentration, barriers to entry
4) increase transparency

All easier with unbundled utilities
European developments

• *Energy Sector Inquiry* completed
  – concern over market power
=> some companies unbundle G & T
• gradual move to cooperation between NRAs
• aim to improve power to get information
  – slow progress on market surveillance

*but inadequate attention to mergers*
Contrasts between UK and EU

**UK**: carefully designed regulation
- but flawed execution on market structure
  - after 10 years now fairly competitive

**EU**: Electricity Directive forces change
- but inadequate attention to framework
- resistance to unbundling and competition
  *gradual progress towards the single market*
Conclusions on competition

• Challenge: create effective competition
• increasing cross-border trade helps
  – but needs adequate capacity and access
• Market structure changes hard to reverse
  ⇒ Be cautious of mergers
• Need pro-competitive regulators
  – with adequate powers (information, enforcement)
Conclusions on regulation

• Regulation of private utilities must protect consumer and investor

• Is the regulatory compact credible?

• Need to combine credibility and ability to change rules

⇒ need good dispute resolution process

• its decisions must also be credible
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Acronyms-1

CC: Competition Commission
CEC: Commission of European Communities
CEGB: Central Electricity Generating Board
COLS: Corrected ordinary least squares
CRS: Constant returns to scale
DEA: data envelopment analysis
Disco: Distribution company
DOJ: US Dept of Justice
ESI: Electricity supply industry
G: generation
Acronyms-2

HHI: Hirschman-Herfindahl Index = sum of squared market shares
PDV: present discounted value
PUC: Public Utility Commission
RAB: regulatory asset base
REC: Regional Electricity (Distribution) Company
RPI: Retail Price Index
rTPA: regulated Third Party Access
T: Transmission
WACC: weighted average cost of capital