Mediating Market Power in Electricity Networks

Richard J. Gilbert (UC Berkeley)

Karsten Neuhoff, David Newbery,
DAE Cambridge

TMR workshop, Lisbon 6 Oct 2001

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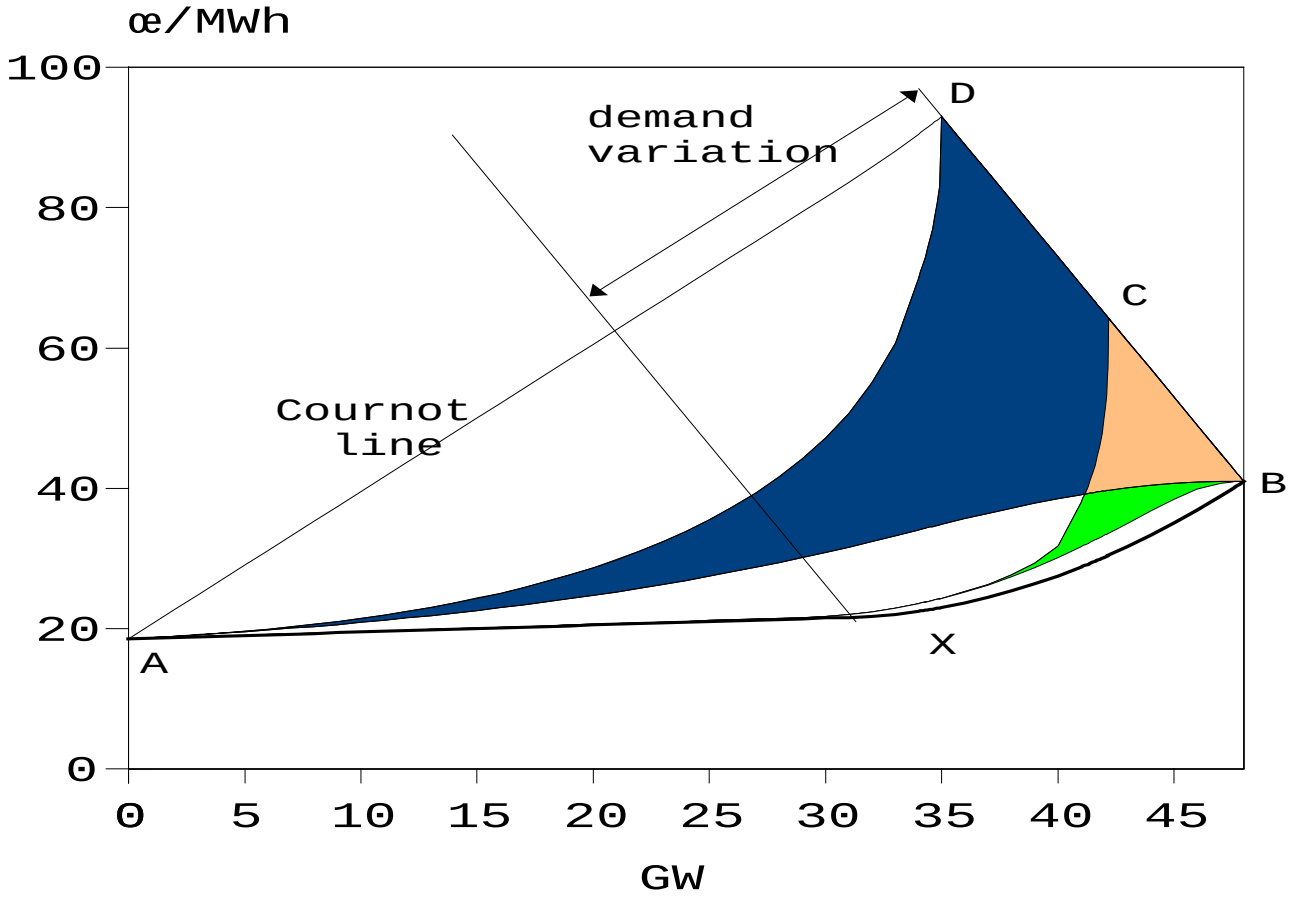
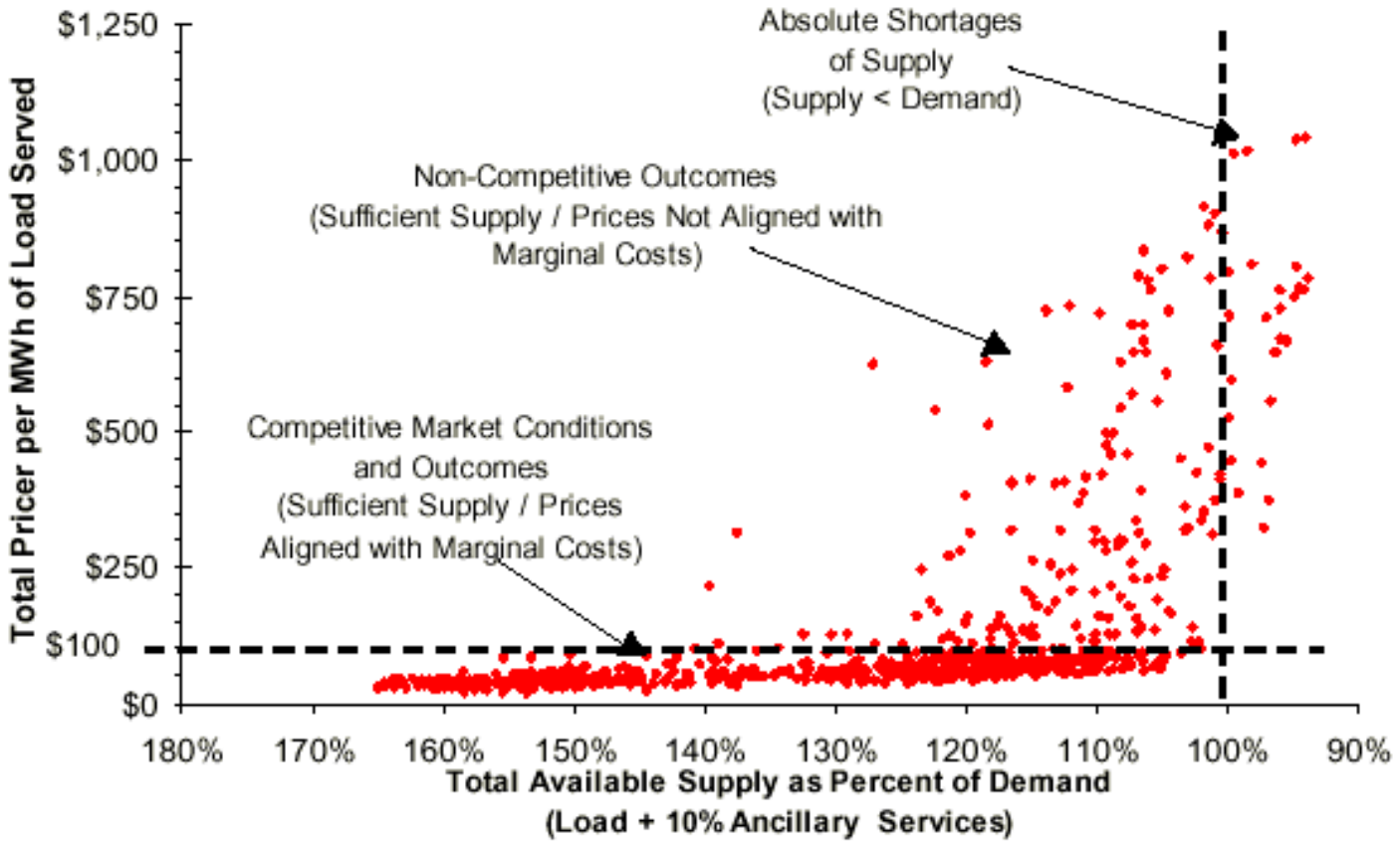
Feasible Supply Functions
Duopoly and Quintopoly



Calibrated for England 1990

Scarcity or Market Power?



* Source: *Report on California Energy Market Issues and Performance: May-June, 2000*,
Prepared by the Department of Market Analysis, August 10, 2000

Market power in networks

- peak price increases as $1/\{(n+1)\epsilon\}$
- demand elasticity ϵ very low
- transmission constraints fragment market
- reduce effective number of generators, *n*
- generators can exploit constraints

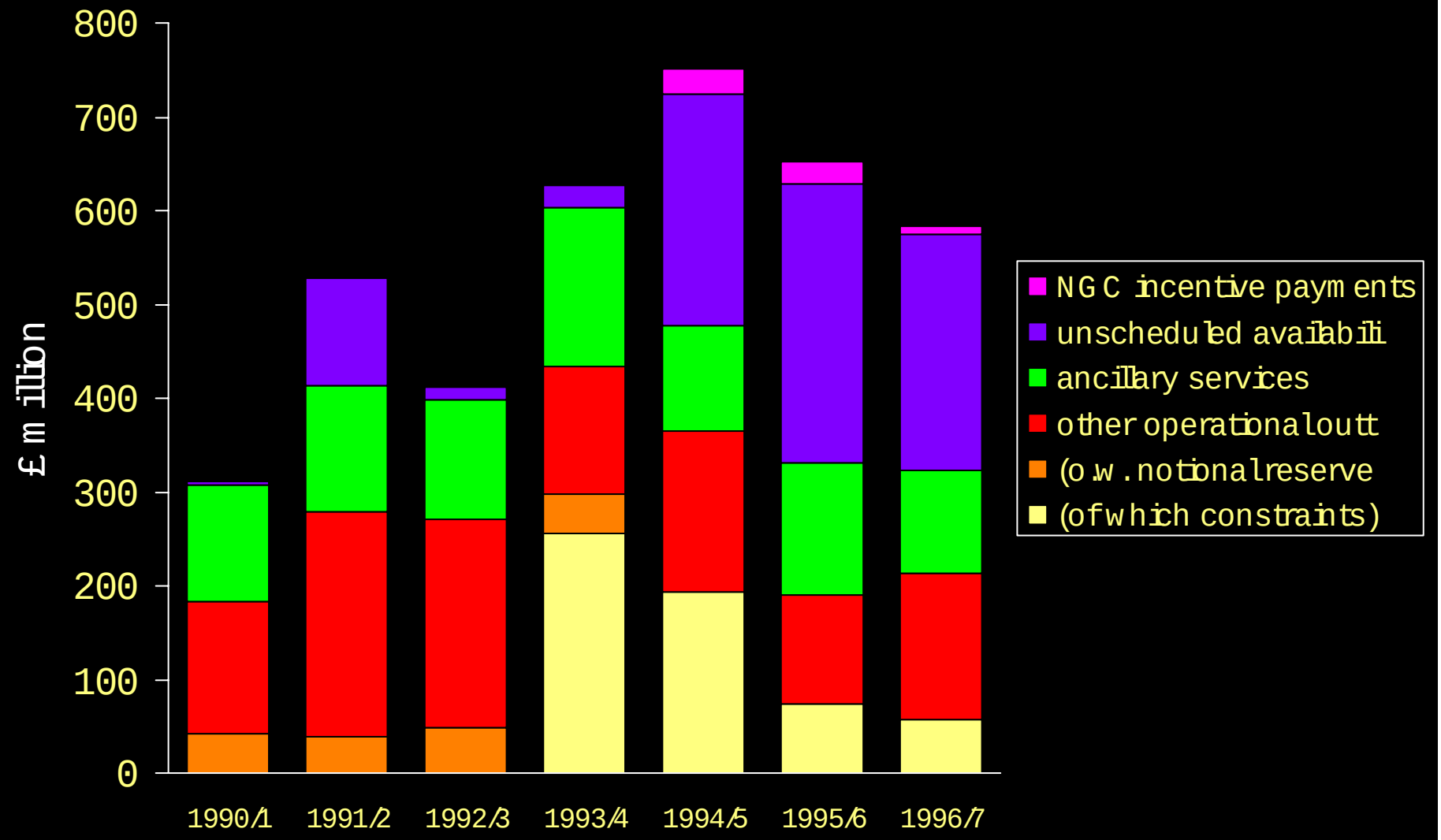
Dealing with market power

- desirable to reduce concentration
  - trend is in other direction
- 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?

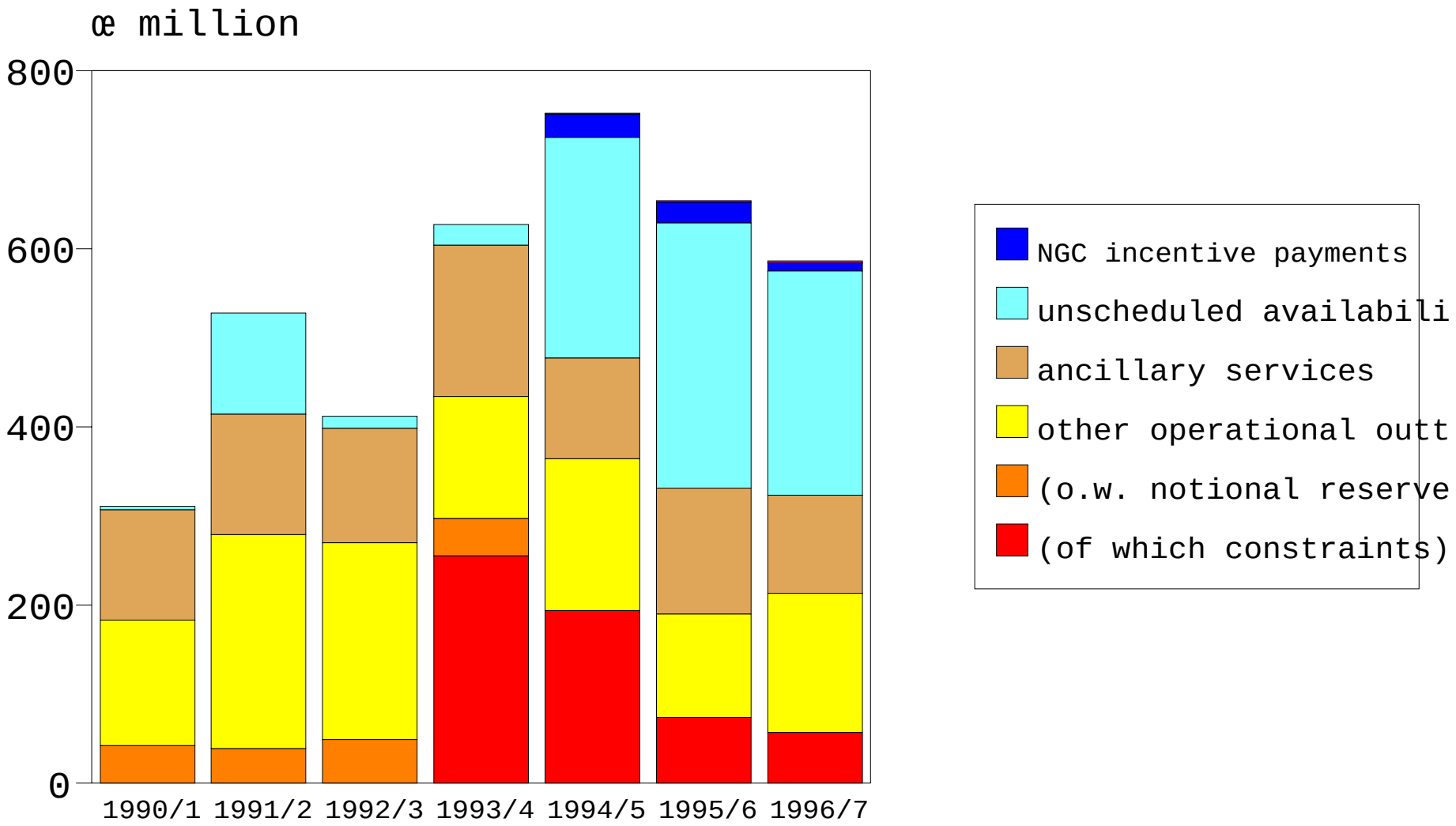
Theory and evidence

- constraints increase after liberalisation
  - PJM, California - Borenstein
  - England and Wales
- Theory: Borenstein, Joskow-Tirole
  - Gencos bid to exploit constraints
  - increasing capacity reduces market power
  - withholding transport abusive

Uplift Payments (at 1995/96 prices)



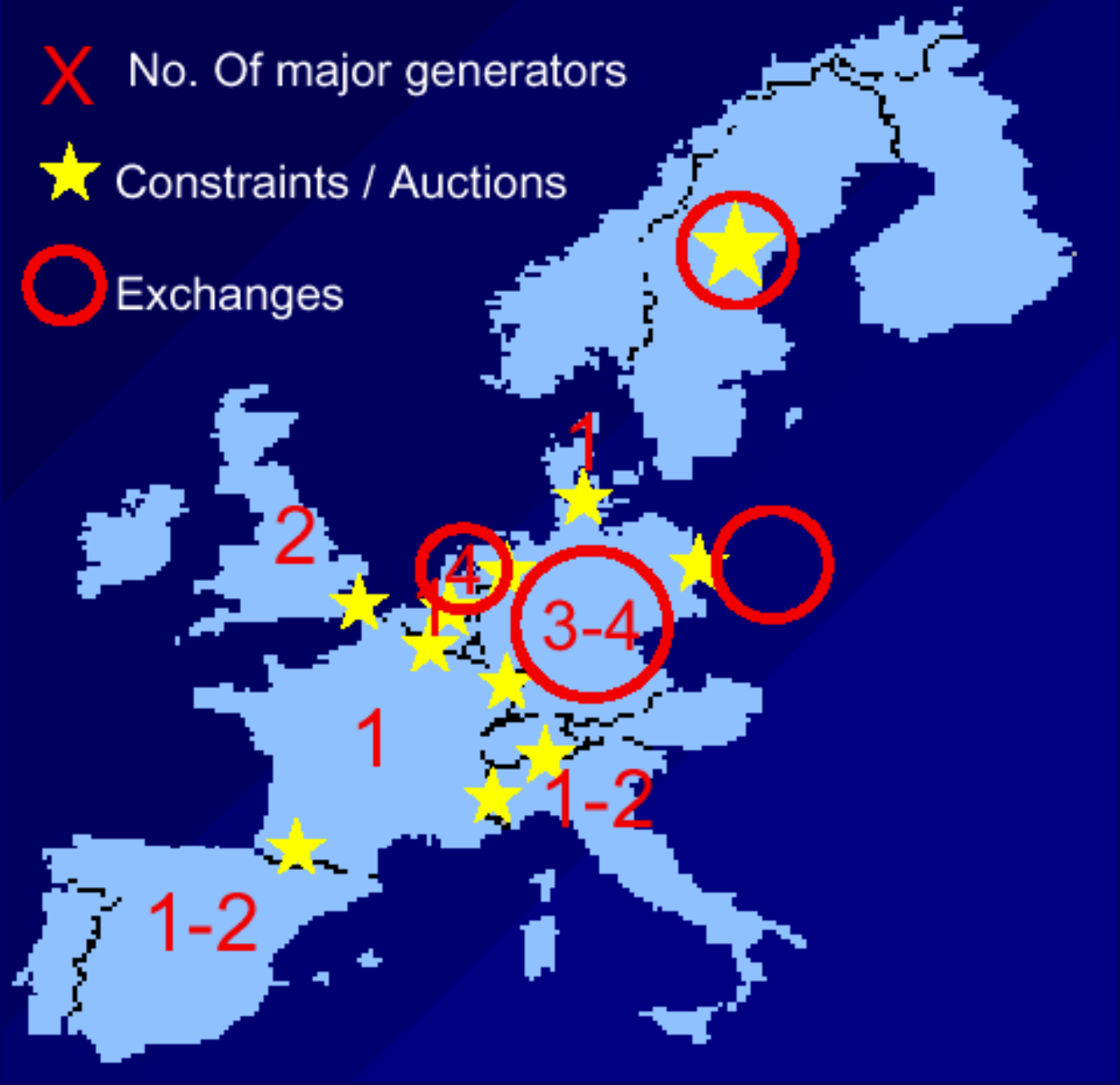
Uplift Payments (at 1995/96 prices)



Examples to model

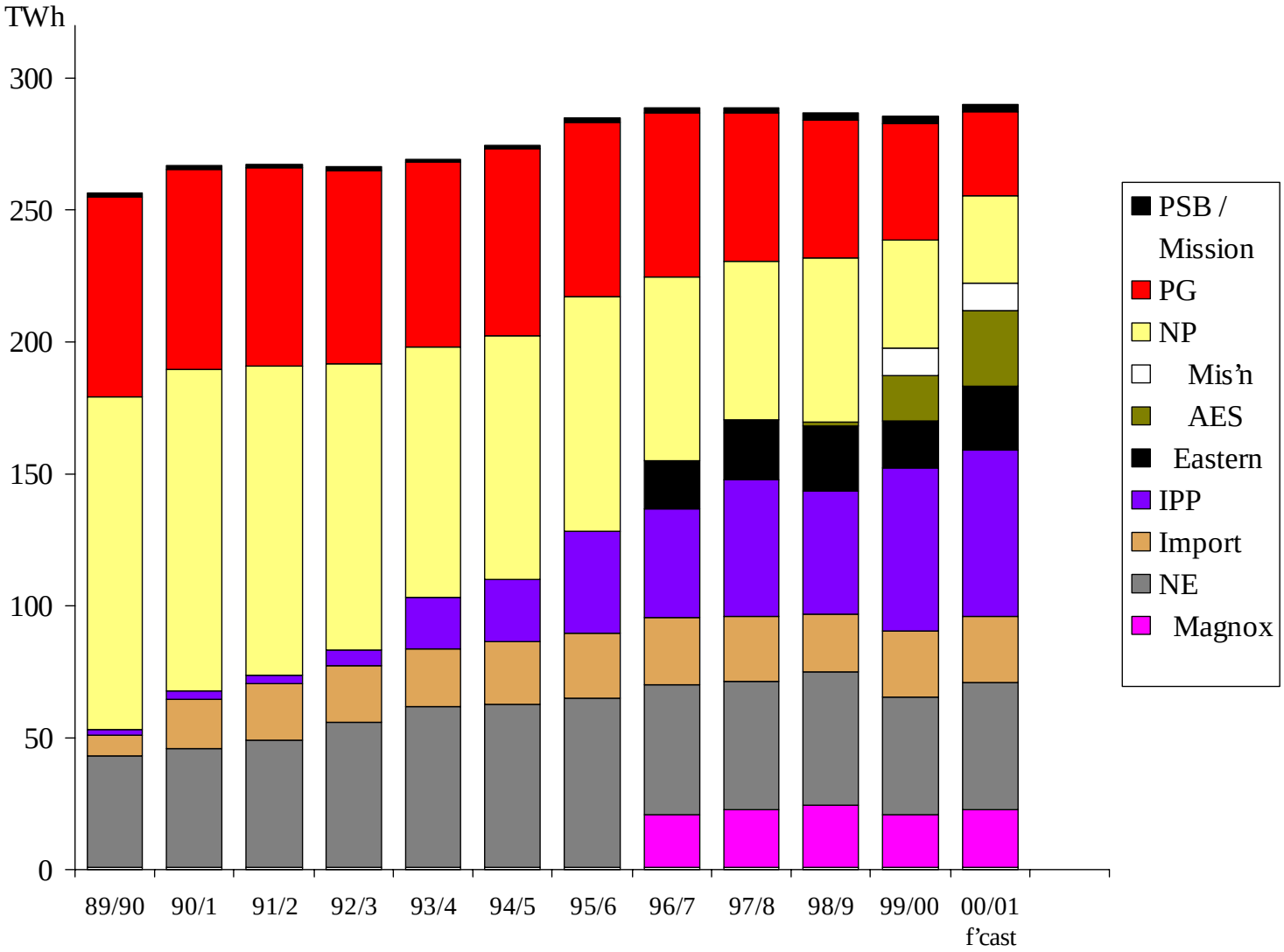
- Scotland-England interconnector
  - Scotland exports are constrained
  - England more competitive than Scotland
- England-France interconnector
  - France is cheap monopolist, IC auctioned
- Netherlands-interconnectors
  - Netherlands imports, IC auctioned
  - NL less competitive than Germany

Transmission constraints in Europe

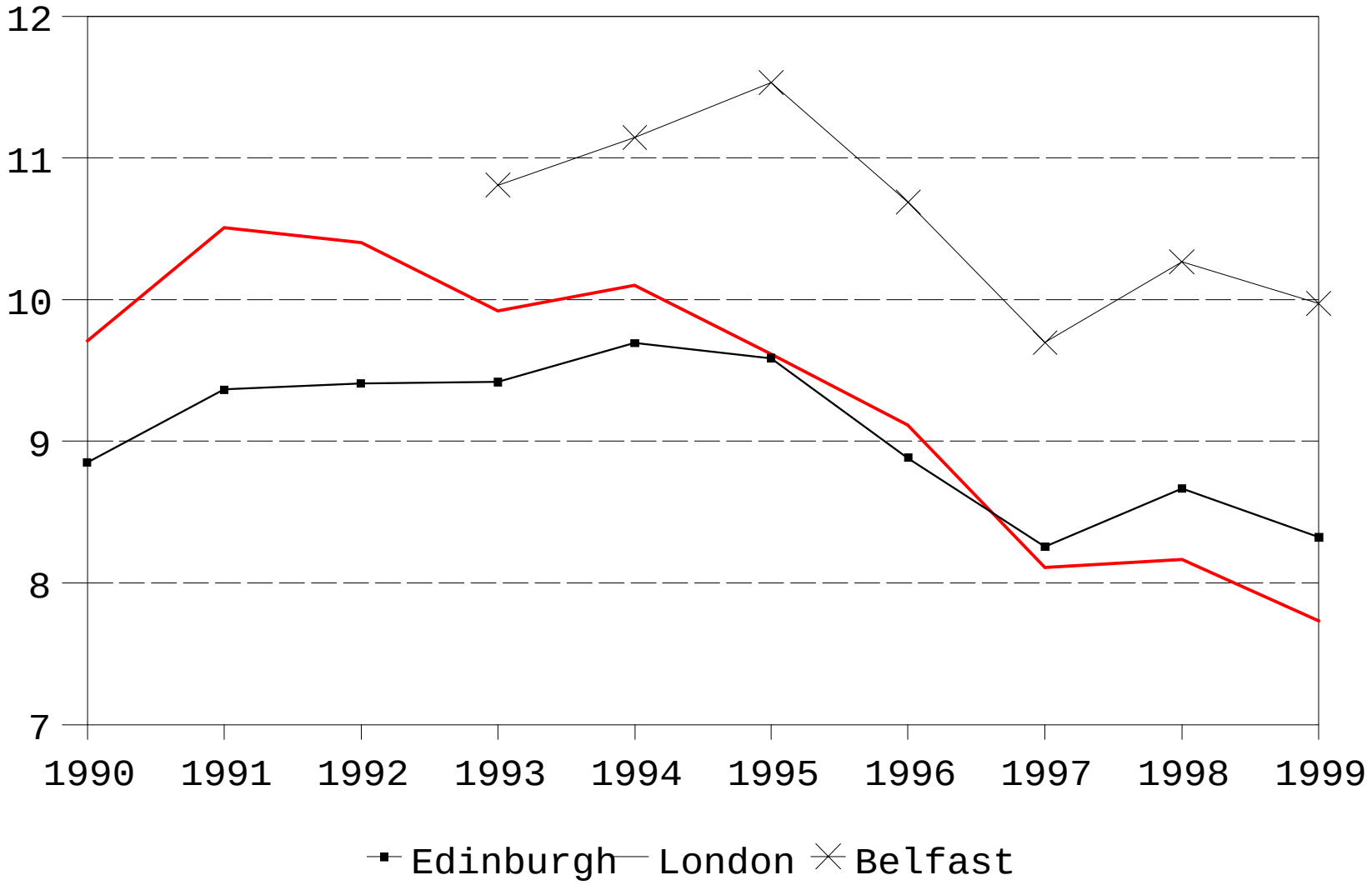


Source: Towards a Reliable European Energy Market, Presentation by B. den Ouden, APX, January 2001

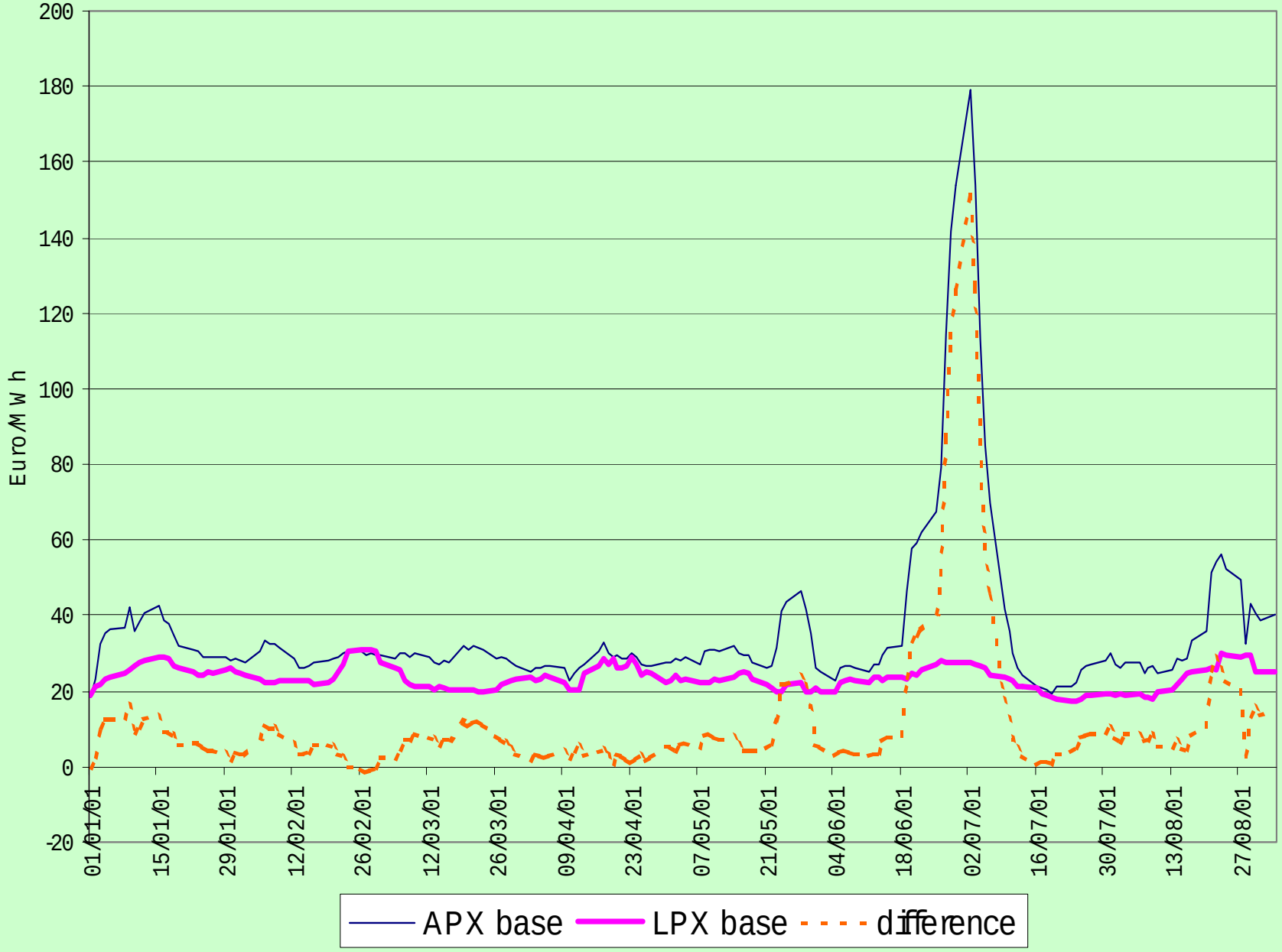
Generation in England and Wales



Electricity prices by town
3,300 kWh at 2000 prices excl VAT



Weekday baseload prices (weekly moving average)



Two-node model - auctions

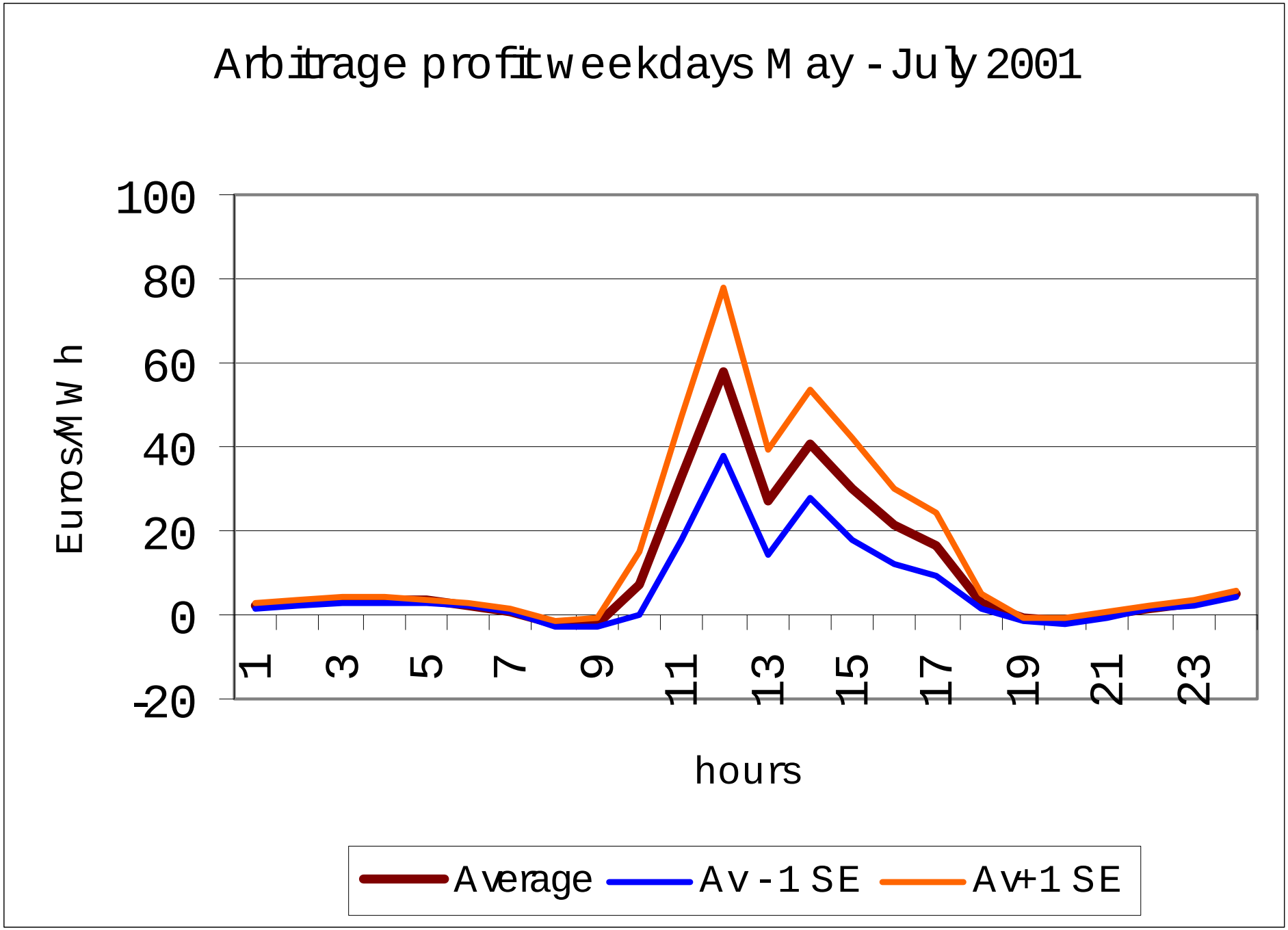
- 2 nodes simplest configuration
- Interconnectors often single links
  - France-England
  - Germany-Netherlands (actually 2)
- increasingly auctioned
- policy issues - auction design

Two-node model - 1

- oligopoly exporters, competitive importers
- should exporters be disbarred from auction?
- If they can pre-empt auction this lowers exporter price
  - pre-commitment of export capacity is pro-competitive (like a forward contract)

Two-node model - 2

- oligopoly importers, competitive exporters
- should importers be disbarred from auction?
- They can only benefit by making a profit on the interconnector
  - But competitive traders can always arbitrage this profit away
  - no need to restrict importing Gencos?


Arbitrage profit weekdays May - July 2001
100
80
60
40
20
0
-20
Euros/MWh
1
3
5
7
9
11
13
15
17
19
21
23
hours
Average
Av -1 SE
Av+1 SE

Conclusion on simple links

- if arbitrage is effective, then no need for restrictions on auctions
- However, arbitrage may not be effective
- Is arbitrage improved by restricting importers?
- If so then restrictions are justified

Issues in meshed networks

- How should capacity be determined?
- How should it be allocated?
- What are the trade-offs?
  - simplicity and liquidity vs efficiency and market power
  - variants of postage stamp pricing vs market-based solutions

Market power in meshed networks

- Kirchoff's Laws imply loop flows

⇒transmission constraints impact on all flows

⇒constraint management complicated

- market-based solutions:
  - nodal prices
  - property rights to entry or exit

Flow-gate rights

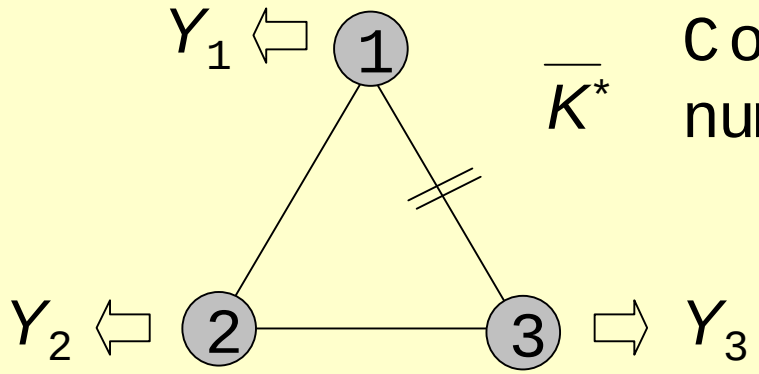
- determine fraction of flow from *i* to *j*
- Physically defined by network
  - independent of (DC) flows
  - change if links changed
- equivalent to exit rights
- Should the SO trade these rights?
- If so, on what terms?

System Operator models

- SO can issue non-tradable exit rights
  - current procedure
- or SO can actively trade exit rights
- Tradable rights give more price elasticity
  - mitigates market power
  - requires careful design of terms of trade

Three zone model to model exit rights

Oligopoly with n generators
Demand = $A_1 - b_1 p_1$
Marginal cost = βq_i

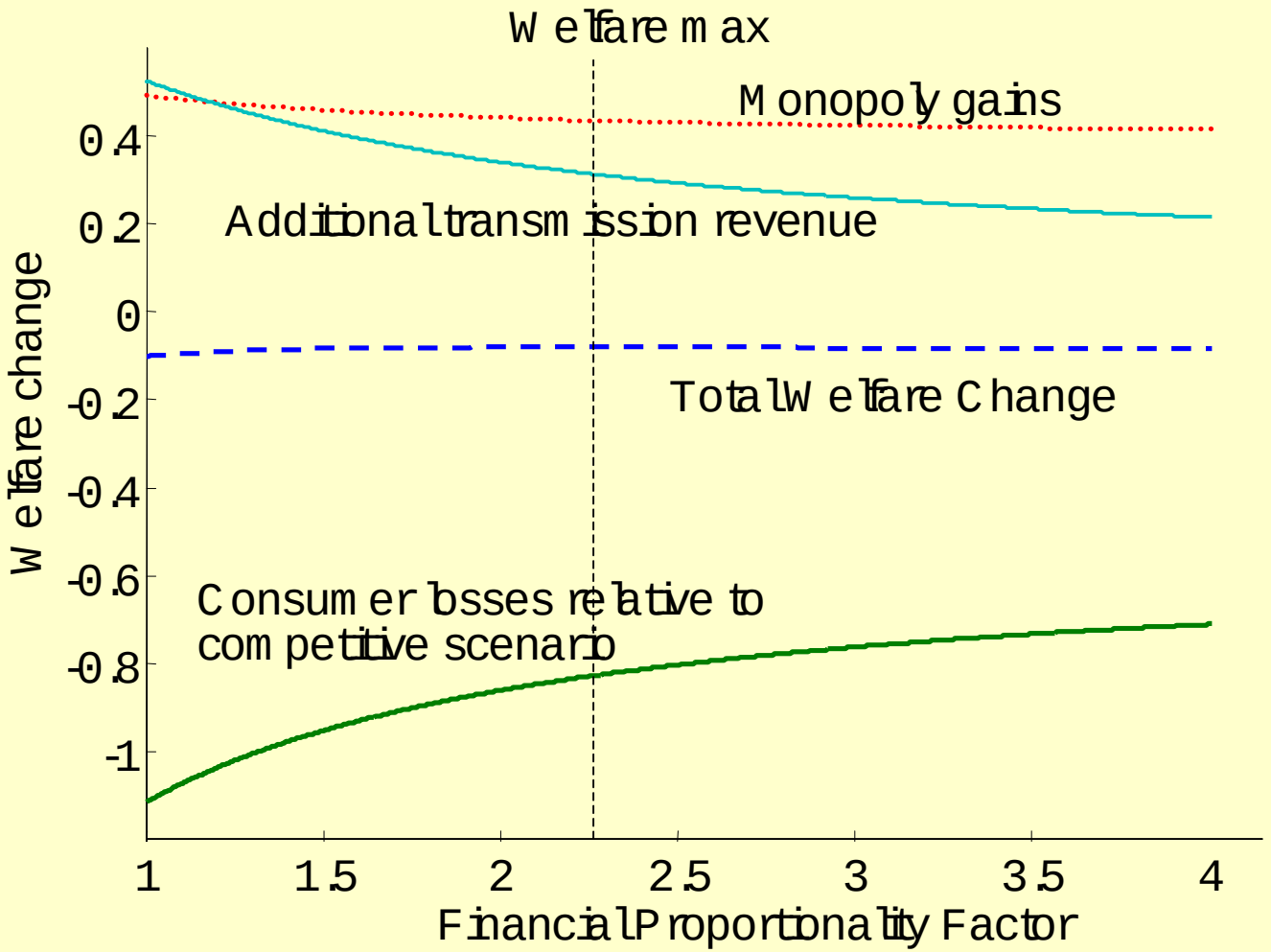


Constraint location in numerical example

Competitive market
Net demand = $A - b p_2$

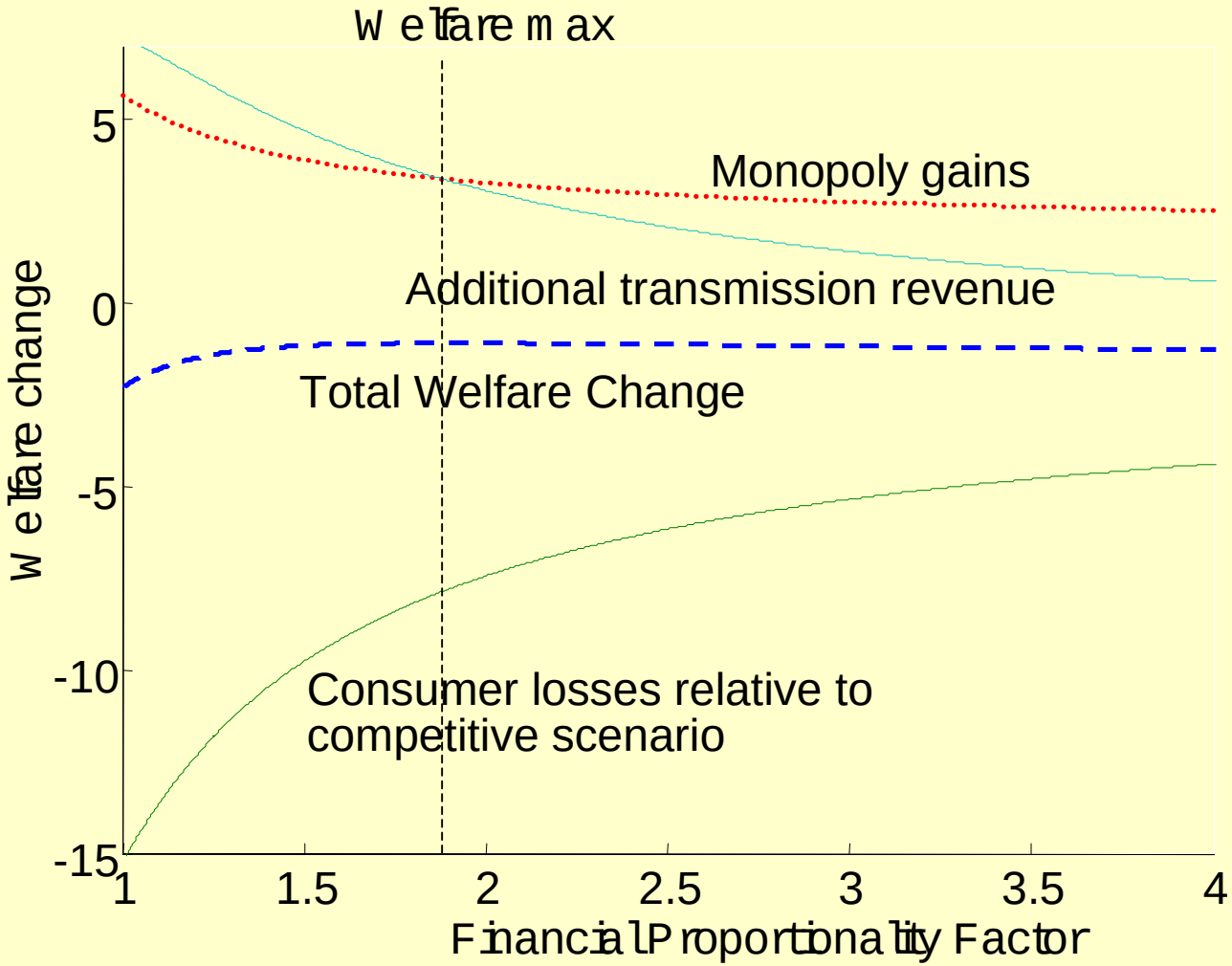
Competitive market
Net demand = $A - b p_3$

Results for importing monopoly assuming low demand elasticity



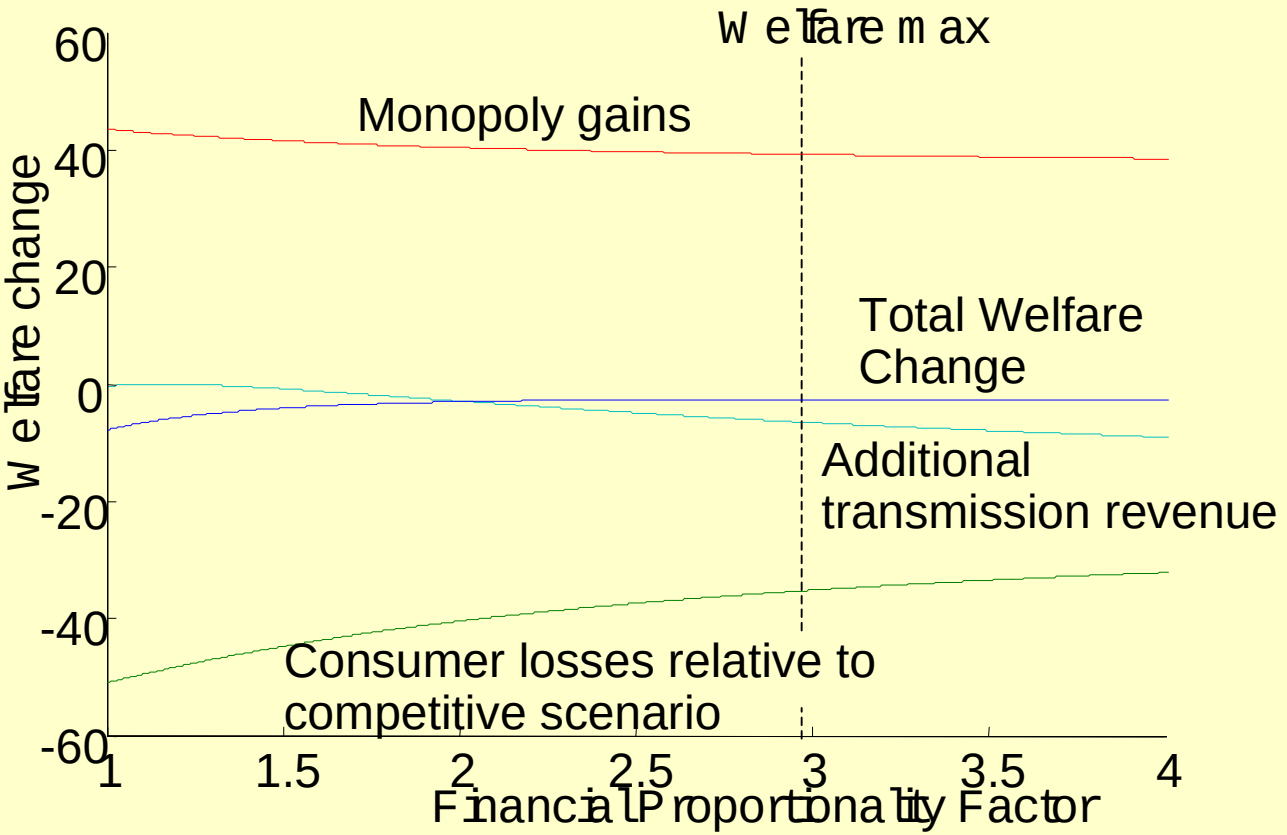
Change in Welfare relative to competitive scenario in the case of an importing monopolist at node one (b_1=1.5, A_1=5, b=1, A=0, beta =1)

Results for importing monopoly assuming high demand elasticity



Change demand slope in zone one to b_1=0.3 changes welfare maximising financial proportionality factor gamma $_F$=1.92.0 ther parameters stay constant (A_1=5, b=1, A=0, beta =1)

Result for exporting duopoly



Transmission investment

- Should the the TO "over-invest"?
  - relative to a competitive analysis
- Exporter market power: $\Delta q > 0$
  - increased value of (p-MC).Δq
- Importer market power
  - is $\Delta q < 0$?
- Whose welfare should count?

Conclusions

- market power requires new approach
- competitive paradigm may mislead
  - auction design for interconnectors
  - exit rights for transmission
  - investment in transmission expansion
- Guidance for multi-systems dispatch needed
- Goal is a workable and robust solution

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