Market monitoring tools

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http://www.electricitypolicy.org.uk

A Review of the Monitoring of Market Power

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download CMI EP 71from

http://www.electricitypolicy.org.uk/pubs/wp.html

Market Power Detection Tools

Choose tools suitable for different tasks:

- Ex-ante versus ex-post analysis

- Long-term vs. short-term/real time analysis

- System-level market power vs. local market power vs firm-level market power

- Horizontal market power vs vertical market power

Applications of Market Power Detection Tools

	Ex-Ante	Ex-Post
Long-Term	- Merger rulings - Assessing applications for market-based rates - Determining potential must-run generators - requiring contracts	- Litigation cases (e.g. California refund case) - Changing market design - requiring contracts and VPPs
Short-Term	- Spot market bid mitigation - Must-run activation & other system operator contracting	- Short term price re-calculations - Penalties for withholding

Inspired by a similar table in Helman (2004)

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Market Power Detection Tools – List

- **Behavioral Indices and Analysis**
  - Bid-Cost Margins (e.g. Lerner Index)
  - Net Revenue Benchmark Analysis
- **Structural Indices and Analysis**
  - Concentration ratios and HHI
  - Residual Supply Index
  - Residual Demand Analysis
- **Simulation Models**
  - Competitive Benchmark Analysis
  - Oligopoly Models

Bid-Cost Margins

- Lerner Index:

$$LI = \frac{\text{Price} - \text{Marginal Cost}}{\text{Price}}$$

- In a competitive market *LI* is zero
  - if MC correctly interpreted as scarcity price
- Cournot oligopoly *LI* = market share/elasticity
- Do not require geographic market definitions
- Is a standard measure of exercise of market power
- but which MC? Short-run or long-run?

Market share methods

- Concentration ratios
  - C1: share of largest firm
  - C3, C4 total share of top 3 or 4 firms
- Capacity, available capacity, with or without imports (depending how interconnector controlled?)
  - shares of production also revealing
- C1 > 20% can be a concern
  - but depends on extent of spare capacity

## Concentration ratios Installed capacity 2001
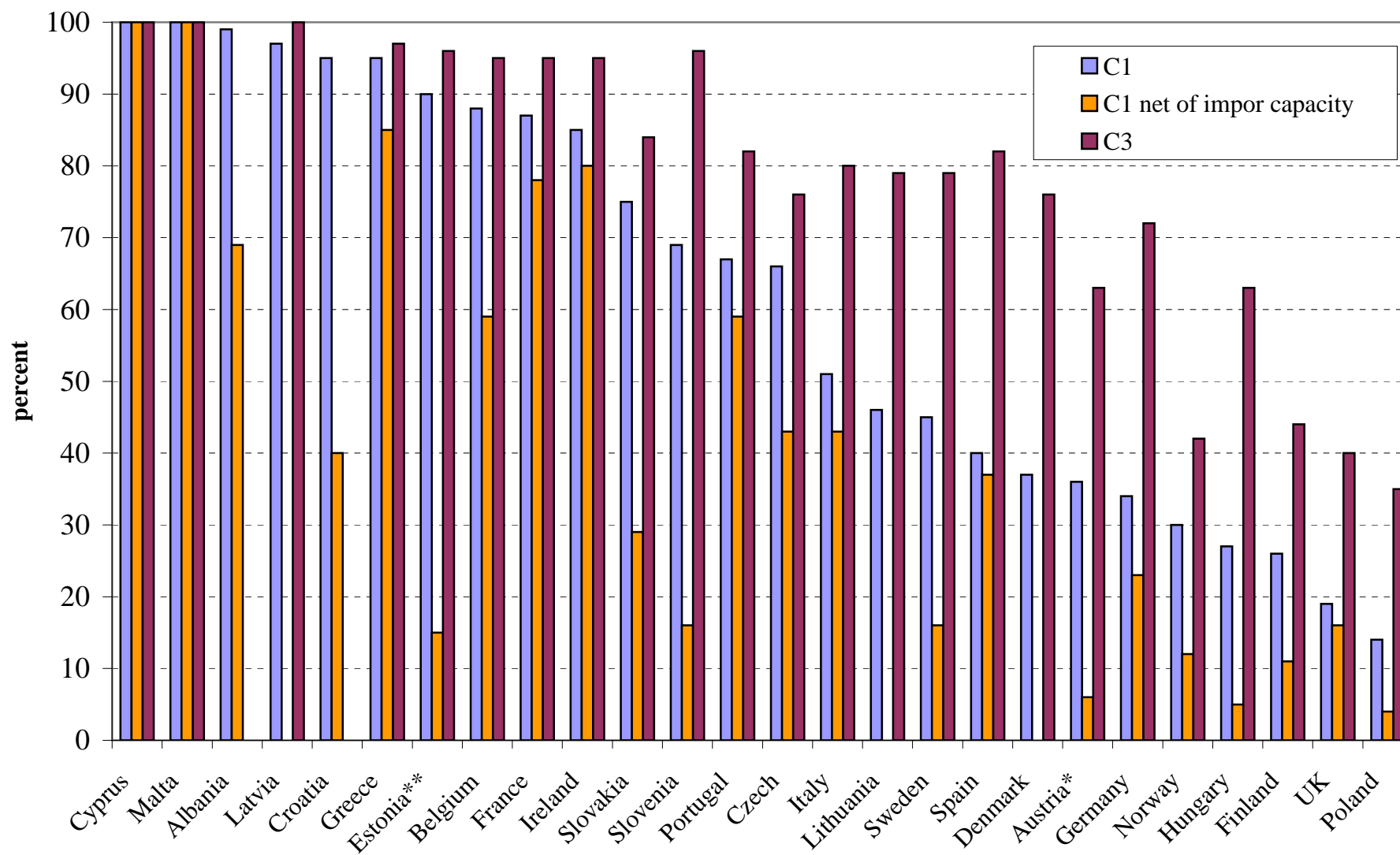
Source: EU 3rd Benchmarking Report

Herfindahl Hirschman Index: HHI

- Standard tool for anti-trust (esp. in US)
- HHI = sum of squared market share %:
  e.g. 5 firms of 20% each => HHI = 2,000
  number of equivalent firms $n = 10,000/HHI$
- screens

  <1000 unconcentrated

  1000-1800 moderately concentrated

  >1800 highly concentrated

  *=> serious concern if HHI>1800 and merger
  raises HHI by more than 100*

HHI by capacity for England and Wales 1990-2002

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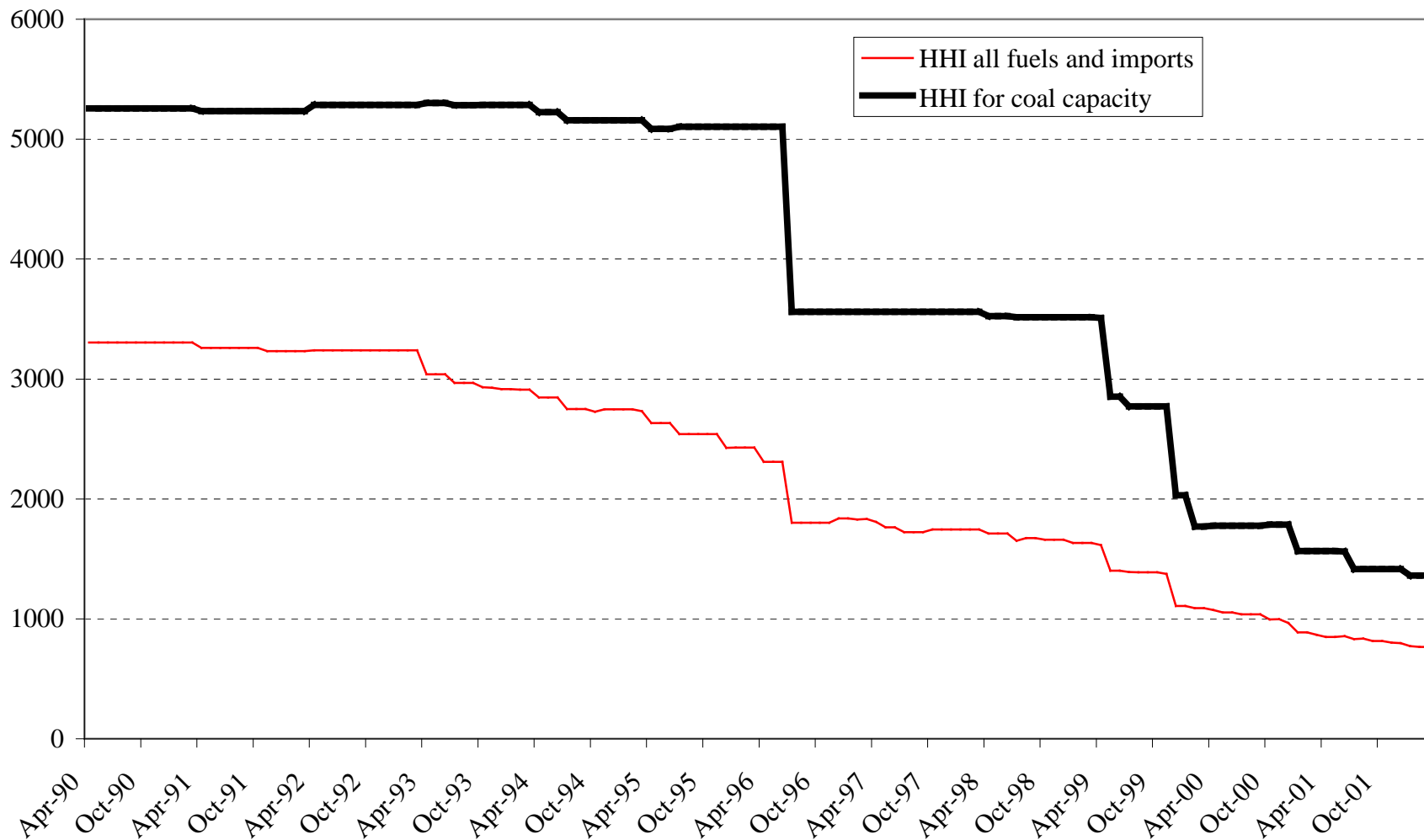
Market Share and HHI

- Difficult to determine appropriate geographic region (e.g. SSNIP test, Hub-and-Spoke)
- Ignores demand side, entry conditions, strategic incentives and often congestion issues
- Little empirical justification
- California - under some market definitions, no single supplier in California had a 20% market share during the crises
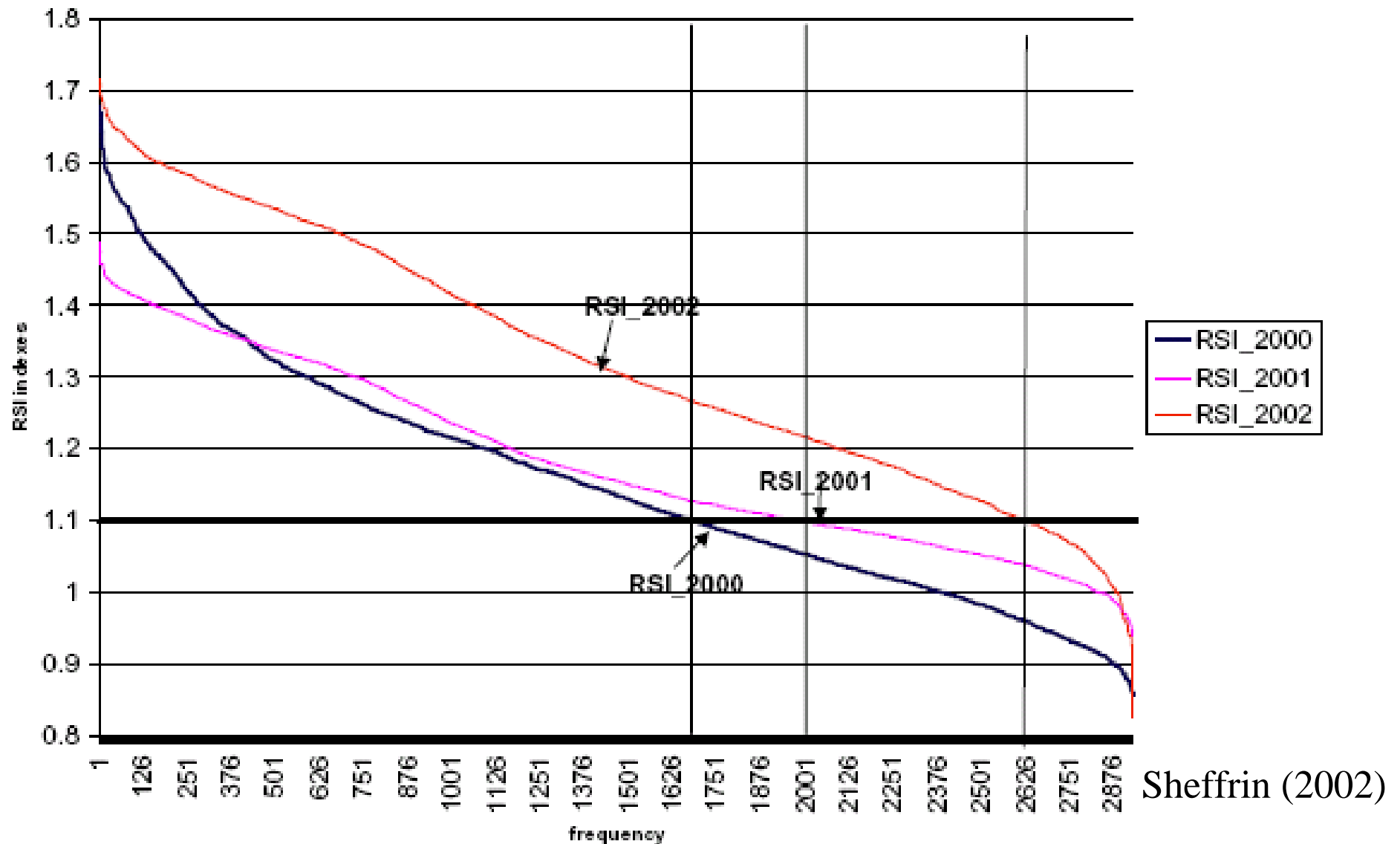
Residual Supply Index

- Measures the extent to which a generator's capacity is necessary to supply demand after taking into account other generators' capacity

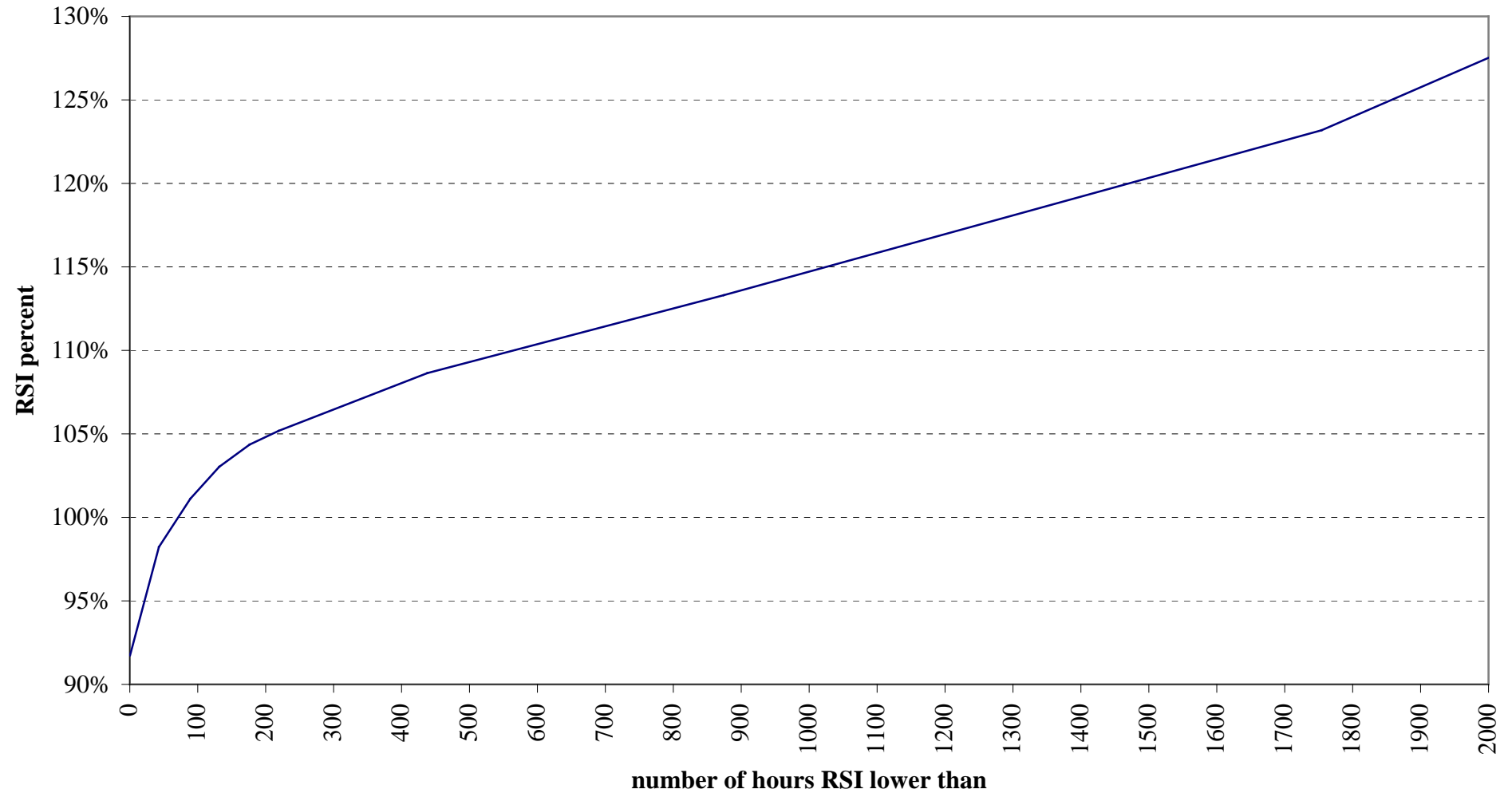- Residual Supply Index – continuous variable

$$RSI = \frac{\text{Total Capacity} - \text{Company i's Relevent Capacity}}{\text{Total Demand}}$$

Sheffrin's screen test: RSI must not be less than 110% for more than 5% of hours per year

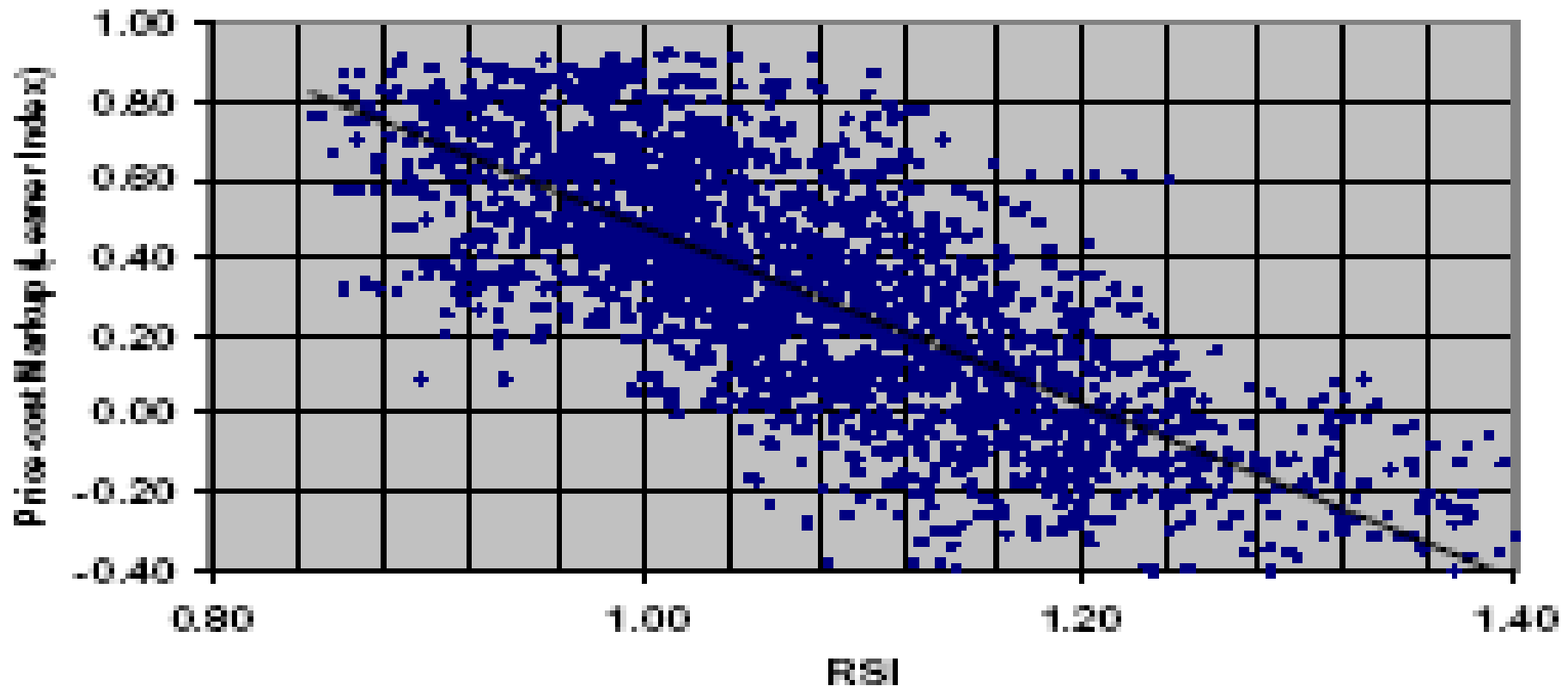# California RSI duration curve
June-Sep 2000-2002 all hours

Sheffrin (2002)

RSI duration curve GB Winter 1999-2000

number of hours RSI lower than (x-axis)
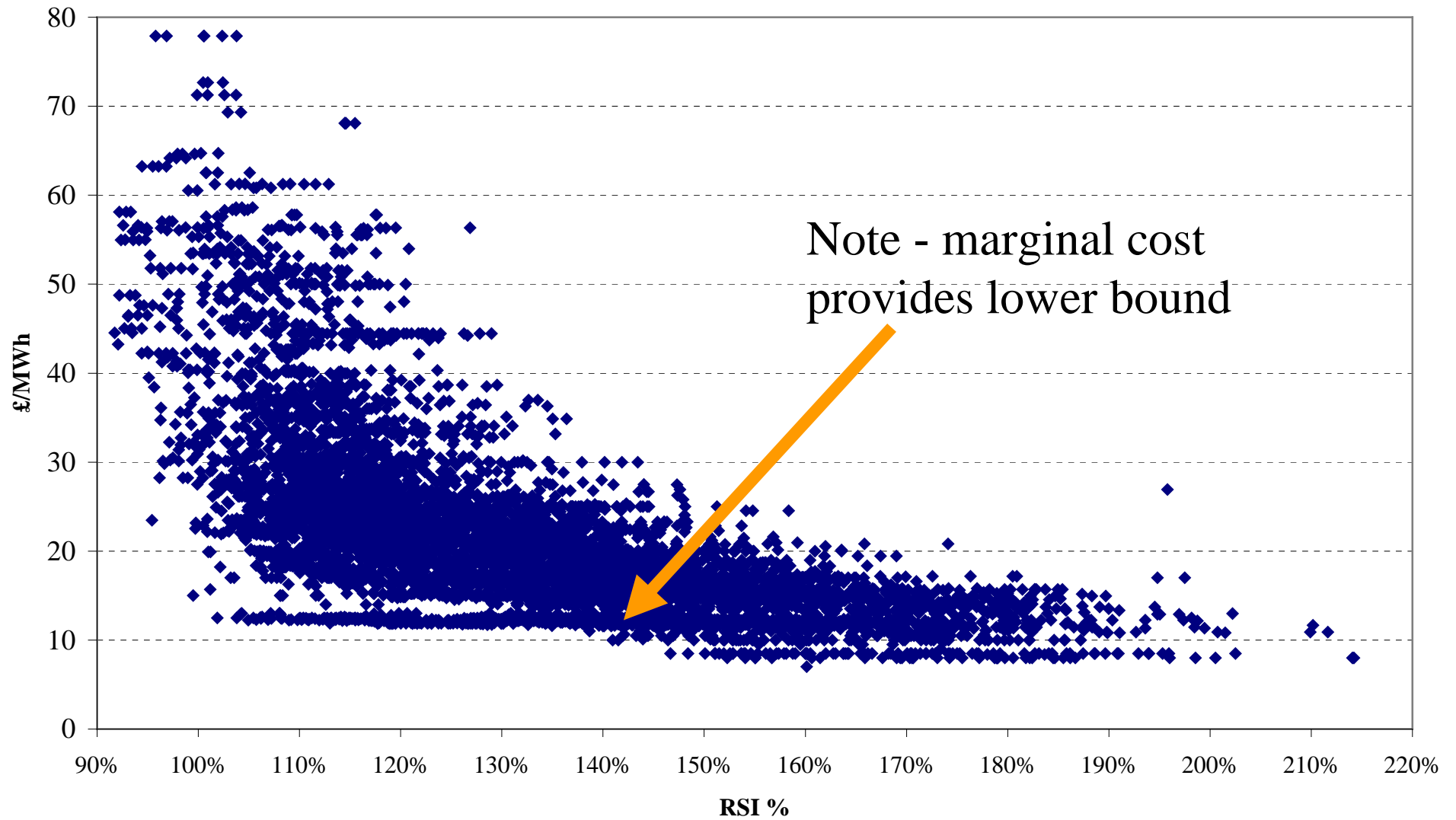
RSI percent (y-axis)

Significant Correlation between RSI and Price-Cost Markup

RSI versus Price-cost Markup -Summer Peak Hours, 2000

Sheffrin (2002)
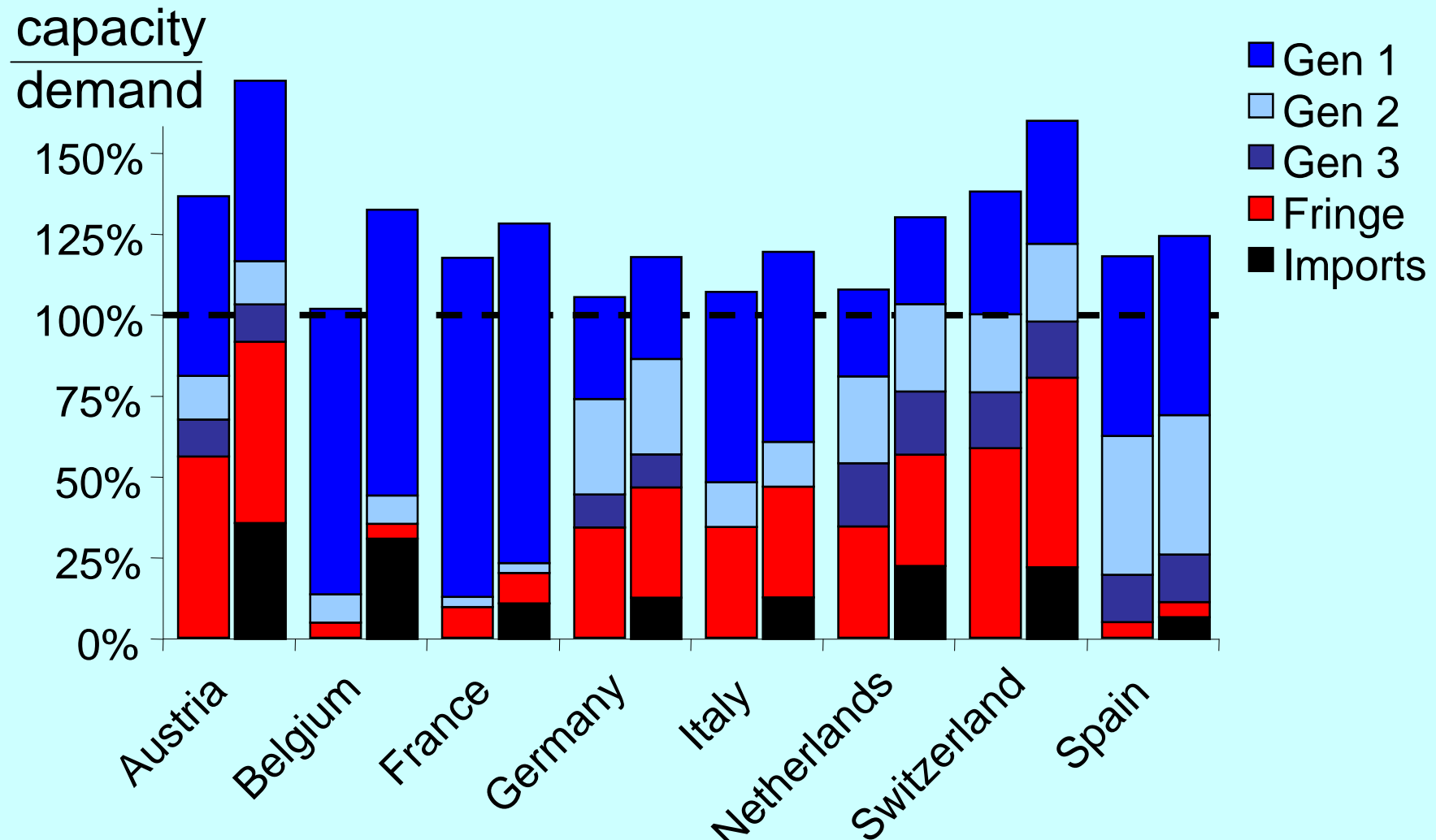
Spot price vs Residual Supply Index GB Winter 1999-2000

Note - marginal cost provides lower bound

Generation companies have MP within countries

... and retain market power due to transmission constraints

Source: Remaining capacity and availability factor from UCTE Power Balance Forecasts 2002-2004, NTC from ETSO (Winter 2001/2002), National Generation Shares from ICF consulting, Annual reports and presentations

Residual Supply Index

- Takes account of capacity scarcity
- Suited to dynamic analysis on an hour-by-hour basis and local market power analysis
- Empirical support of predicting market power
- Needs access to availability data (from TSO?)

Arguably the best tool

Collective dominance if:

- Market characteristics conducive to tacit coordination, *and*

- Tacit coordination sustainable:
  - firms lack ability and incentive to deviate, given incentives for retaliation, and
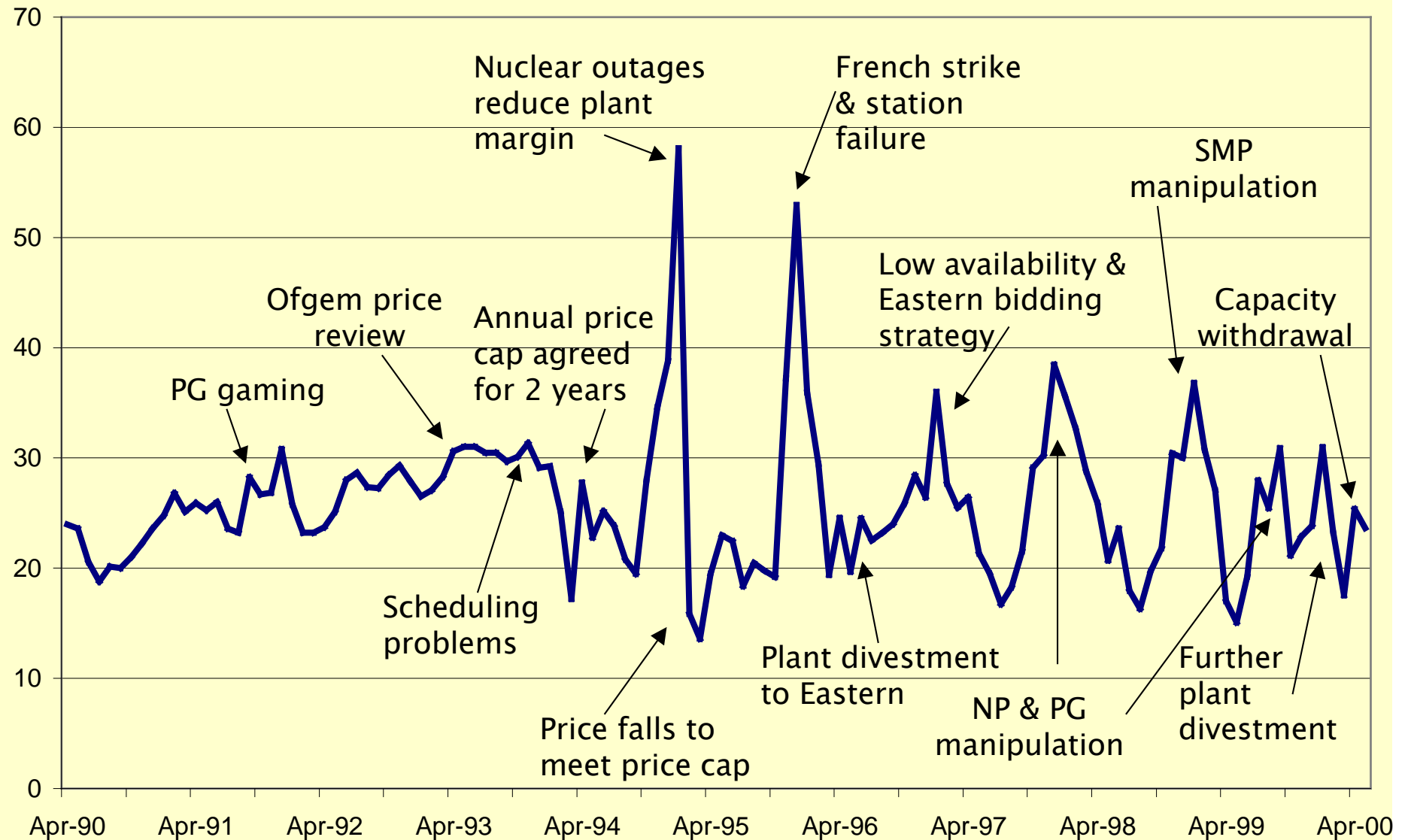 - Buyers, fringe firms, entrants cannot challenge tacit coordination

Collective dominance criteria

- Markets concentrated, transparent, mature
- Low elasticity of demand
- Homogenous product, similar costs, shares
- Little excess capacity, barriers to entry
- Excess pricing, profit
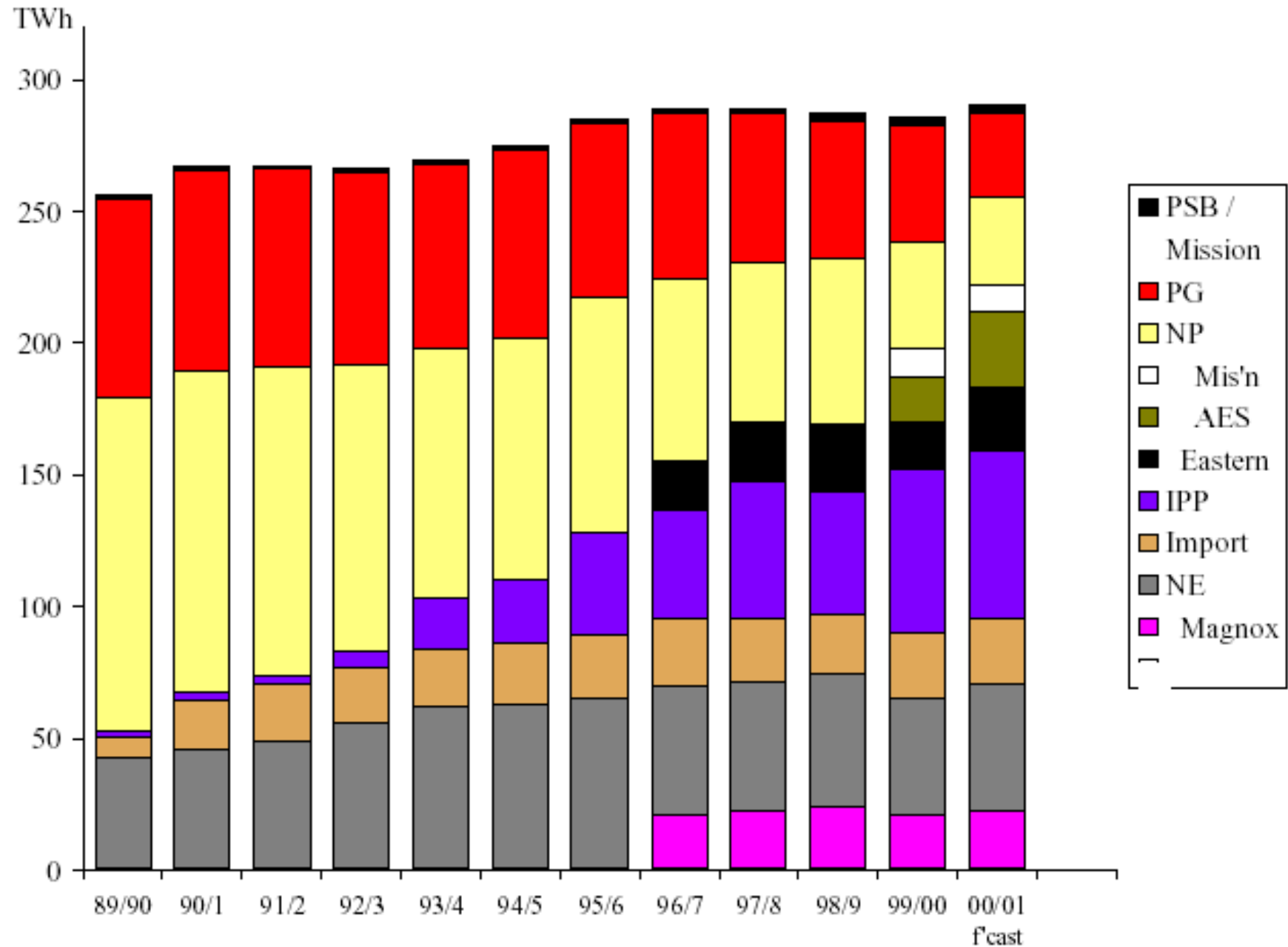   - little response to cost fall, barriers to switching

Electricity as a test case
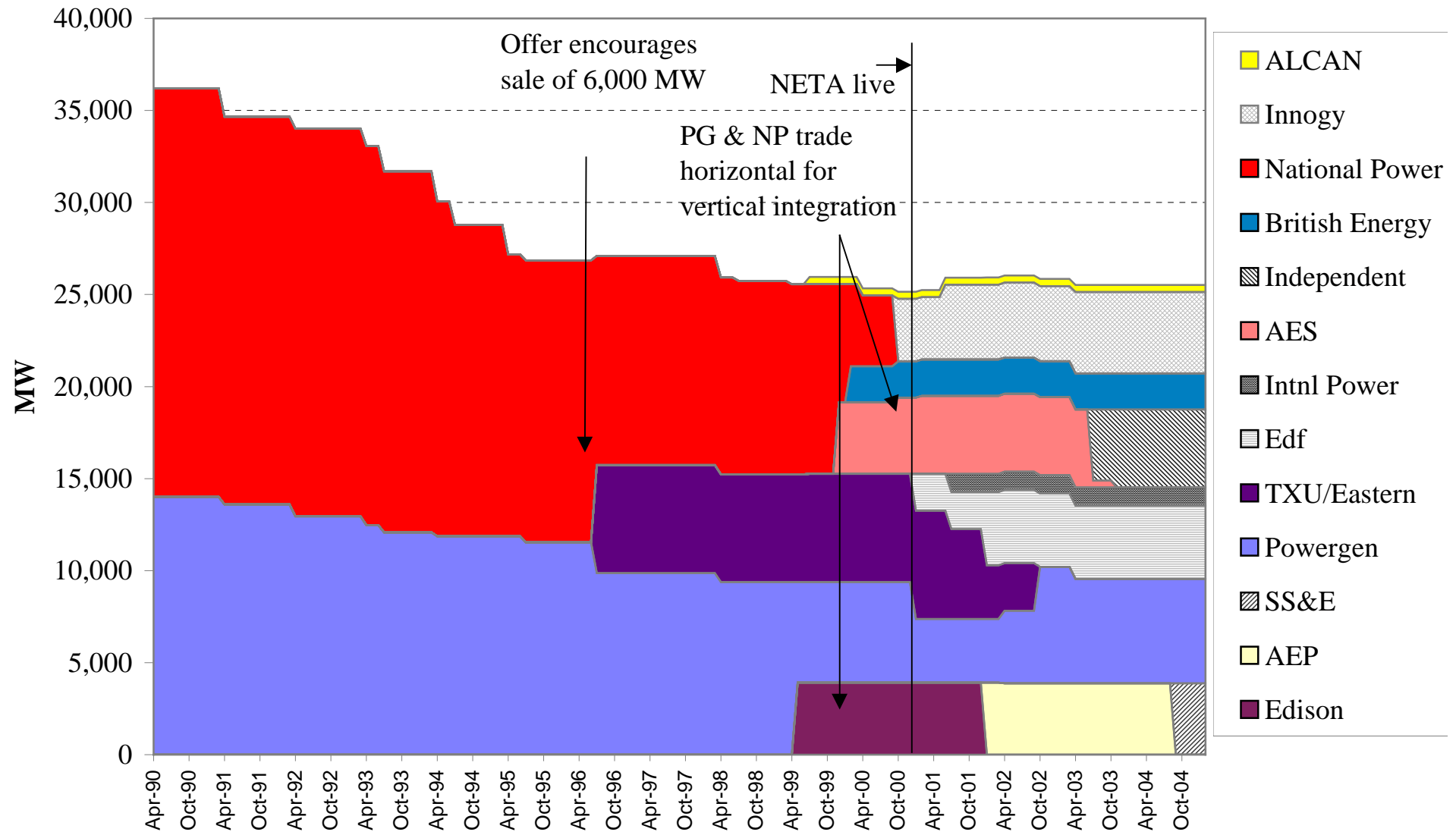
Pool prices since vesting

Generation in England and Wales

Capacity Ownership of Coal Generation 1990-2004

Source: NGC *Seven Year Statements*, various years, and data from J Bower and C Humphries, slide from D Newbery

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Collective dominance: the GB Electricity Pool

- Markets concentrated, transparent, mature ✓
- Low elasticity of demand ✓
- homogenous product, similar costs, shares ✓
- little excess capacity, barriers to entry **?**
- excess pricing, profit ✓
  - little response to cost fall, ✓
  - barriers to switching **??**

Need to be able to test for tacit collusion

Residual Demand Analysis

- Best response to generator's residual demand
- Theoretical justification – Supply Function Equilibria (locally profit maximising)
- Requires individual bid data to construct residual demand curves
- Can detect collusion as well as market power
- e.g. Wolak, Sweeting, Hortacsu/Puller

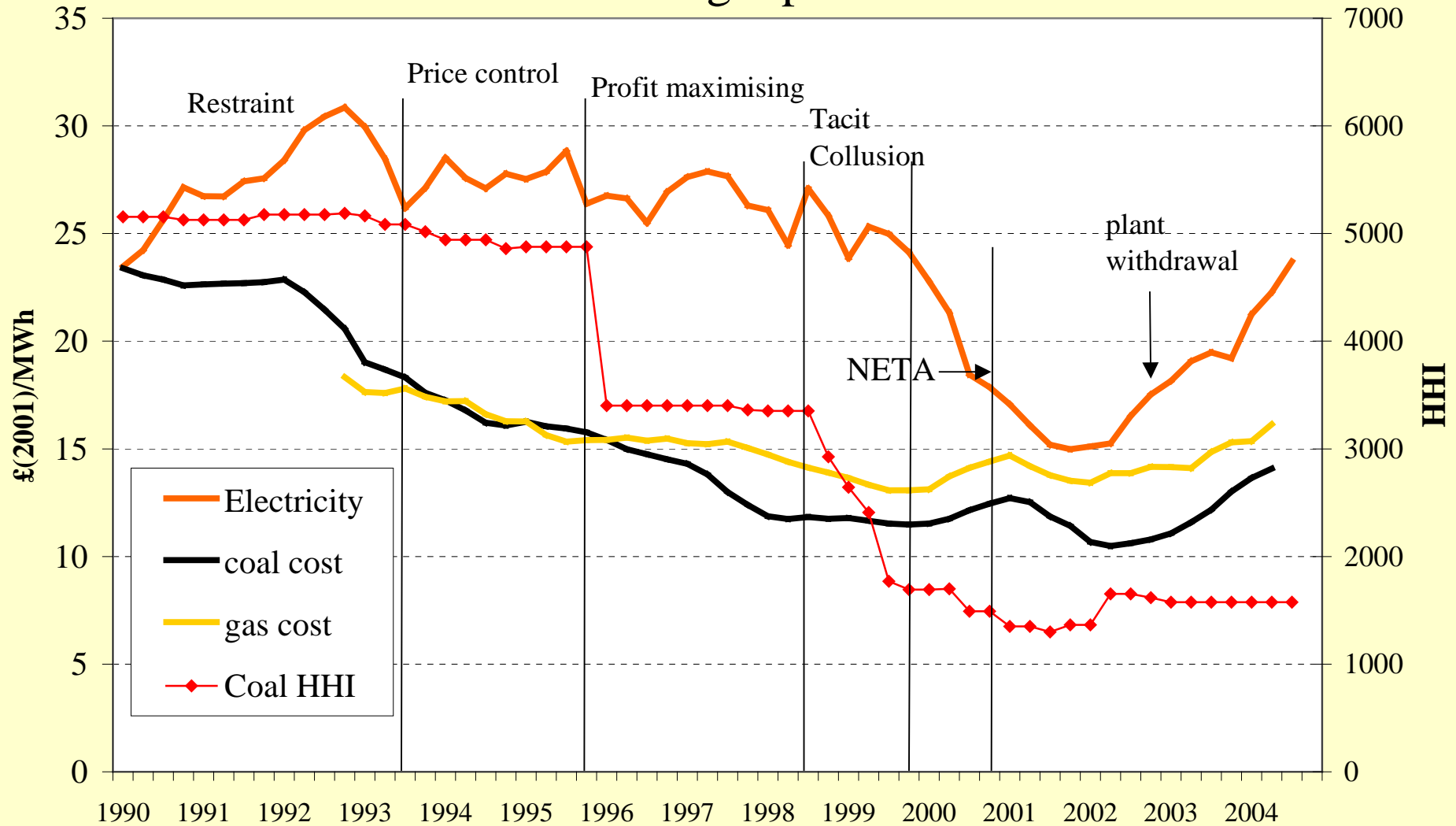Reliant on February 8, 2002 6:00-6:15pm
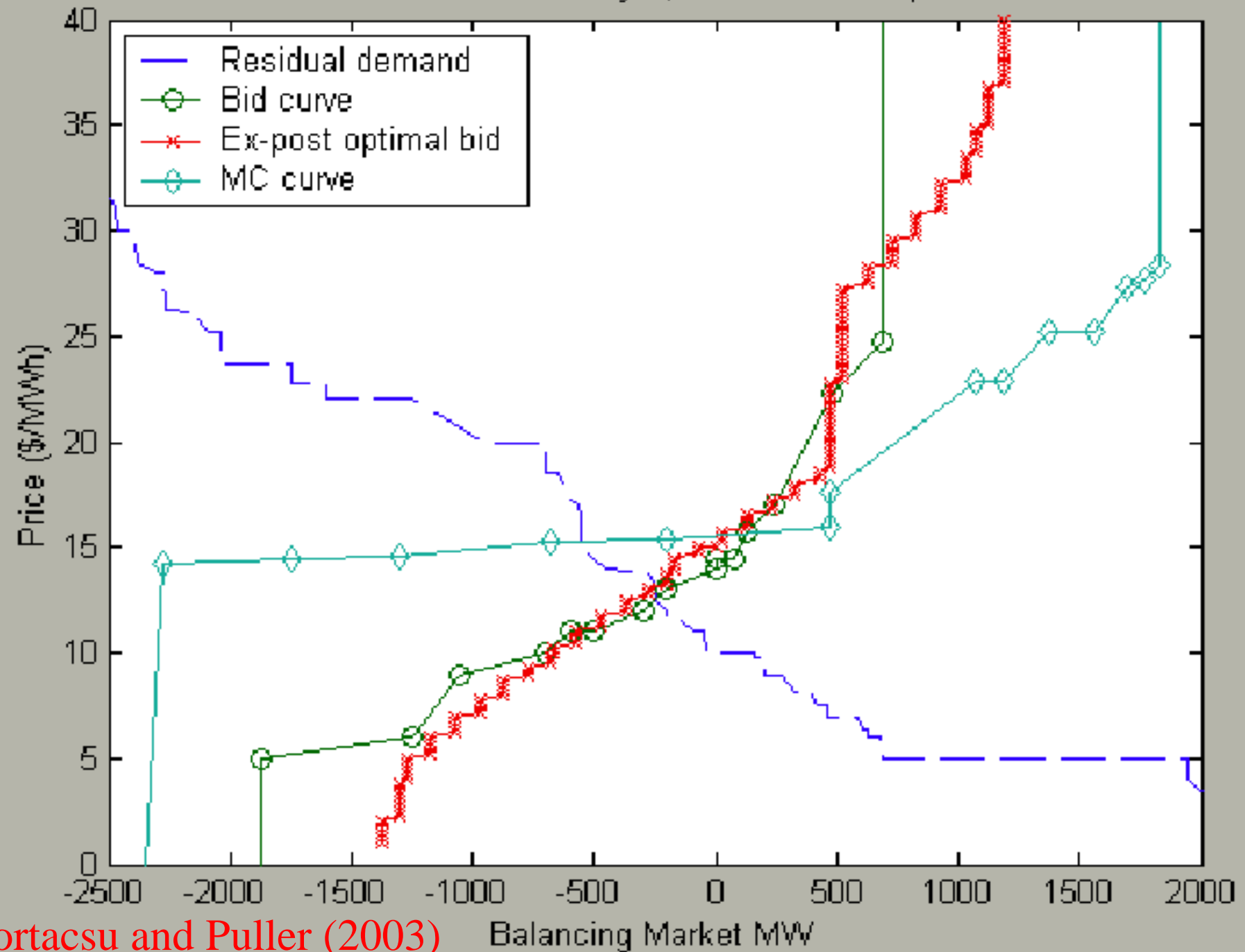
Hortacsu and Puller (2003)

Real GB electricity prices and costs

Sweeting's periods

Net Revenue Benchmark Analysis

- Compares estimated revenues with total costs
- Assess financial viability and barriers to entry
    - important in presence of price caps
- Spark and dark spreads useful proxy
    - need to allow for EUA opportunity cost
- Persistent excess profit suggestive of market power and barriers to entry
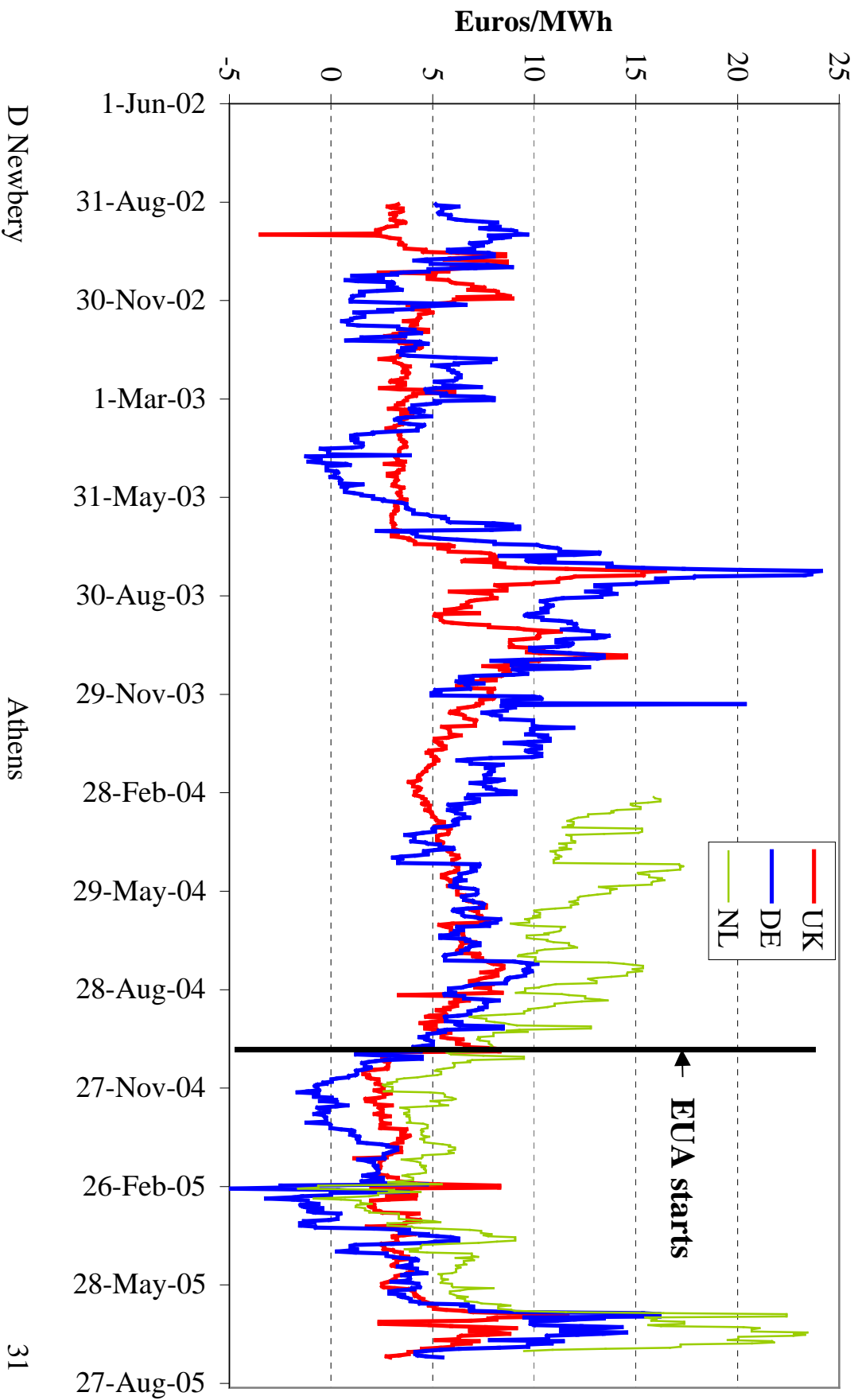- Persistent failure to cover total costs suggestive of predatory behaviour?

Spark spread month ahead 50% efficiency
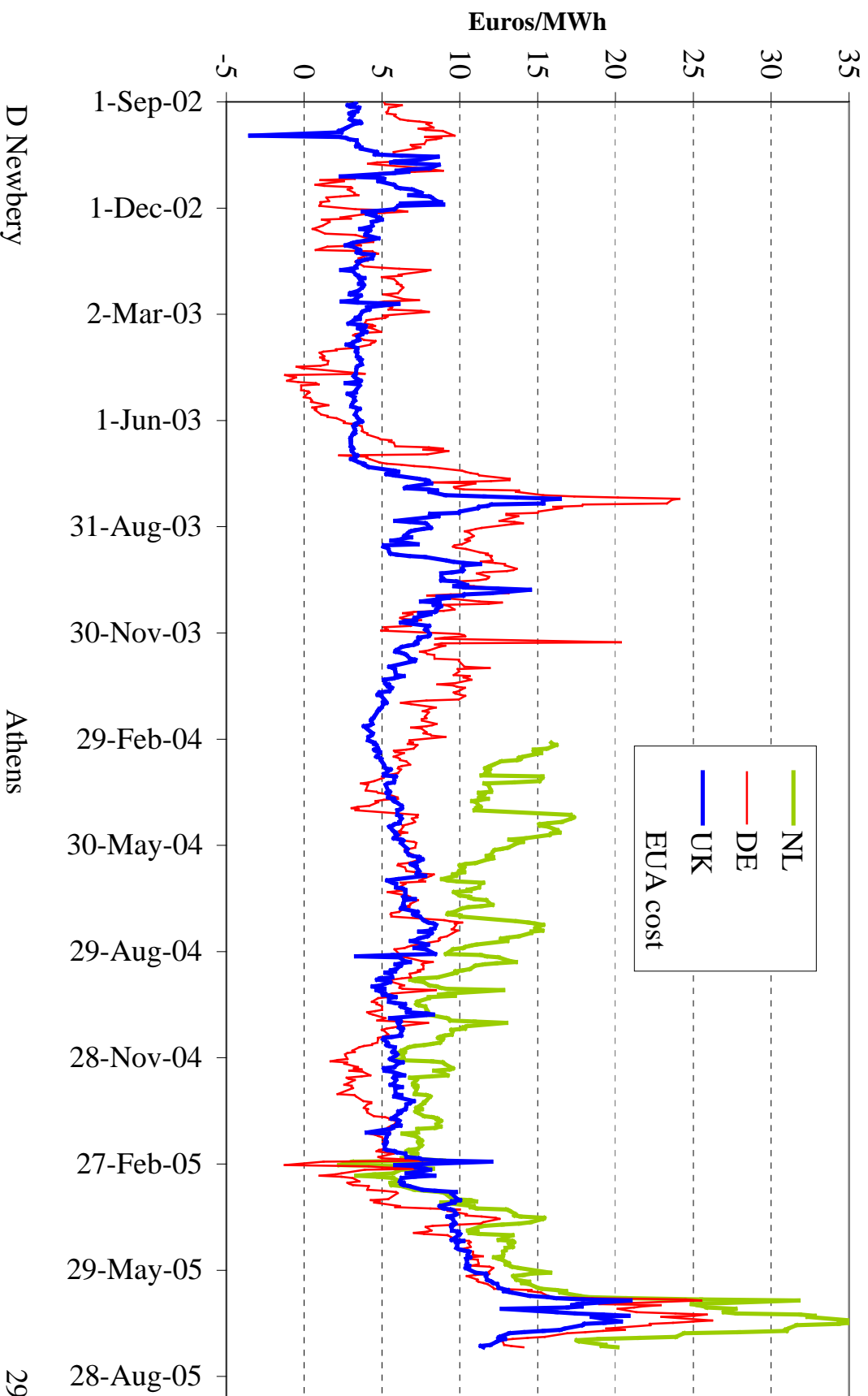
Spark spread month ahead 50% efficiency
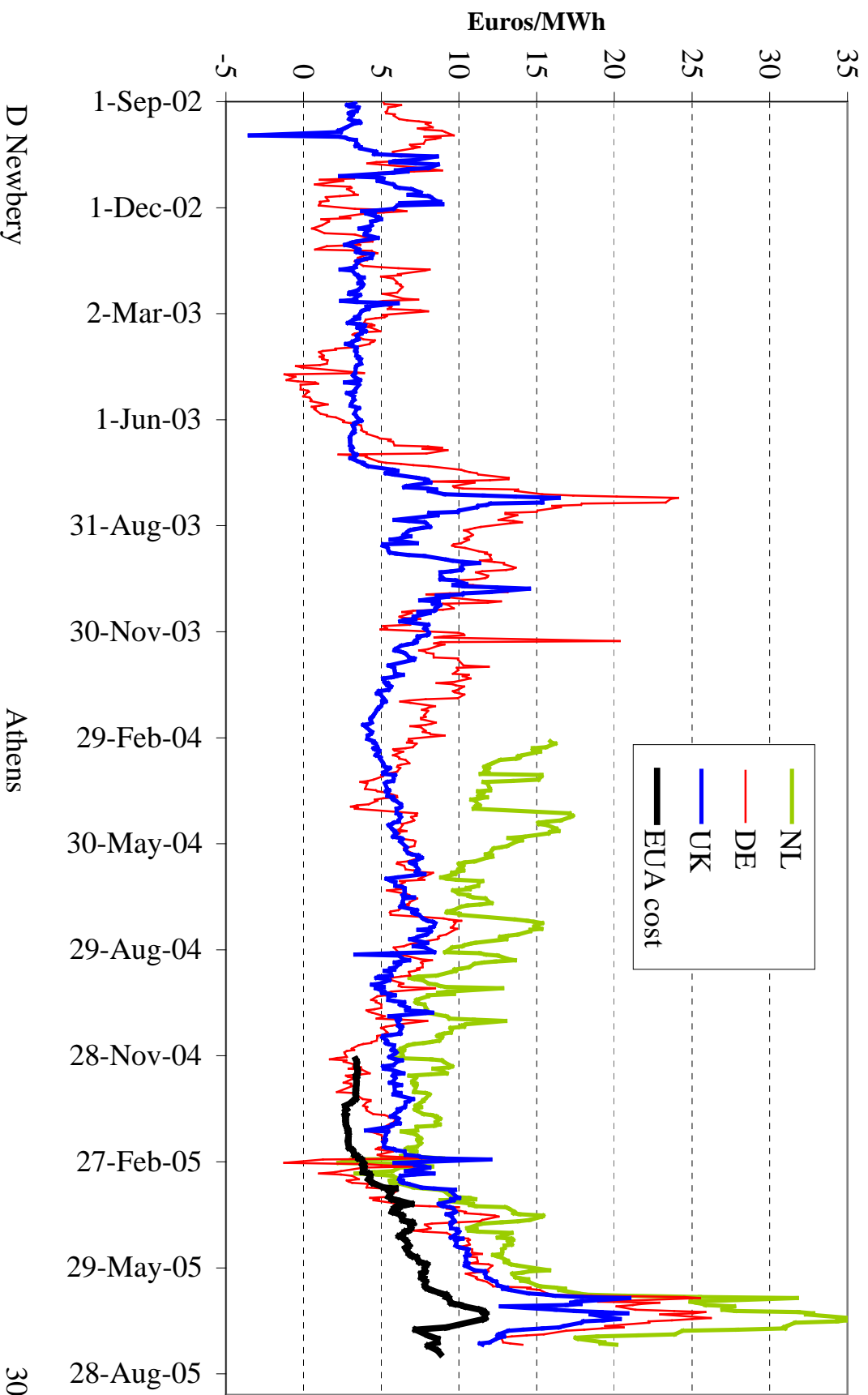
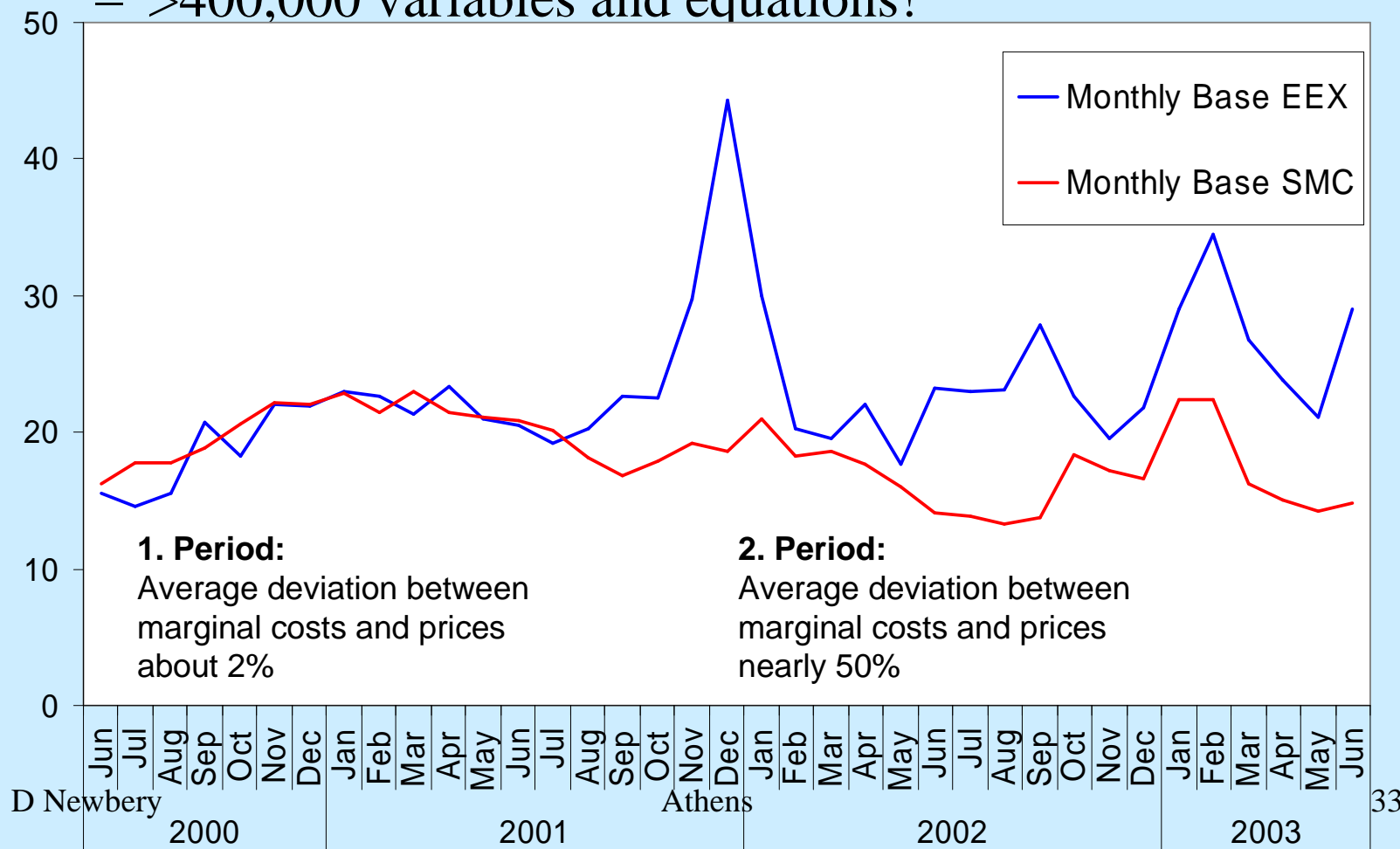Spark spread net of EUA

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Competitive Benchmark Analysis

- Simulate the competitive market in order to calculate Lerner Index of actual price over simulated competitive price
- Increasingly popular tool of analysis
- Does not identify individual generators exercising market power
- Difficulties in identifying appropriate costs
- Subsequent controversy over quantitative results

Competitive Benchmark Model of German ESI

- Müsgens (2004) for period 2000 to 2003
  - Multi-regional approach with dynamics (e.g. hydro)
  - >400,000 variables and equations!

Legend:
- Monthly Base EEX
- Monthly Base SMC

1. Period:
Average deviation between marginal costs and prices about 2%

2. Period:
Average deviation between marginal costs and prices nearly 50%

Oligopoly Models

- Ideally integrates relevant factors (costs, demand, strategic incentives, transmission constraints)
- Equilibrium problematic, especially with contracts
- Recent European examples
  - ECN's COMPETES model - Cournot and Conjectured Supply Functions (CSF) model of Netherlands, Belgium, France and Germany with transmission constraints **for market integration**
  - Frontier's SPARK model – a supply function equilibrium model (but there are multiple equilibria)
  - Results influential in Nuon-Reliant **Merger Case** in the Netherlands

Acronyms - 1

AMPs: Automatic Mitigation Procedure (very US)

ATC: Available Transmission Capacity

CEC: Commission of European Communities

CEGB: Central Electricity Generation Board

ESI: Electricity supply industry

EUA: EU allowance (permit to trade 1 tonne CO_2)

FERC: Federal Energy Regulatory Commission

GW: Gigawatt = 1000 Megawatt = 1m kW

G: Generation

HHI: Herfindahl Hirschman Index

ISO: Independent System Operator

MC: marginal cost

MO: market operator

Acronyms - 2

MOU: memorandum of undestanding

MM: Market monitoring

MP: Market power

NETA: New Electricity trading Arrangements

NRA: National Regulatory Authority

OTC; Over the counter (markets)

PUC: Public Utility Commission

PX: Power exchange

S: Supply

SSNIP: 'small but significant non-transitory increase in price'

RSI: Residual Supply Index

T: Transmission

TSO: Transmission System Operator