Toulouse School of Economics

Concentration in the electricity industry

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Introductory remarks on Final Report of Energy Sector Competition Inquiry

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- "… many energy markets are too highly concentrated. The sector inquiry report shows that incumbents have very high market shares in their respective national gas markets. The level of concentration has also remained very high in many electricity markets, but there are some fairly competitive markets.
- In a nutshell it seems fair to conclude that many incumbents have retained firm control of the liberalised markets. Markets themselves remain national in scope, with little new entry. All this gives too much leeway to incumbents to exercise market power, and so impose high prices. To protect their market positions and profits, incumbents engage in various practices that make it harder for new entrants to compete."

Neelie Kroes (10th January 2007)

why does it matter?

- concentration gives the opportunity for non competitive behavior;
- non competitive behavior in demand and/or supply creates price distortions with negative effects:
  - deadweight loss
  - unfair allocation of surplus
- but automatic stabilization should be at work:
  - high prices should inflate supply and deter demand
  - low prices should discourage supply and increase demand
- except if
  - insiders are price inelastic
  - challengers are locked out by law or technology

The SCP paradigm

- developed during the 1930's at Harvard:
  - the industry **S**tructure determines the **C**onduct of firms
  - the firms' **C**onduct determines **P**erformance (private and public)
  - therefore the industry **S**tructure determines private and social **P**erformance
- for behaviorists **C** ⇒ **S** … at least in the medium run;
- structure characteristics:
  - horizontal concentration
  - vertical integration
  - barriers to mobility (entry, exit, switching)
  - product differentiation
  - diversification

sources of concentration

- how come firms exist?
  - transaction costs
  - economies of scale, scope, coordination, …
  - internalization (vertical relationship, security, ancillary services, …)
- why all industries are not natural monopolies?
  - cost of information (collection, storage, processing,…)
  - opportunistic behavior of employees, loss of control
- why are there small and large firms in the same industry?
  - minimal optimal scale; Gibrat's law
  - specific segments of demand (product differentiation)
  - mergers and acquisition
  - legal barriers and USO

horizontal concentration

- refers to the number and size of firms active in the same market
- how to measure it?
  - first define the "relevant market"
  - second calculate market shares for the *n* active firms
  - third, compute a comprehensive index of concentration
- various indices
  - standard tools for competition authority: CR_2, CR_4, Herfindhal-Hirschmann (HHI)
  - others: Rosenbluth, Entropy, …

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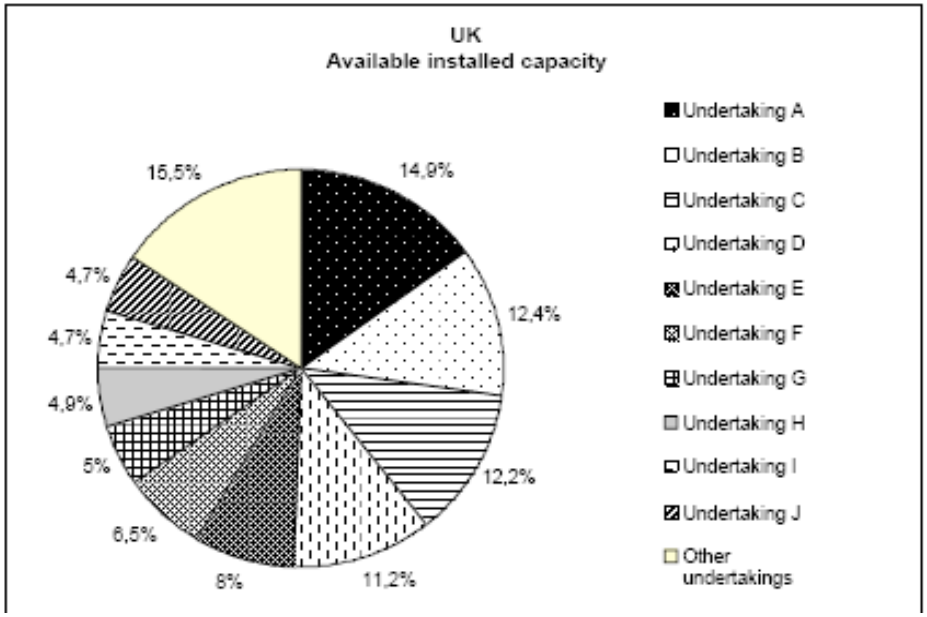
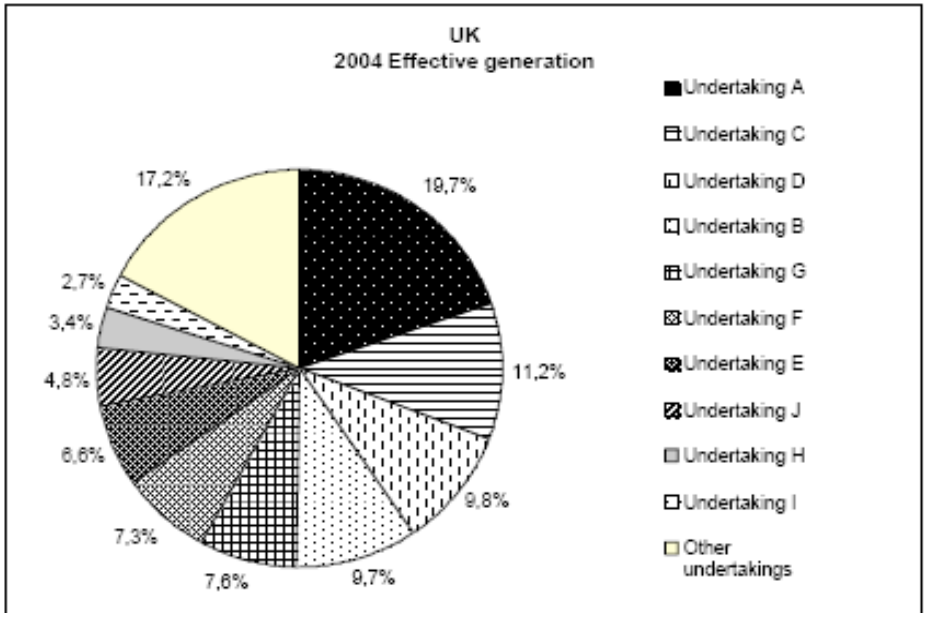
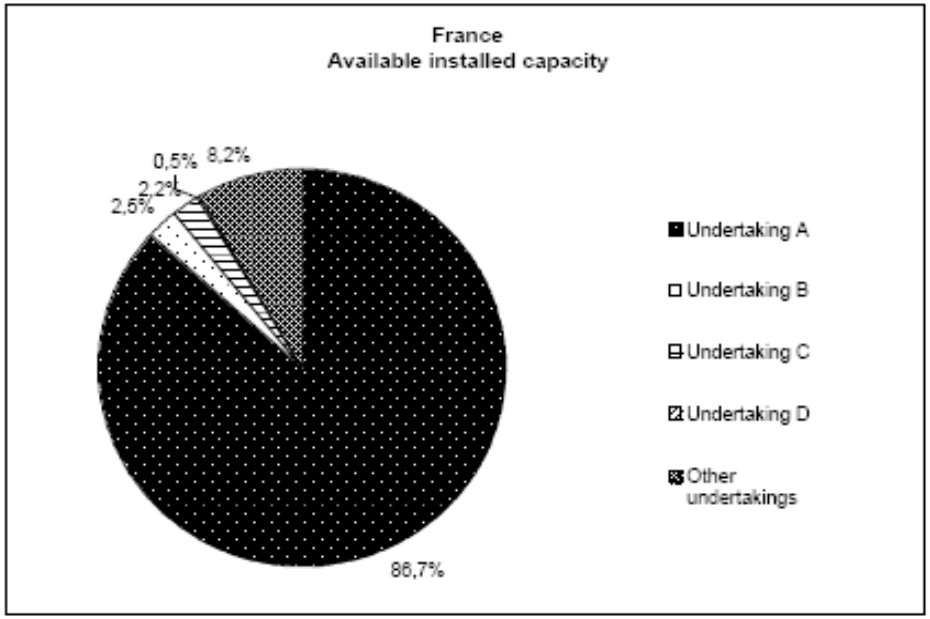
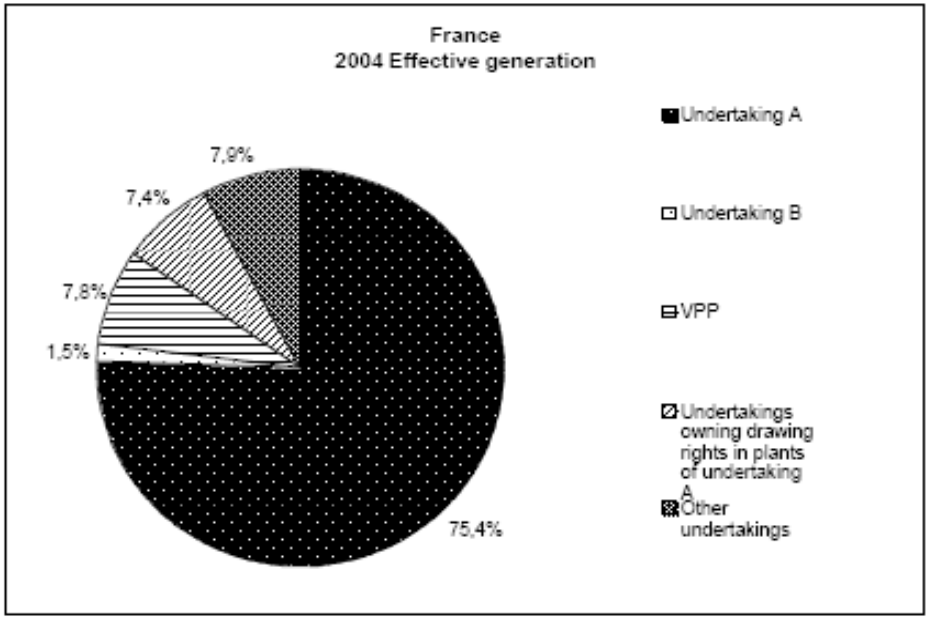
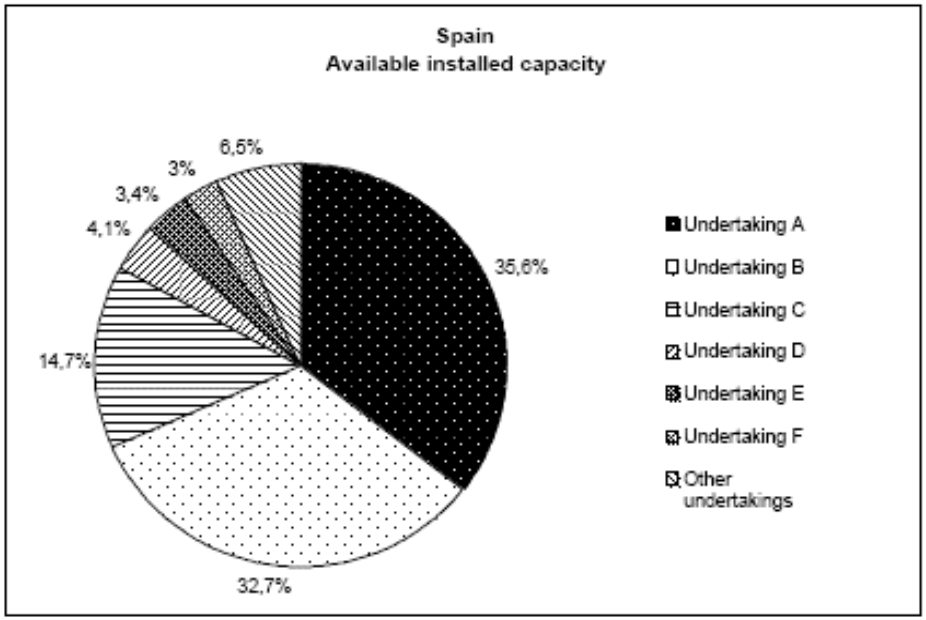


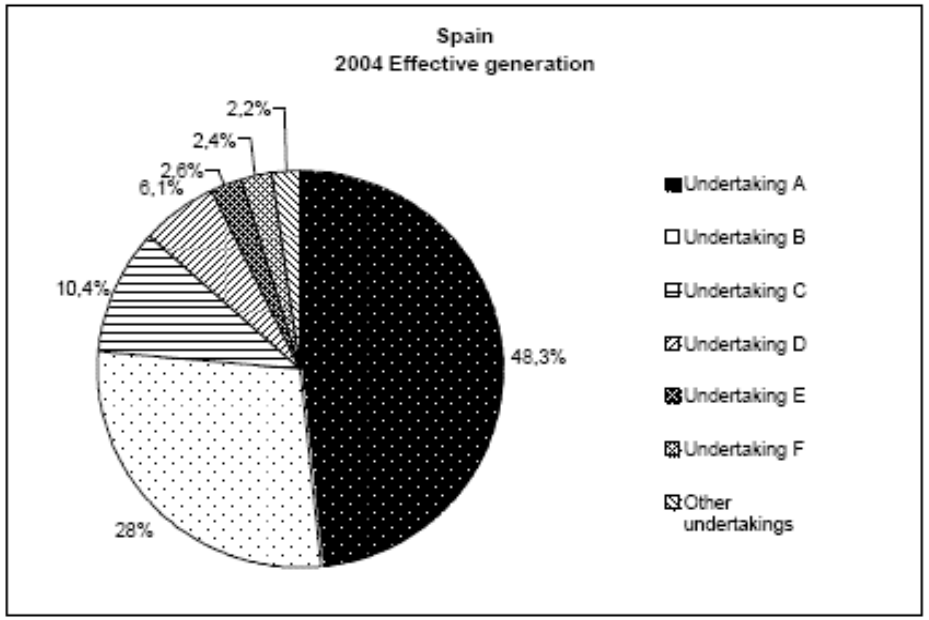


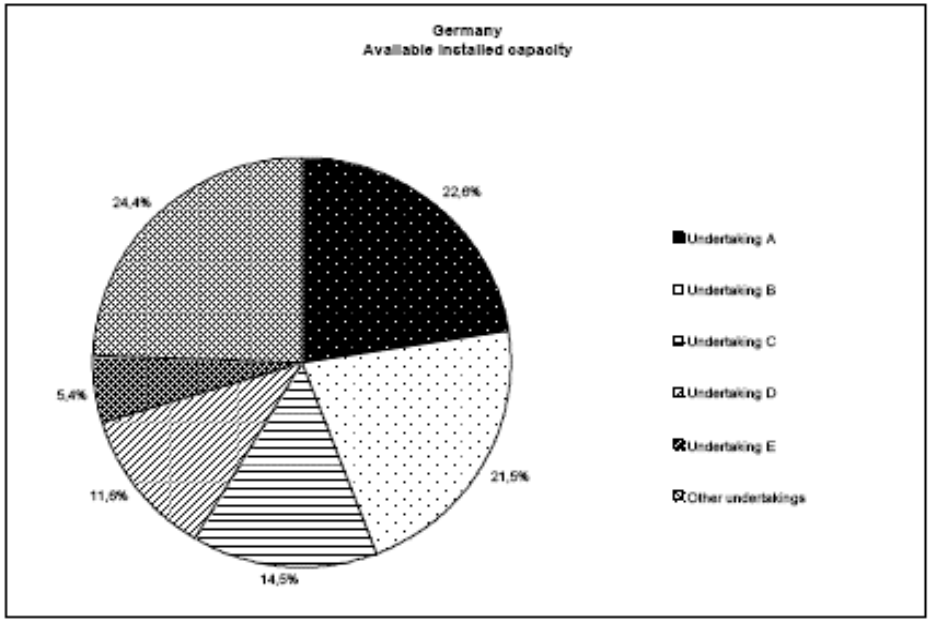


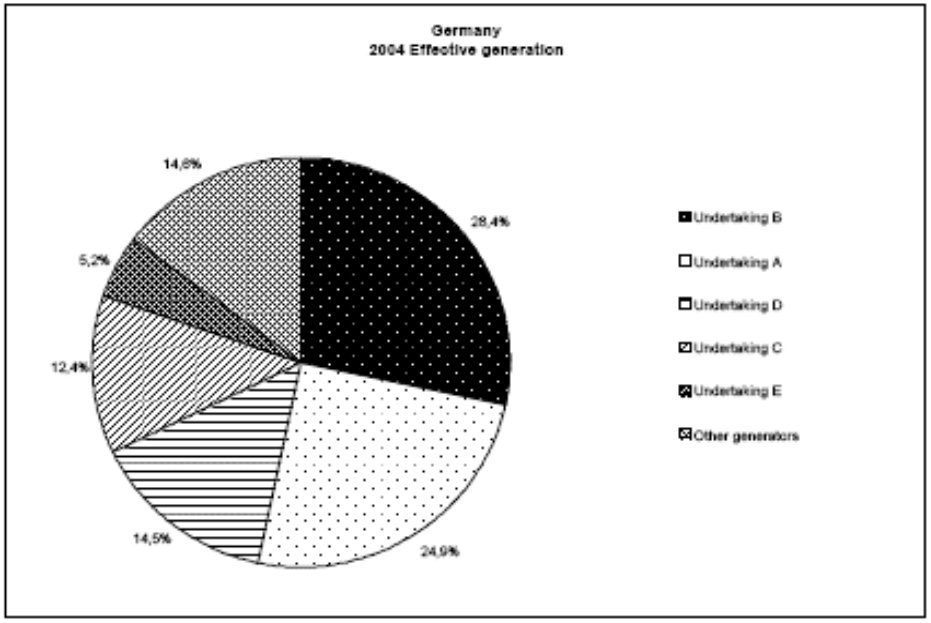


Florence, May 2008


Spain
Available installed capacity
35,6%
32,7%
14,7%
4,1%
3,4%
3%
6,5%
Undertaking A
Undertaking B
Undertaking C
Undertaking D
Undertaking E
Undertaking F
Other undertakings


Spain
2004 Effective generation
48,3%
28%
10,4%
6,1%
2,6%
2,4%
2,2%
Undertaking A
Undertaking B
Undertaking C
Undertaking D
Undertaking E
Undertaking F
Other undertakings


Germany
Available installed capacity
22,6%
21,5%
14,5%
11,6%
5,4%
24,4%
Undertaking A
Undertaking B
Undertaking C
Undertaking D
Undertaking E
Other undertakings


Germany
2004 Effective generation
28,4%
24,9%
14,5%
12,4%
5,2%
14,6%
Undertaking B
Undertaking A
Undertaking D
Undertaking C
Undertaking E
Other generators

On *HHI*

- $HHI \overset{\text{def}}{=} \sum_{i=1}^{n} s_i^2 \times 10^4$ where s_i is the market share of firm *i*.

- When $s_1 = s_2 = \ldots = s_n = \frac{1}{n}$, $HHI = \frac{10^4}{n}$.

- Therefore, $\eta = \frac{10^4}{HHI}$ is an index of the number of key firms in the industry.

merger thresholds

- $HHI \geq 1800$ identifies highly concentrated markets

  $\Leftrightarrow \quad \varsigma \leq 5$

- $1800 > HHI \geq 1000$ identifies moderately concentrated markets

  $\Leftrightarrow \quad 5 < \varsigma \leq 10$

- $1000 > HHI$ identifies non concentrated markets

  $\Leftrightarrow \quad 10 < \varsigma$

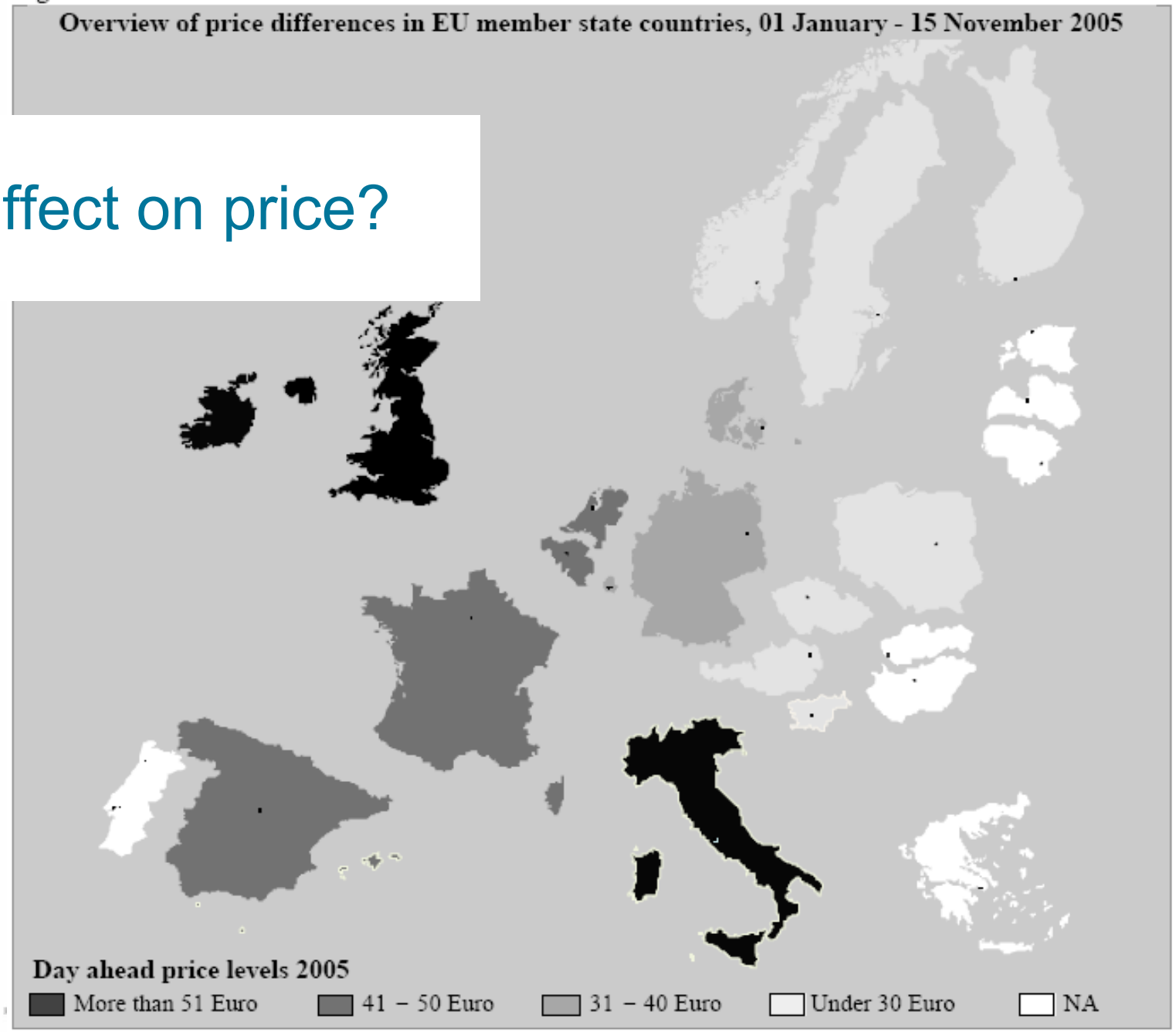
concentration based on average available installed capacity

country	France	Germany	Great Britain	Spain
HHI	8 592	1 914	1 068	2 790
ç	1.16	5.22	9.36	3.58

source: *London Economics*

Figure 59

Overview of price differences in EU member state countries, 01 January - 15 November 2005



Source: Platts[280], Power exchanges.

effect on price?

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Relationship between concentration and margins

- the profitability index of Lerner: $L_i \overset{\text{def}}{=} \frac{p - MC_i}{p}$
- if firms compete in quantities (*à la Cournot*), at equilibrium

$$L_i = \frac{s_i}{\varepsilon}$$

where $\varepsilon \overset{\text{def}}{=} -\frac{\Delta q}{\Delta p}\frac{p}{q}$ is the demand elasticity.

- therefore, an index of average profitability is

$$L \overset{\text{def}}{=} \sum_{i=1}^{n} s_i L_i = \sum_{i=1}^{n} s_i \frac{s_i}{\varepsilon} = \frac{HHI}{10^4}\frac{1}{\varepsilon}$$

Alternative forms of competition

- no evidence that firms compete *à la Cournot;*
- if they compete in prices (*à la Bertrand*), two is enough

$$p = c \qquad \text{or} \qquad p = c_2 > c_1$$

- if they compete in supply functions, intermediary market rents.
- power to withdraw capacity creates suspicion of price making: close scrutiny of pivotal firms.

Pivotal Supplier Indicator (PSI)

- If $K_i(t) \geq \sum_{j \neq i} K_j(t) - D(t)$, i is pivotal at date t

(if it withdraws its capacity, the remaining producers cannot satisfy demand).

- $$PSI_i = \frac{\text{number of hours where } i \text{ is pivotal}}{8760}$$

- Used by FERC under the name Supply Margin Assessment (SMA) since 2001 to identify firms with Market Power and to monitor them.

Residual Supply Index

- "continuous" version of PSI:

$$RSI_i(t) = \frac{\sum_{j \neq i} K_j(t)}{D(t)}$$

- when RSI > 100%, firm *i* is not necessary to satisfy demand; otherwise, it is pivotal.

- Shreffrin (2000) suggests that the average RSI should not be below 110 % for more than 5 % of the hourly markets (~ 440 hours/year).

heterogeneous technologies

- cost is not minimized under competition whereas a monopoly increases profits by minimizing cost
- why are the technologies for power production heterogeneous when controlled by a monopoly? Because of load volatility:
  - base demand requires permanent production
  - more flexible technologies are needed for medium and peak demand
  - only highly responsive technologies can satisfy uncertain demand and prevent production failure.
- concentrated industries can plan and dispatch these heterogeneous plants; competition requires markets for each type of needs:
  - peak and off peak, reserves, ancillary services, capacities

concentration and equity

- $\max \quad \text{Welfare} \overset{\text{def}}{=} \text{Consumers' Surplus} + \text{Profits}$
- contains the implicit assumption that shareholders are under the responsibility of the regulator;
- households are consumers, taxpayers, employees and shareholders, but some can live in foreign countries;
- concentration creates an equity bias only if ownership is concentrated; special case of state-owned firms.

concentration and innovation

- Schumpeter principle
  - creative destruction: an industry's economic structure changes from within;
  - role of potential competition
- helping minor firms can reduce welfare
  - under Cournot oligopoly, social welfare increases if a firm with a sufficiently low share is removed from the market (Lahiri and Ono (1988) *The Economic Journal*)

concentration and environment

- a concentrated industry
  - produces less than its competitive equivalent, therefore it also emits less pollutants;
  - is easier to supervise as regards polluting emissions;
  - internalizes more externalities; for example it exhausts non renewable resources less rapidly than competition and it resists the tragedy of commons;
  - is stronger to resist additional regulation

concluding remarks

- concentration is neither necessary nor sufficient for exerting market power
- competitive industries are not generically better than concentrated ones at promoting efficiency, equity, environment protection, …
- oligopoly balances the advantages and drawbacks of competition and concentration.