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# Chapter 1: Introduction to Quantitative Techniques for Competition Policy

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Quantitative Methods for Competition and Regulation  
Albert Banal-Estanol

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# Quantitative Techniques in Competition Policy

- The use of QT has a longer tradition in the US:
  - Earlier influence of economists
  - More litigious nature of antitrust policy
- However, it has recently surged in the UK and EU
- Main applications:
  - Definition of relevant markets
  - Analysis of market structure
  - Analysis of competition (pricing behaviour, mergers...)
  - Efficiency analysis

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# In this lecture...

- Introduction of the different applications of the QTs:
  - Market definition
  - Market structure and market performance
  - Mergers and collusion
  
- From Lecture 2 on, analysis of each technique in detail:
  - Main elements and description
  - Data requirements
  - Interpretation, problems and possible solutions
  - Applications and case studies

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# Chapter 2 of Competition Act 1998

- Any conduct which amounts to the **abuse of a dominant position** in a market is prohibited if it may affect trade
  
- Conduct may, in particular, constitute such an abuse if it consists in
  - a. directly or indirectly **imposing unfair purchase or selling prices** or other unfair trading conditions;
  - b. **limiting production**, markets or technical development to the prejudice of consumers;
  - c. **applying dissimilar conditions** to equivalent transactions with other trading parties, thereby placing them at a competitive disadvantage;
  - d. making the conclusion of contracts subject to acceptance by the other parties of supplementary obligations which, by their nature or according to commercial usage, have no connection with the subject of the contracts

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# Dominance and market power

- For an abuse of a dominant position to exist, we need..
  1. To establish that *dominant position exists*, then
  2. To show that this dominant firm has engaged in an *abusive behaviour*
  
- Here, we focus on step 1. What is dominance?
  - “A position of economic strength enjoyed by an undertaking which enables it to prevent competition being maintained on the relevant market by affording it the power to behave to an appreciable extent independently of its competitors, its customers and ultimately of the consumers” (EC, United Brands)
  - “An undertaking will not be **dominant** unless it has **substantial market power**” (OFT)
  
- But, what is market power?

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# Market power and market share

- Market power:
  - “ability to reduce output profitably to raise prices above the competitive level”
- Market shares are related to market power, although the Competition Act does not set any thresholds:
  - “Very large market shares are in themselves, and save in exceptional circumstances, evidence of a dominant position. That is the situation where there is a market share of 50%”
  - “the OFT considers it unlikely that an undertaking will be individually dominant if its market share is below 40%”
- But what is the “market”?

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# Delineation of Markets

- Identify the set of products and producers (and the geographical areas) that exercise some competitive constraint on each other
- Important feature in competition analysis:
  - Too narrow: unnecessary competition concerns
  - Too wide: competition concerns disguised
- SSNIP test (“a conceptual test”):

“Given a particular set of goods or services, would a hypothetical monopolist (owning this set) be able profitably to implement a **S**mall but **S**ignificant (5-10%) **N**on-transitory **I**ncrease in **P**rice?”

  - If yes, this is a market
  - If not, widen set of products and start again

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# Demand-side Substitution

- What substitutes exist for buyers?
- In the event of a price increase, would enough customers switch and hence constrain behaviour?
- Products and prices do not need to be identical:
  - Differentiated products: still, sparkling water, soft drinks,...
  - Different quality: organic bananas and standard bananas
- Not all consumers need to switch:
  - Only enough to prevent higher than competitive prices
- But product substitution needs to be relatively quick:
  - Need to evaluate switching costs (e.g. video games market, changing the hardware may be very costly)



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# Supply-side Substitution

- In absence of demand-side substitution, supply-side substitution can still constrain behaviour
- Example: paper used in publishing
  - Buyers do not see paper with different coating grades as substitutes
  - But suppliers can rapidly switch production between different grades
- Suppliers should be able to switch *rapidly* and *easily* to produce a substitute of the product
- Of course, costs and risks need to be evaluated
- Should we also consider potential entrants?

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# Relevant Geographic Market

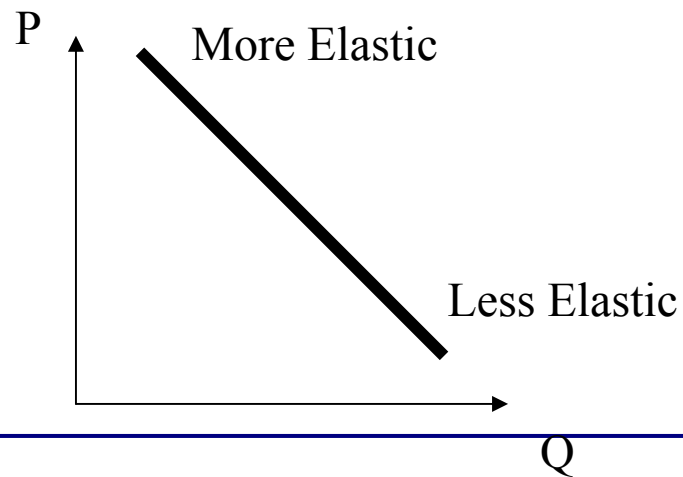
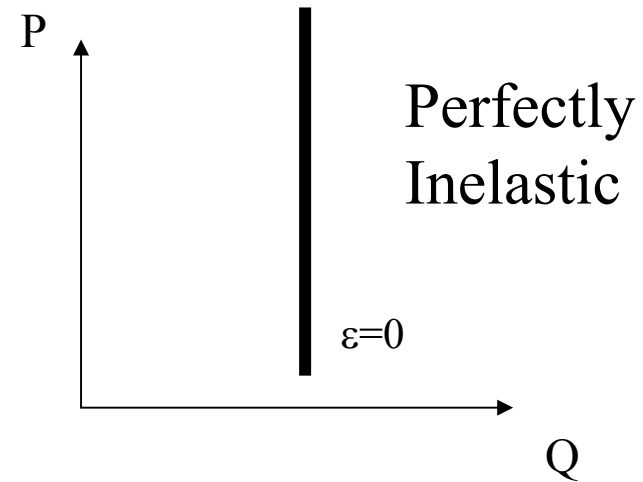
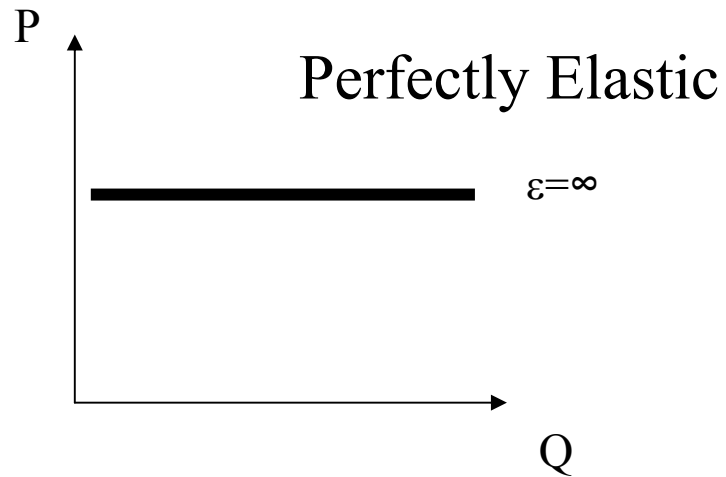
- *SSNIP test used to determine both product and geographic dimensions of the market*
- Area over which demand-side and supply-side product substitution takes place
- Imports may also be considered since they may constrain price increases

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# Own-price elasticity of demand

- Own-price elasticity of demand of a product:
  - Definition: % change in quantity demanded when there is a 1% increase in price
- Low elasticity implies that a SSNIP is profitable:  
e.g. suppose that elasticity of demand is -0.5. If the initial price is £2 and demand is 100 (revenues £200), then a price increase to £2.20 implies sales of 95 (revenues £209)
- In fact, a price rise increases revenues as long as demand is inelastic (between 0 and -1)
- If demand is elastic then revenues decrease and we need to assess how lower sales affects costs

# Elasticity on a Graph



# Demand Elasticities

Table: Selected Estimates of Demand Elasticities

	Short Run	Long Run
Cigarettes	–	0.35
Water	–	0.4
Beer	–	0.8
Physicians' Services	0.6	–
Gasoline	0.2	0.5-1.5
Automobiles	–	1.5
Chevrolets	–	4.0
Electricity	0.1	1.9
Air Travel	0.1	2.4

Source: Browning and Mark Zupan, *Microeconomics and Applications*. Hendrik Houthakker and Lester Taylor, *Consumer Demand in the United States, 1929-1970*. Kenneth Etzinga, “The Beer Industry”, in *The Structure of American Industry*, edited by Walter Adams. James Sweeney, “The Response of Energy Demand to Higher Prices: What Have We Learned?”, *American Economic Review*, 74, #2, May 1984, pp.31-37.

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# Cross-price elasticity of demand

- Cross-price elasticity between two products:
  - Definition: “% change in quantity demanded when there is a 1% increase in the price of the other product”
  - Positive if products are substitutes and negative if they are complements
- Higher elasticity, more likely the products are in the same market
- Difference between own and cross elasticities:
  - Own-price elasticity analysis determines the total sales lost following an increase in price
  - Cross-price elasticity analysis reveals the part that goes to a particular product

	Sentra	Escort	LS400	735i
Sentra	-6.528	0.454	0.000	0.000
Escort	0.078	-6.031	0.001	0.000
LS400	0.000	0.001	-3.085	0.032
735i	0.000	0.001	0.093	-3.515

Source: Berry, Levinsohn and Pakes,  
"Automobile Price in Market Equilibrium,"  
Econometrica 63 (July 1995), 841-890.

## Example: The Cross-Price Elasticity of Demand for Cars

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Elasticity	Coke	Pepsi
Price elasticity of demand	-1.47	-1.55
Cross-price elasticity of demand	0.52	0.64
Income elasticity of demand	0.58	1.38

Source: Gasmi, Laffont and Vuong, "Econometric Analysis of Collusive Behavior in a Soft Drink Market," *Journal of Economics and Management Strategy* 1 (Summer, 1992) 278-311.

## Example: Elasticities of Demand for Coke and Pepsi

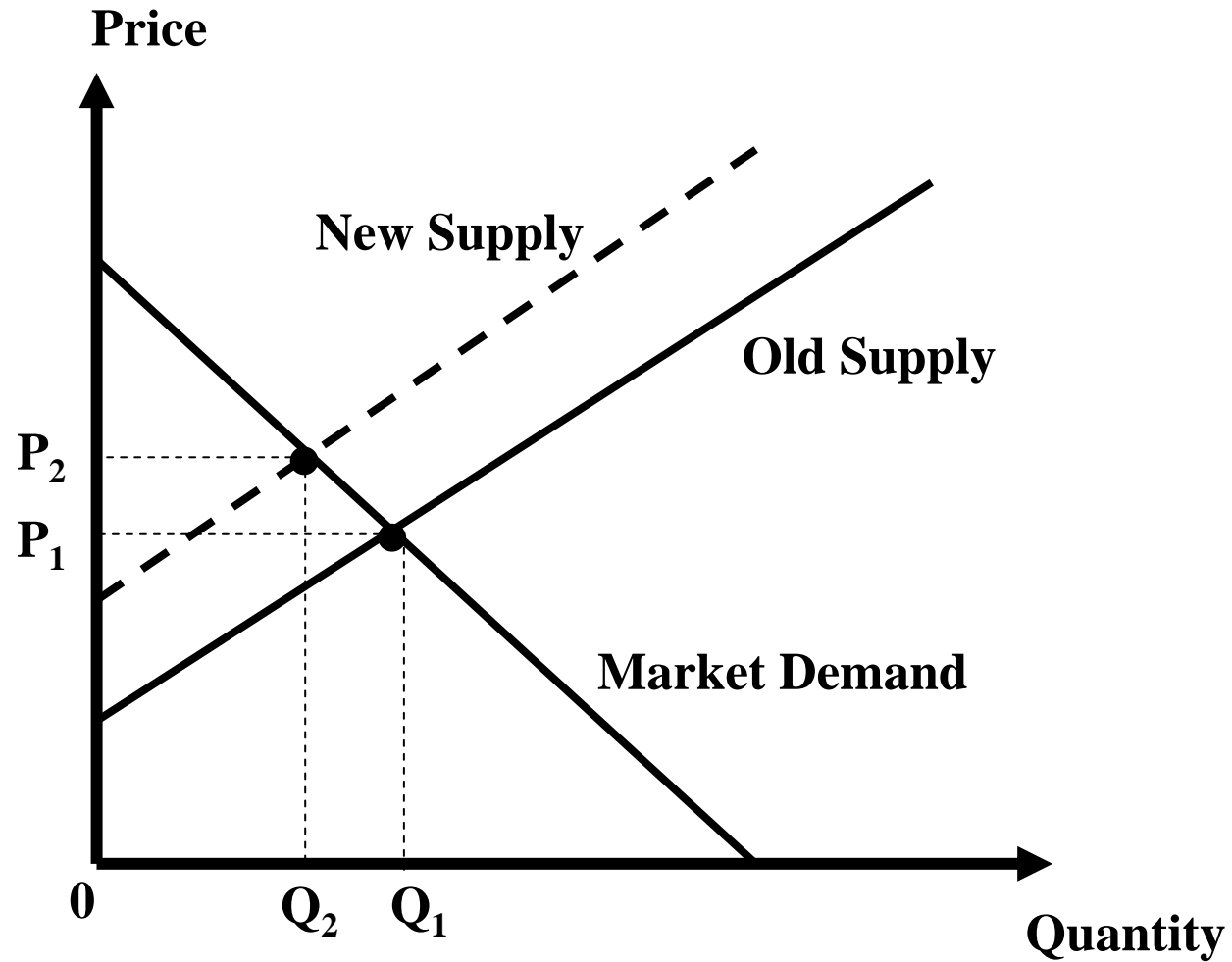


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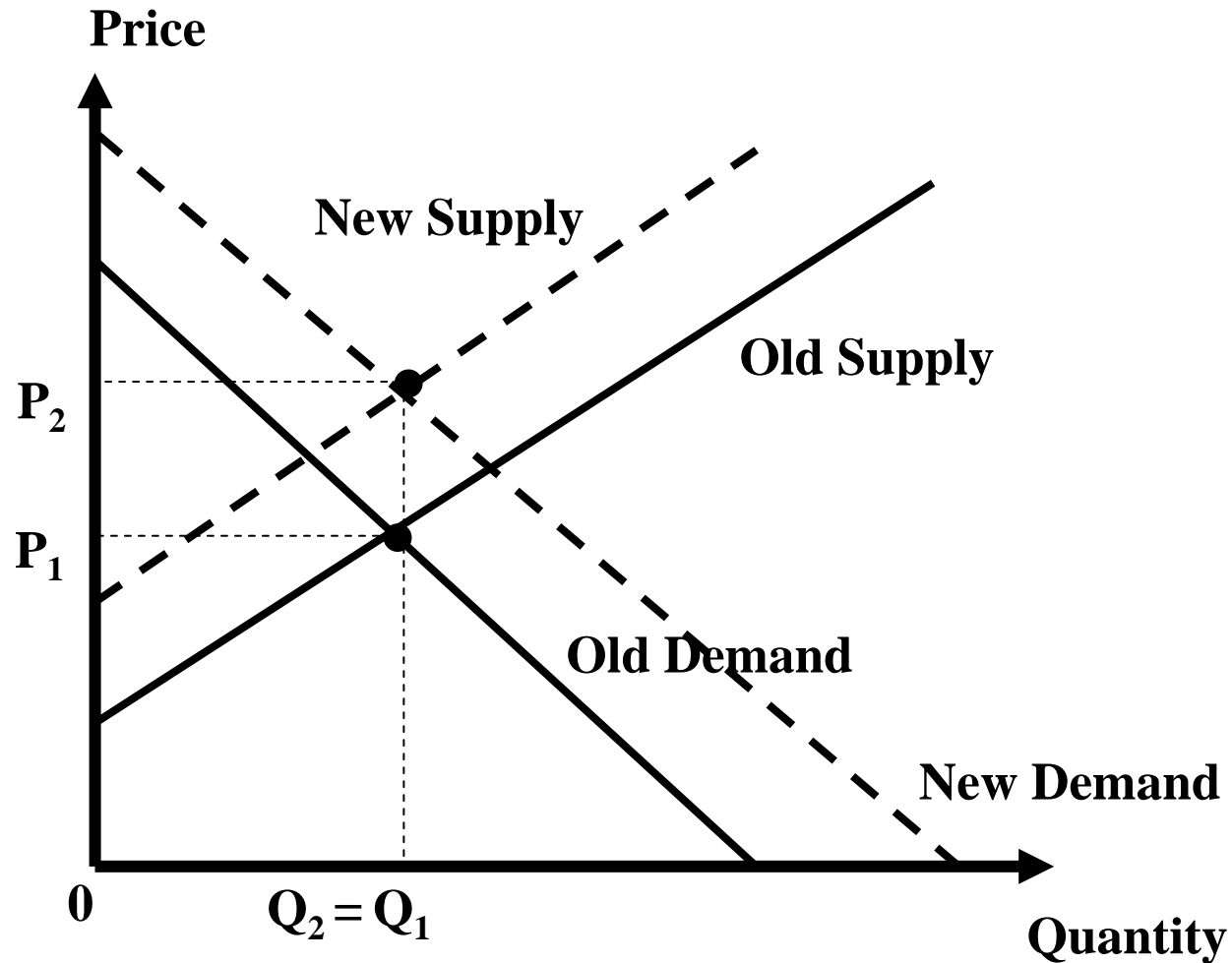
# Quantitative Techniques (1):

- **Elasticities based on event studies:**
  - Evaluate actual episodes of price perturbations and the corresponding changes in market volume
  - Computation: divide percentage change in volume by the percentage change in price
  - For demand elasticities, perturbations should be induced by a supply-side factor (input costs, tax or suppliers, promotions, factory strike...)
  - No other changes need to take place
- **Elasticities based on customer surveys:**
  - Information and data can be collected
  - However, it depends only on stated preferences

Example: Finding the Elasticities based on event studies



-This technique only works if *one or the other* of the curves stays constant.



Example: Identifying demand when both curves shift

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## Quantitative Techniques (2):

- Estimating (residual-demand) elasticities:
  - Regression of the quantity on the price and other variables
  - E.g. elasticity of demand for a football match: regress attendance on ticket price, composition of the team, opposing club, whether it is broadcasted on tv,...
  - We obtain an estimate for the effect of the price and confidence intervals
- Critical loss analysis:
  - Estimating the “critical” elasticity of demand at which a price increase is unprofitable
- Import penetration tests:
  - Test whether imports are sensitive to price increases

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# Quantitative Techniques (3): Analysis of Time Series of Prices

- Price correlation:
  - Two products are likely to be substitutes if their prices tend to move together
  - Similarly for two different geographic areas
  - Need to compute degree of correlation between the series
- Causality tests
- Dynamic price regressions and co-integration analysis

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# Market Structure and market performance

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# Market Structure and market performance

- Structure-conduct-performance paradigm:
  - Structure determines performance via the conduct of market participants
  - Performance is measured by the ability of firms to increase price above competitive levels
  - Structural characteristics of the market: e.g. number of firms, market concentration,...
- Nowadays, this is considered overly simplistic but still a lot of emphasis is placed in structural characteristics

# Concentration Indices

- Market shares for all firms (in volumes or value) in the relevant market, including those only arising after a SSNIP
1. Concentration ratio (CR4) is sum of the four largest firms' market shares
  2. Herfindahl index (HI or HHI) is the sum of the squared market shares of all firms in the industry

$$HI = \sum_{i=1}^N MS_i^2$$

- Examples:
  - 10 equally sized firms:  $HI=10*(10)^2 =1000$
  - 1 firm with 20% and 8 with 10%:  $(20)^2 +8*(10)^2 =1200$
  - 1 firm with 55% and 9 with 5%:  $HI=(55)^2 +9*(5)^2 =3250$



# Application of HI by US DoJ

US Department of Justice classification	Herfindahl index	DoJ “safe haven” for merger
“Unconcentrated”	HI < 1000	any merger
“Moderately concentrated”	1000 < HI < 1800	$\Delta HI < 100$
“Concentrated”	HI > 1800	$\Delta HI < 50$

$\Delta HI$  = Change in HI due to merger of firm i with firm j

Before merger,  $HI = \text{Sum of squared MS of others} + MS_i^2 + MS_j^2$

After merger,  $HI = \text{Sum of squared MS of others} + (MS_i + MS_j)^2$

But  $(MS_i + MS_j)^2 = MS_i^2 + MS_j^2 + 2 MS_i * MS_j$

So,  $\Delta HI = 2 * MS_i * MS_j$

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# Indicators for market power

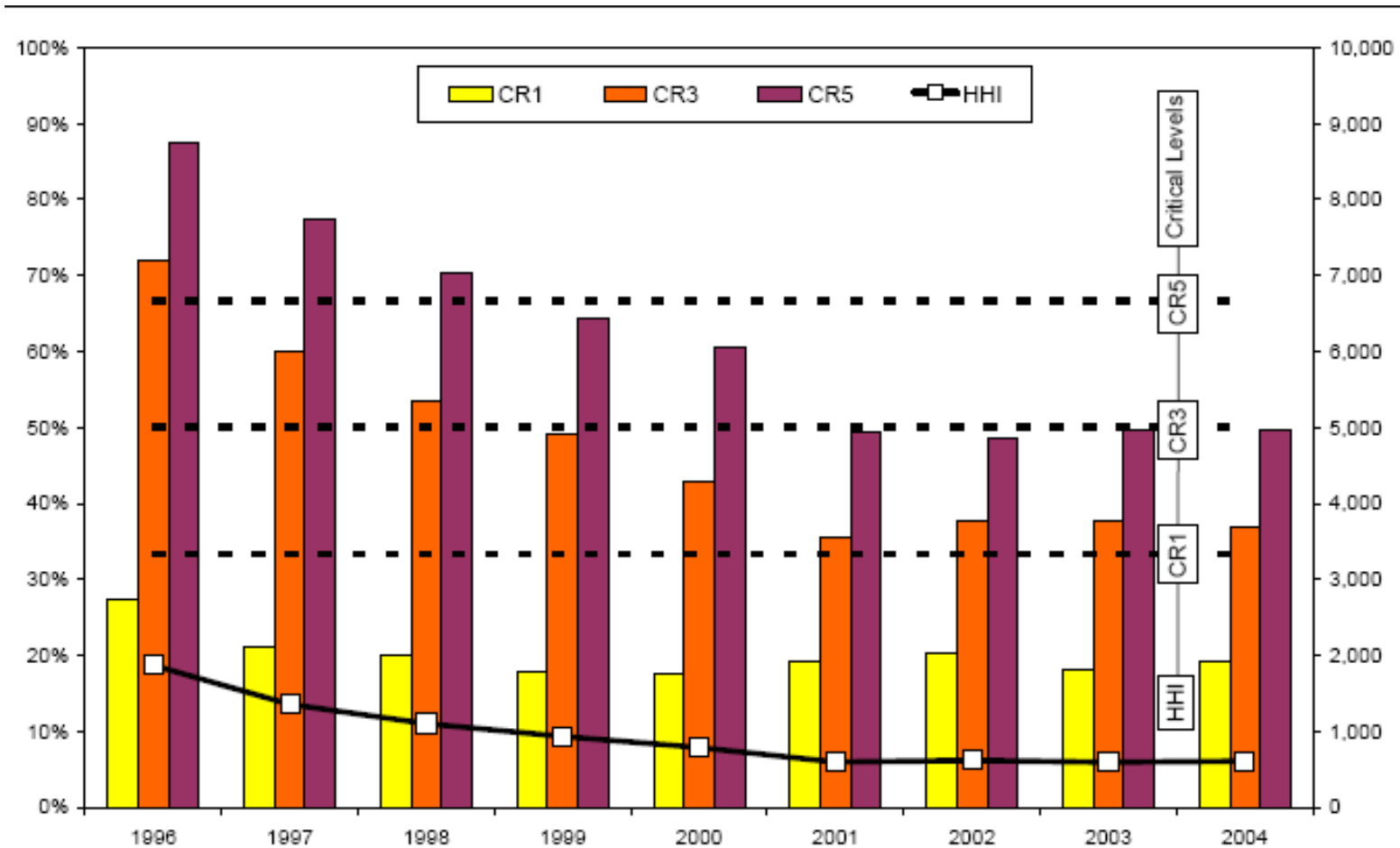
- Theoretically:

- Atomistic market 100
- Loose oligopoly 1000
- Substantial monopoly power >1800
- Pure monopoly 10000

- In electricity markets:

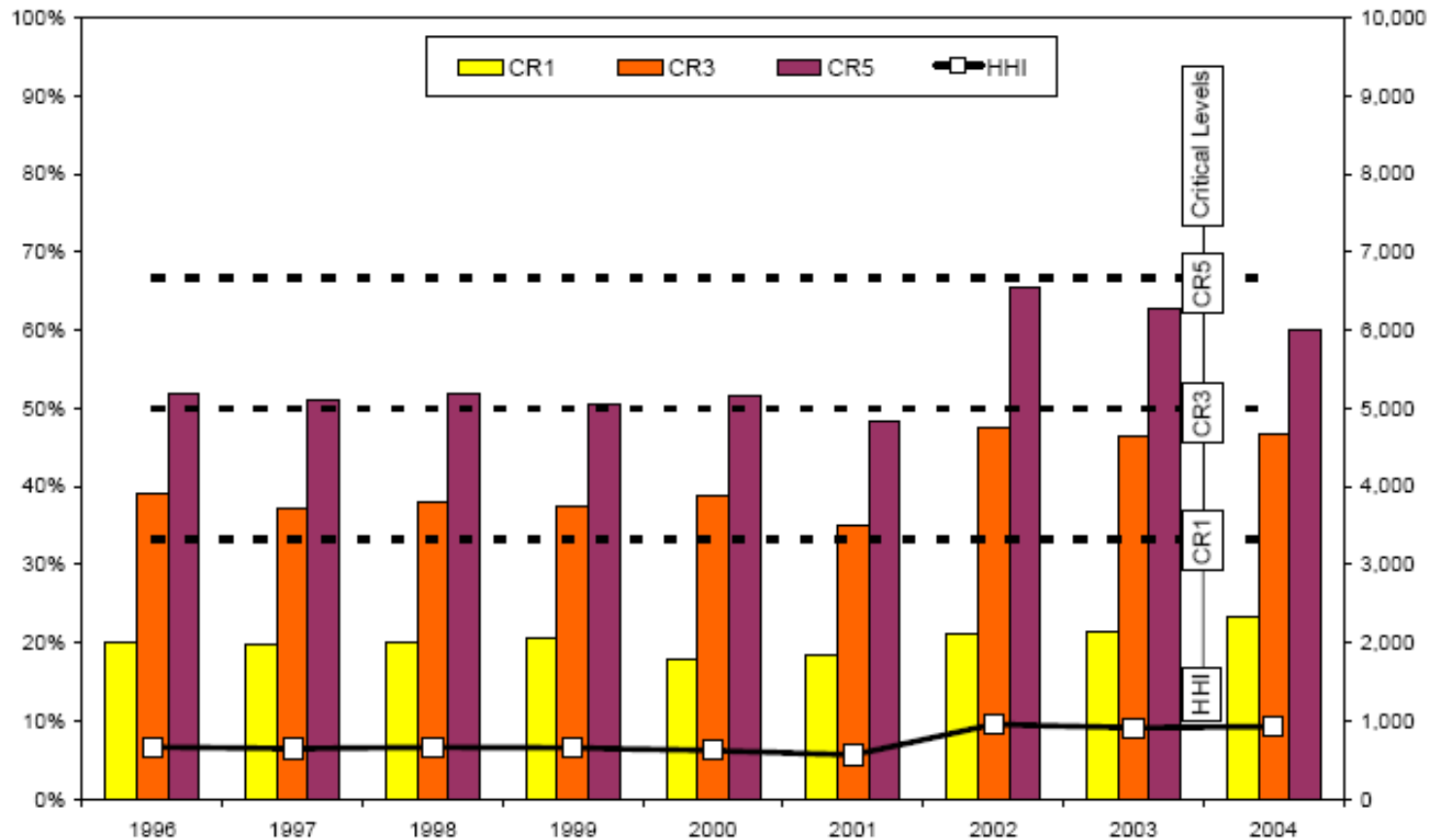
- “[1750] Dividing lines between moderately concentrated and highly concentrated markets”, Littlechild
- “An HHI of 2000 could have eliminated most of the inefficiencies of a duopoly in generation”, Newbery/Green
- “An HHI above 2500 indicate a risk of market power problem so severe as to justify regulatory intervention”, Joskow

# Generation Market Concentration in the UK (96-04)



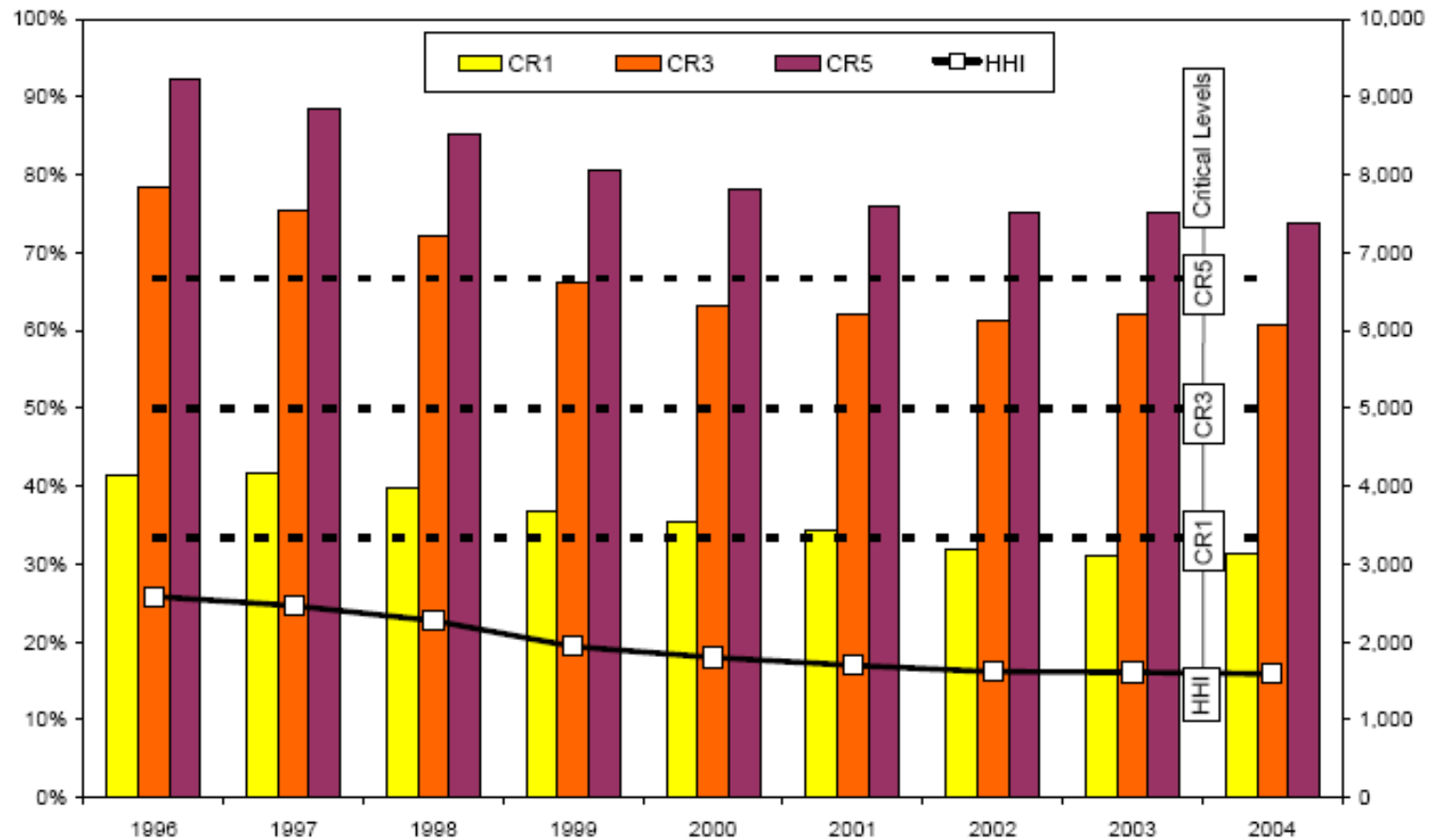
Source: *Öko-Institut*

# Generation Market Concentration in Scandinavia (96-04)



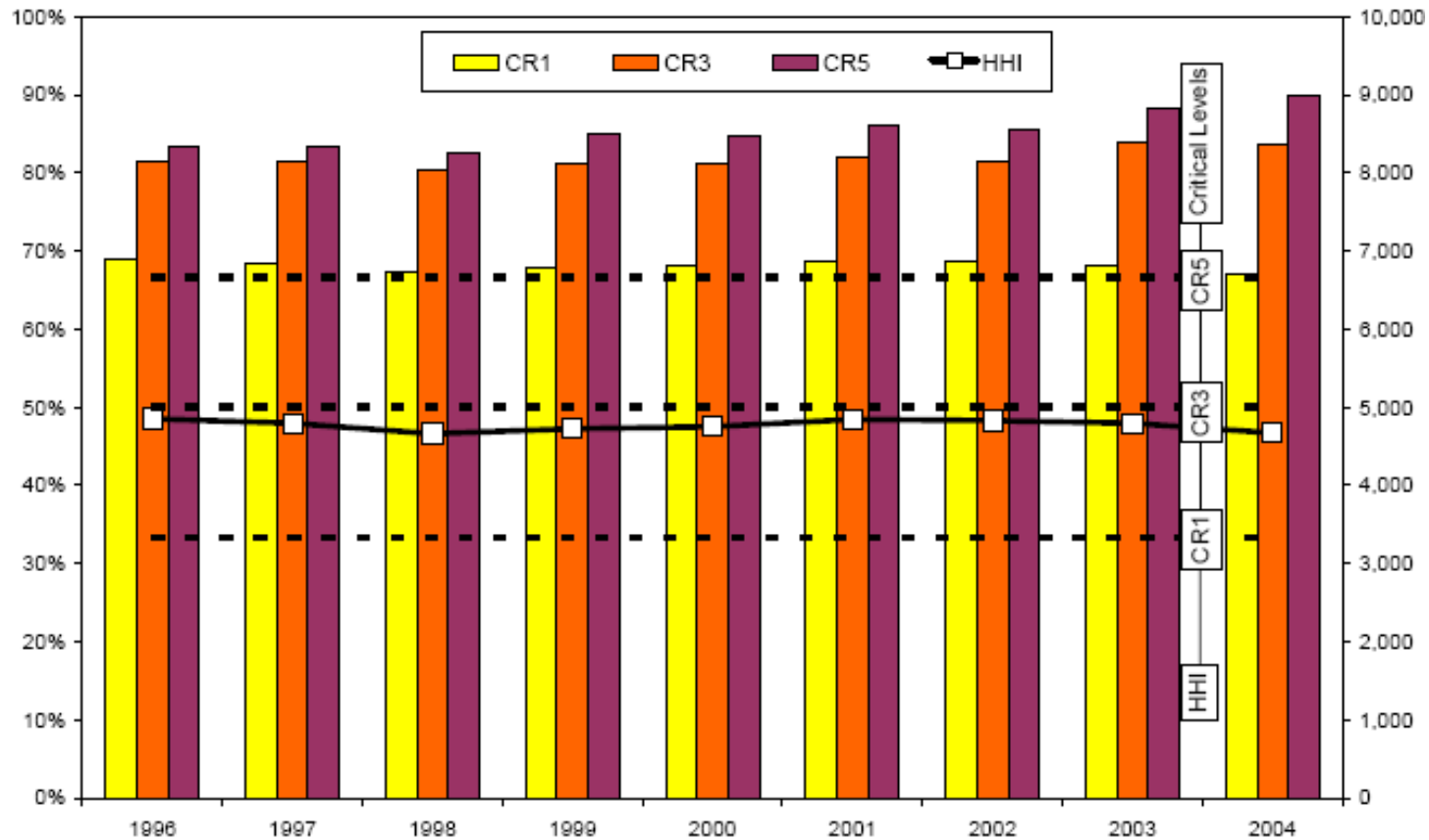
Source: *Öko-Institut*

# Generation Market Concentration in Spain-Portugal (96-04)



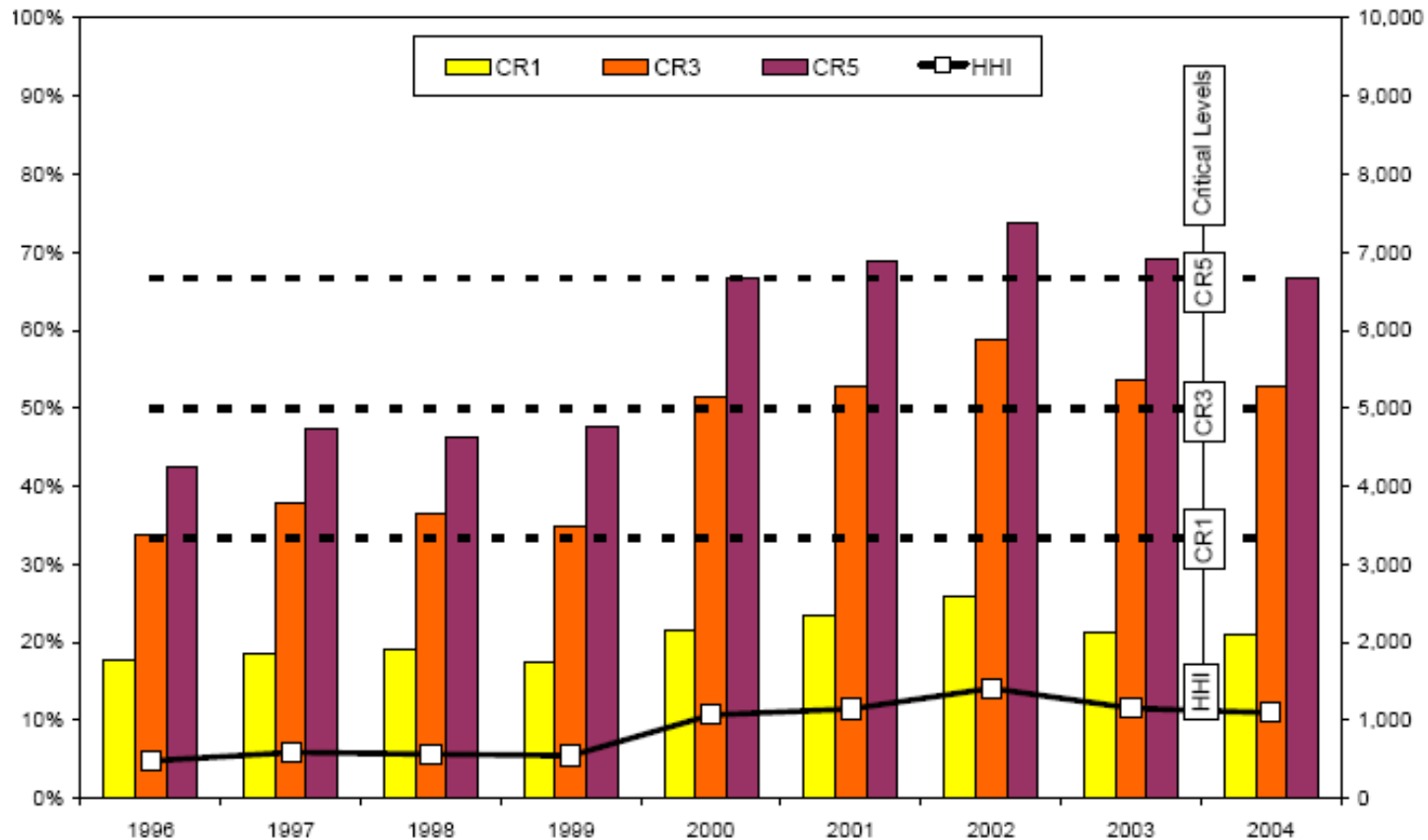
Source: *Öko-Institut*

# Generation Market Concentration in France-Benelux (96-04)



Source: *Öko-Institut*

# Generation Market Concentration in Germany-Austria-Switzerland (96-04)



Source: *Öko-Institut*

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# Caveats of Concentration Measures

- Sensible to market definition
- But also, Farrell and Shapiro (1990):
  - In some simple (Cournot) models, higher HHI does not lead to lower welfare
- McAfee and Williams (1992):
  - Merger making the industry more symmetric may improve welfare
- In the presence of economies of scale or other efficiencies, concentration may improve welfare



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# Quantitative Techniques (4)

- Price-concentration analysis:
  - Estimate the impact of concentration on prices
  - Use large cross-section data on local markets
  - Example: compare cities with the four supermarkets stores with cities with only three to analyse the impact of a merger
- Bidding studies:
  - Analyse the importance of having an additional independent bidder
  - Similar to price-concentration analysis

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# Mergers and collusion

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# Chapter 1 of Competition Act 1998

- Agreements, decisions or practices which...
  - (a) directly or indirectly **fix** purchase or selling **prices** or any other trading conditions;
  - (b) limit or control production, markets, technical development or investment;
  - (c) share markets or sources of supply;

...are prohibited

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# Explicit Collusion

- Such agreements are also illegal in other countries
  - Article 81 of EC Treaty
  - Section 1 of US Sherman Act
- Examples:
  - European Commission fined eight companies €218.8m for price fixing and market sharing in the 90's ("graphite electrode cartel")
  - Christie's and Sotheby's agreed to pay more than £180 million each, in 2001, to clients who lost under the collusion
- Therefore collusive agreements are not legally enforceable
- But, can companies collude "implicitly" or "tacitly"?

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# Competition analysis and Scope for Market Power

- Effect of a particular event (merger, possible formation of a cartel,...)
- Anomalies in prices may reflect competition problems:
  - Differences in CD prices between UK-US
  - Price uniformity in petrol stations in the UK
  - Rapid upwards adjustments after crude oil prices

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# Quantitative Techniques (5)

- Analysis of prices, e.g. cross-sectional price tests:
  - Establish whether two sets of prices are uniform
  - E.g. are prices in one area higher than in another?
  - Also used for (product and geographic) market definition
- Hedonic price analysis:
  - Compare prices of products whose quality differs or changes over time
  - E.g. cars and computers
  - Regression analysis with dummy variables
- Also analysis of the time series of prices (see QT (3))

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# Quantitative Techniques (6)

- Diversion ratios:

- Measure the percentage of lost sales to particular competitors wrt total losses due to a price increase
- Not necessary to compute elasticities
- Mainly used in merger analysis

- Simulation models:

1. Estimate demand model (own and cross-price elasticities)
2. Develop a theoretical model of competition to simulate the *alternative* situation (merger)
3. Estimate prices and output in the alternative world, using (1) and (2)
4. Evaluate efficiencies