ΠΑΝΕΠΙΣΤΗΜΙΟ
ΠΑΤΡΩΝ
UNIVERSITY OF PATRAS

LECTURE 6- MARKET PERFORMANCE, CONCETRATION PROFITABILITY & GROWTH

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Market Performance-Intro

- Many empirical studies use the terms structure and concentration almost synonymously.
- A interest in concentration is not confined to SCP economists.
- The term "market concentration" describe the extent to which the individual market is dominated by its larger sellers (i.e. sugar, cigarettes, petrol, cars e.t.c). Concetration curves!
- Moreover it is well known that a "aggregate concentration" exists (i.e in UK 100 firms almost account for the 40% of total manufacturing output.
- Are those two connected?

Some definitions

- *Performance* generally refers to how competitive (or efficient) an industry is or, more broadly, how successful it is at delivering benefits to consumers. The main focus is on competition, and its connection to the profitability of firms. Competitiveness can be captured by the degree of market power, which refers to a firm's ability to set price above the cost of producing a single additional (i.e price cost margin (p-c)/p).
- *Market structure* refers to the identity and relative sizes of the firms that comprise an industry (and, in the case of multi-product firms, the products they produce). Often, it can be fully captured by a list of each firm and their respective market shares (i.e. their share of total industry revenue).

Theoretical Justification

- Suppose an industry of N firms producing a homogeneous good for which price is determined by the aggregate industry output , $X = \sum_{i=1}^{N} X_i, P = P(X)$ and the elasticity of demand $e = -\frac{dX}{dP}\frac{P}{X}$
- In the Cournot model each firm sets its output on the supposition that the outputs of all other firms remain unchanged $\frac{dX}{dX_i} = 1$
- Given fixed costs FC and marginal costs constant profits can be calculated from $\Pi_i = PX_i - c_i X_i - FC_i$ and the optimal output

$$\frac{d\Pi_i}{dX_i} = \frac{dP}{dX_i} X_i + P - FC_i = 0 \Leftrightarrow P - C_i = -\frac{dP}{dX_i} X_i \Leftrightarrow$$

$$\frac{P - C_i}{P} = -\frac{dP}{dX}\frac{X_i}{P} \Leftrightarrow \frac{P - C_i}{P} = -\frac{dP}{dX}\frac{X}{P}\frac{X_i}{X} \Leftrightarrow$$

$$\frac{P - C_i}{P} = \frac{S_i}{e} \xrightarrow{\ i\ } \sum \frac{P - C_i}{P}\frac{X_i}{X} = \sum_i \frac{S_i^2}{e} \equiv \frac{HHI}{e}$$

Theoretical Justification

- The aggregate margin in Cournot or Nash quantity setting equilibrium is therefore greater, the less elastic is demand and the larger is the sum of squared market shares.
- HHI is the well known Herfindahl index (small industries to monopoly with values 0-1).
- A connection between margins and concentration even when firms do not cooperate.
- Is there any causal relationship? Both margin and concentration are jointly determined in equilibrium by the cost and demand parameters and the nature of behavior?

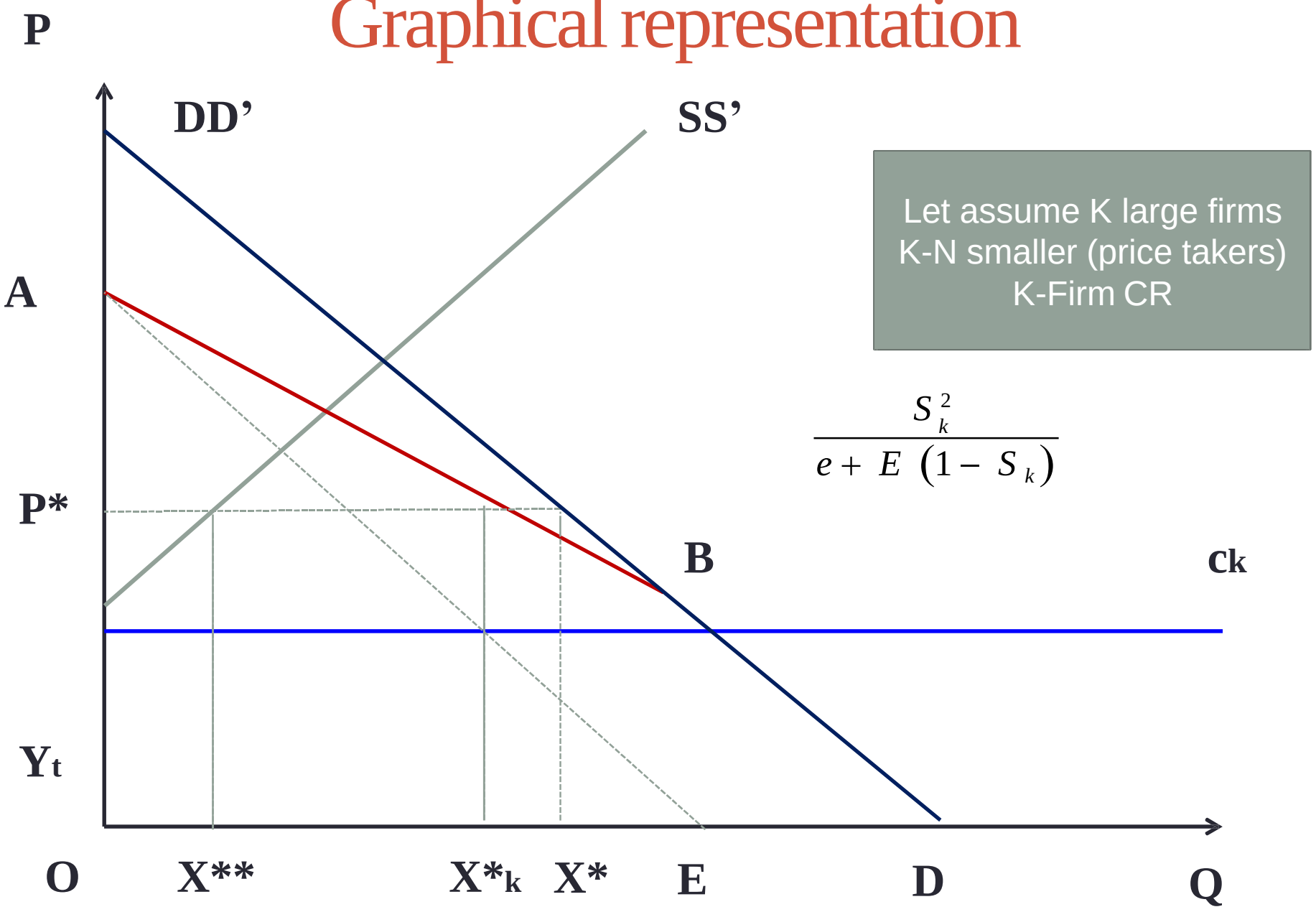
COOPERATIVE SOLUTIONS

- The same model allowing for non-Cournot behavior is provided (Dixit and Stern, 1982; Clarke and Davies, 1982). Thus a firm expects of its rivals to proportionally match a change in output either fully or partially. $\frac{dX_j}{X_j} = a\frac{dX_i}{X_i}, \forall j, a \le 1$
- Have we a generation of mark-up?

$$\frac{\sum_i P - c_i X_i}{PX} = \frac{\sum_i S_i^2 (1-a)}{e} + \frac{a}{e} = \frac{H(1-a)}{e} + \frac{a}{e}$$

- a= 1 — Perfect collusion, fixed market shares
- a= 0 — Back to Cournot case

Graphical representation



Let assume K large firms
K-N smaller (price takers)
K-Firm CR

$$\frac{S_k^2}{e + E\,(1 - S_k)}$$

Concentration and Collusion

1. Price leadership is more likely in concentrated industries (large values of a)
2. Conduct assumed endogenous and high concentration increase the possibility of collusion.
3. Propose the sum of squared market shares as a appropriate measure.
4. Higher concentration is associated with higher prices (without establishing causality).

Hannah and Kay (1977) concentration criteria of concentration curve ranking criterion, sales transfer principle, entry condition and merger condition.

Concentration Indices I

- Two dimensions to concentration can be identified: firm numbers and size inequalitites.
- Number of sellers in a market but….. (weakness of N-ignores size inequalities)

$$\sum \frac{P-C_i}{P}\frac{X_i}{X} = \sum_i \frac{S_i^2}{e} \equiv \frac{HHI}{e}, \text{where } S_i = 1/N \Rightarrow$$

Δείκτης Lerner

$$L = \theta - \frac{H}{e}$$

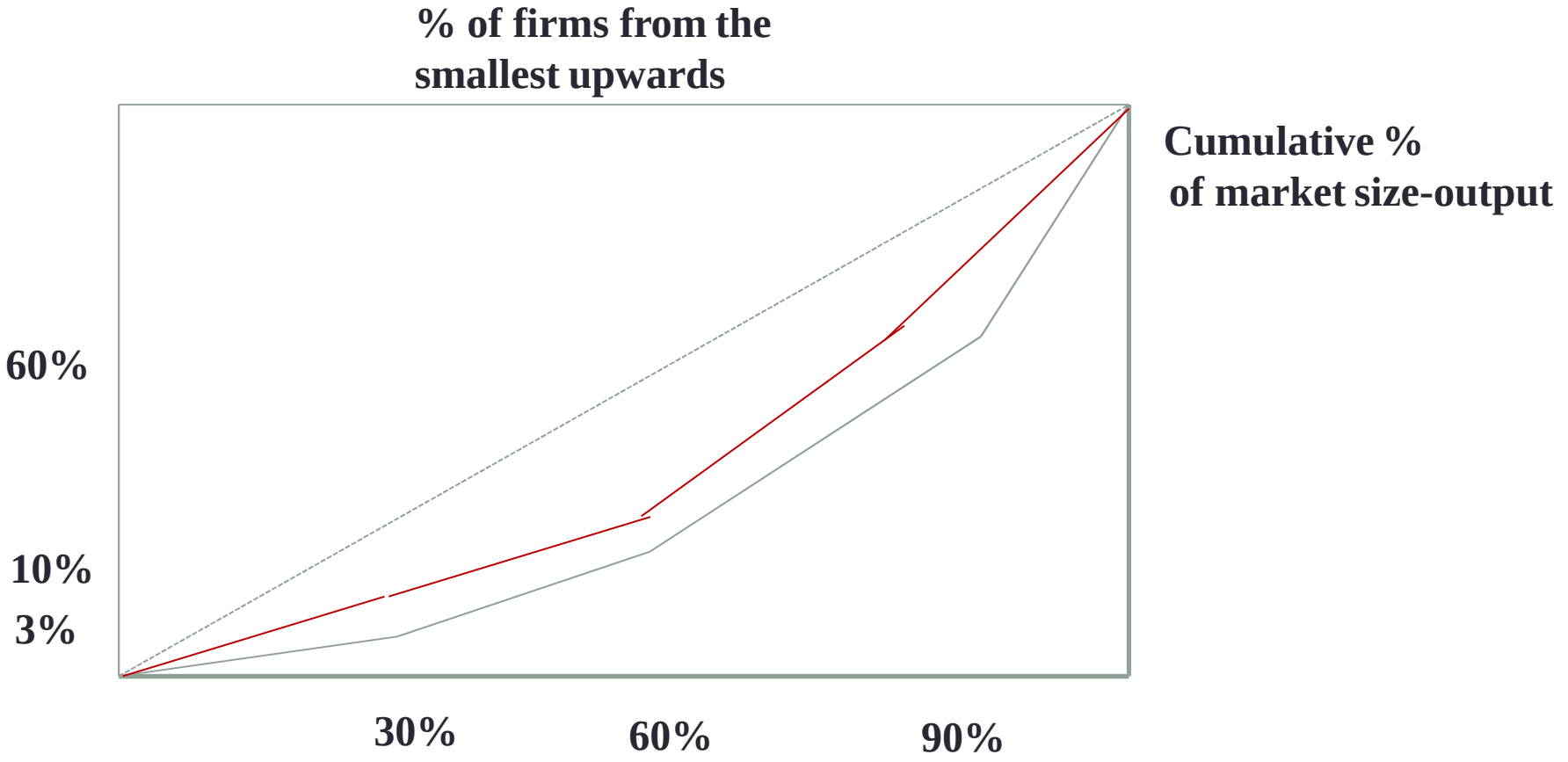
- Symmetric equilibrium in an oligopoly?
- Some measures??
- The first measure is the coefficient of variation .The ratio of the standard deviation to the mean.

$$CV = \frac{\frac{1}{n}\sum_{i=1}^{n}\left(x_i^2 - \bar{x}^2\right)}{\frac{1}{n}\sum_{i=1}^{n}(x_i)}$$

- The second one is the Lorenz curve.

Concentration Indices II

- The second one is the Lorenz curve and occupies many respects as the perfect measure. This curve plots the cumulative % of market size against the cumulative percent of firms. Gini coefficient!



An example-Lorenz curve-Concentration Indices III

Let us assume an industry that produces plastic turnips made up of ten firms. Each firm's contribution to the overall industry output in a given year is as follows:

Firm	Units sold (millions)
A	25
B	4
C	3
D	12
E	17
F	30
G	20
H	17
I	12
J	10
Total	150

Concentration Indices III

- The third one: the variance of the logarithm of firm size σ^2 (Hart, 1975).

$$\upsilon = \frac{1}{n}\sum_{i=1}^{n}\left[\log\left(x_i / x_g\right)\right]^2 \text{, geometric mean}$$

- Herfindahl-Hirschman Index:

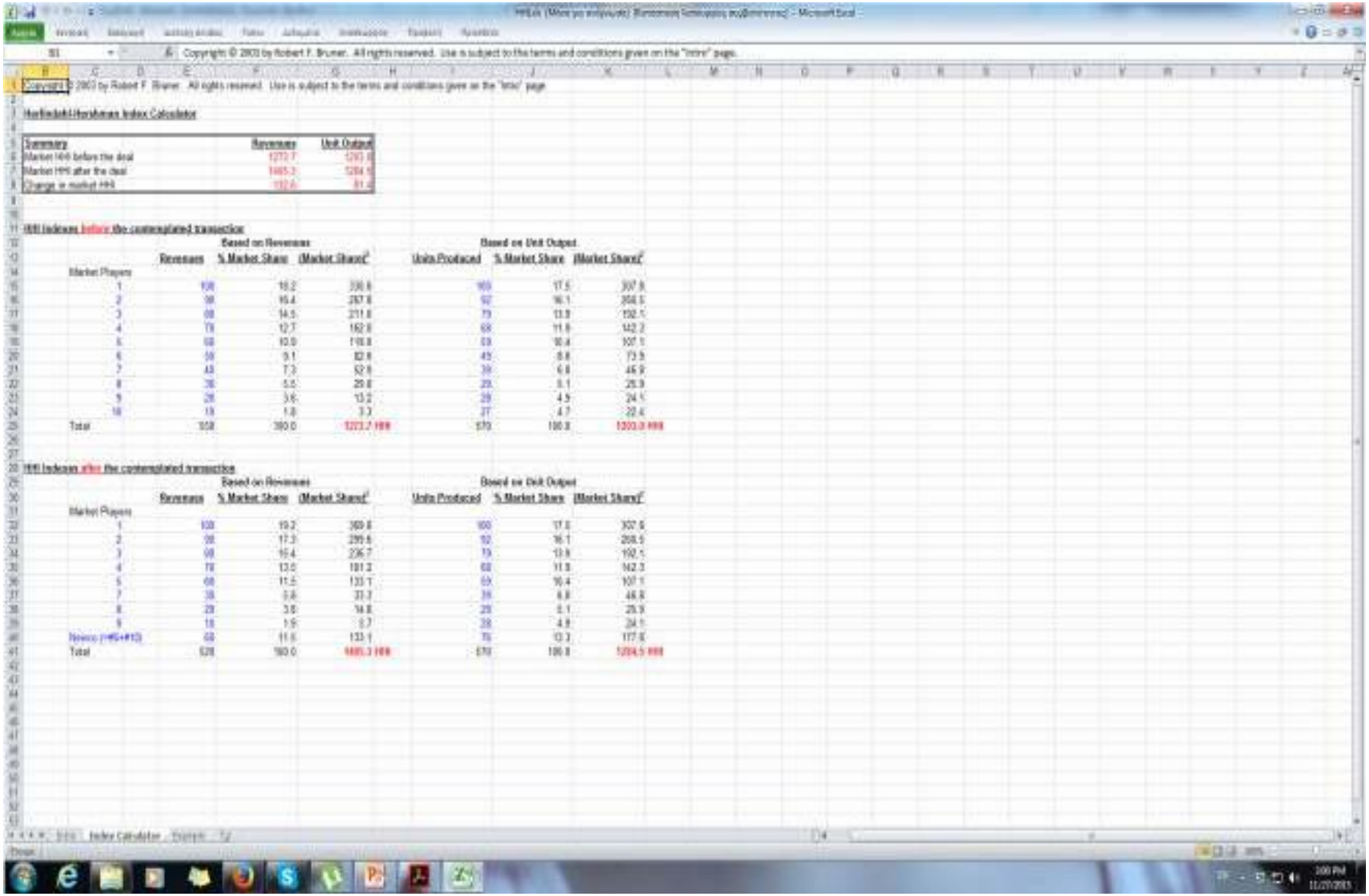
$$HHI = \sum_i S_i^2 = \sum_{i=1}^{N}\left(\frac{x_i}{x}\right)^2 = \frac{1+CV^2}{N}$$

where CV coefficient of variation of firm size

- Larger values means larger concentration but requires information on the sizes of all firms in the industry.
- Is the reciprocal of the equivalent number of equal sized firms?
- A appropriate measure of the degree of oligopoly but it is too sensitive to firms numbers (Hart and Clarke , 1980).

HHI.xls - Fisher College of Business Use hhi5 command in STATA!

Do it by your own! !! Please



Concentration Indices IV

- The fourth one: Entropy $E = -\sum S_i \log(S_i)$
- Entropy is more sensitive to firm numbers (Hart, 1975) and has no theoretical justification.
- The fifth and most commonly approach in measuring market power is Concentration Ratio.

$$CR_k = \sum_i^k S_i$$

- CR's larger values indicate more dominance for the leading firms.
- However, and in a statistical matter it emphasizes inequalities between the top K and the rest of the industry.

Concentration Indices V

- All indices provide roughly the same information. An evidence is that these industries are highly correlated and provide the similar ranking for participated firms.
- However, Boyes and Smith (1979) denotes significant differences in their behavior in an econometric analyses.
- In addition, HHI is more suitable in terms of oligopoly theory while CR is the practical choice.

Concentration-Theoretical approaches I

- The **Structure-Conduct-Performance Hypothesis** posits a positive relationship between concentration and performance (Stigler, 1964). That is, higher concentration would be associated with higher prices and profit. Furthermore, if only the SCP hypothesis holds, the market share variable should have only a small impact (at best), and efficiency effects should be small or insignificant. The SCP framework posited a one-way chain of causation running from industry structure (firm concentration) to firm conduct (pricing) to market performance (profitability, innovation).
- The **Relative-Market-Power Hypothesis** states that a high market share is associated with relatively more market power (see Rhoades, 1985; Shepherd, 1986; Berger and Hannan, 1993; Berger, 1995). Hence, the key variable is market share when investigating the relative market power hypothesis. Essentially, market share is assumed to capture both firm's efficiency and other factors like market power and product differentiation. In this context, Hicks' quiet life hypothesis (1935) is often considered as a special case of RMP because it establishes that concentrated markets reduce competitive pressure as managers put less effort to maximize the firm's efficiency.

Concentration- Theoretical approaches II

- The **Efficiency Hypothesis** suggests that overall cost efficiency is the driving force for profit and price after controlling for the effects of other variables. Firms that are more cost efficient operate with lower relative costs, and they are hypothesized to charge lower prices as a result. In addition, they can earn economic rents from their cost advantage (i.e., earn higher profits)
- The **Scale Efficiency Hypothesis** suggests that scale efficiency is an important determinant of prices and profit in and of itself. Also states that firms operating at the optimal scale have lower unit costs and higher unit profits. As a result, more cost and revenue scale-efficient insurers are expected to charge lower relative prices and earn relatively larger unit profits. All firms have equally good management and technology (the same X-efficiency), but some simply produce at more efficient scales than others. Under the scale efficiency version of the Efficient-Structure Hypothesis, since these firms which locate on more efficient scale are also assumed to gain large market shares that may result in high concentration, the positive profit-structure relationship is spurious (Lambson, 1987).

Determinants of concentration-Theoretical approaches I-A closer Inspection

- Fixed Cost and Market Size $\Pi^n(n^c) \geq F \geq \Pi^n(n^c+1)$
- An increase in the market should decrease profits for each firm.

$$n^c = \sqrt{Z} - 1, Z = \frac{(a-c)^2}{bF}$$

$$n^c = \left[(a-c)\sqrt{m/F\bar{b}}\right] - 1$$

- Where entry occurs Concentration will fall.

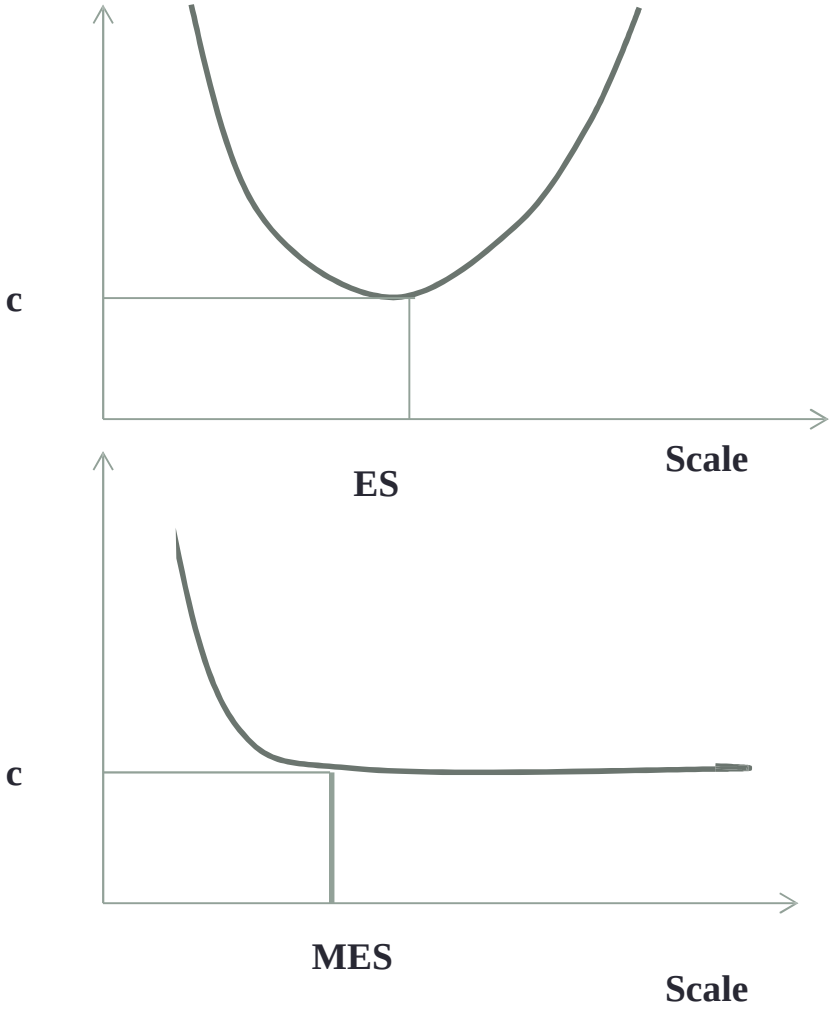
$$H = \sum_i S_i^2 / S^2$$

$$H^* = \frac{\sum_i S_i^2 + \lambda S^2 \mathrm{H}^2}{(S + \lambda SH)^2} = .. = \frac{H(1+\lambda^2 H)}{(1+\lambda H)^2}$$

$$H^* > H \text{ if } 1+\lambda^2 H > (1+\lambda H)^2$$

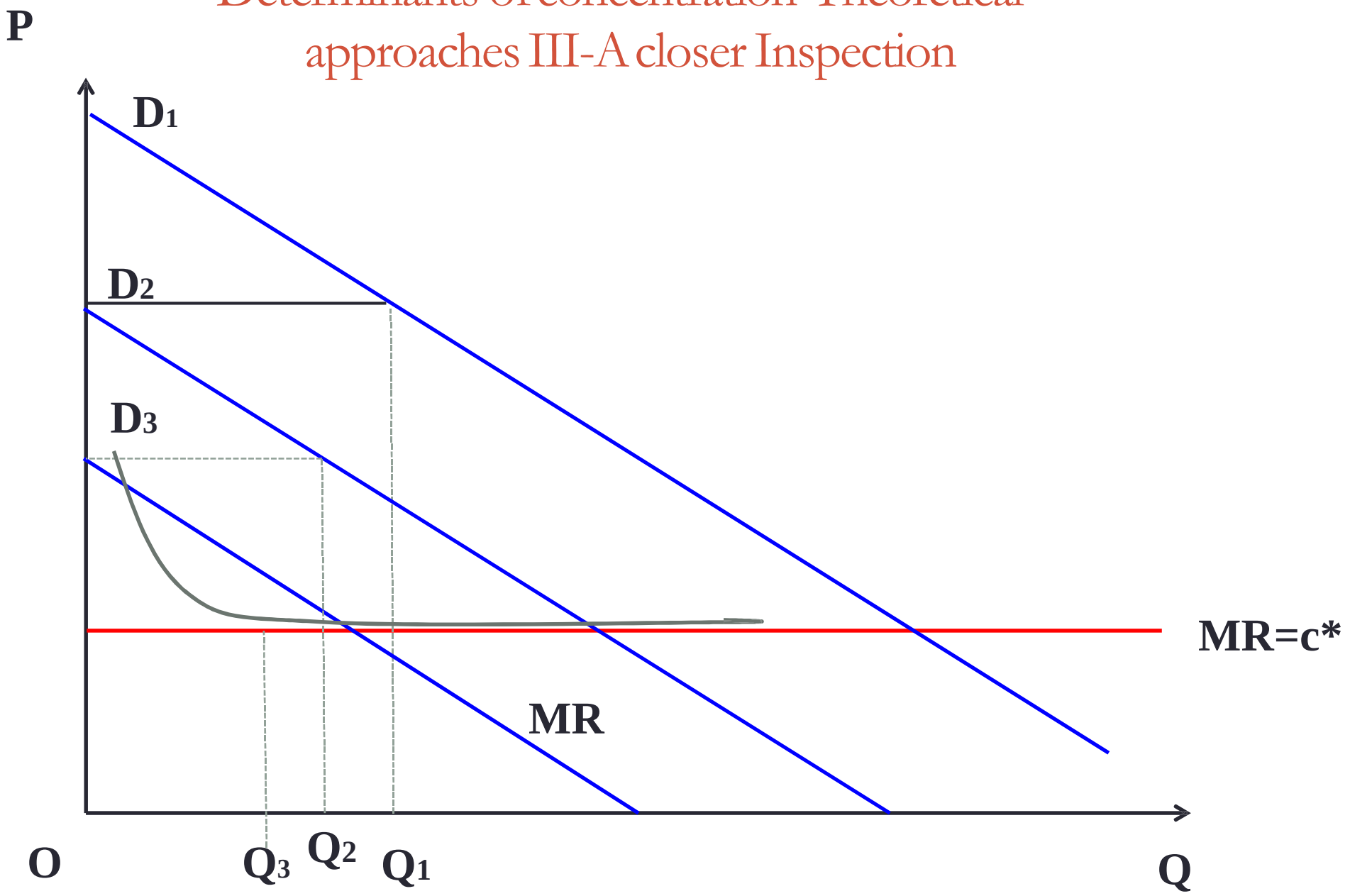
$$\lambda > \frac{2}{1-H}$$

Determinants of concentration-Theoretical approaches II-A closer Inspection



- Concentration reflects technology and thus cost structures. The industry more concentrated, the larger is efficient size relative to market size under a U-shape scheme.
- In a L-shape scheme there is an upper limit on firm numbers and concentration is relative to MES.
- Three interesting cases.
- Remember Gilbrat Law.

Determinants of concentration-Theoretical approaches III-A closer Inspection



Determinants of concentration-Theoretical approaches IV-Acloser Inspection

- Stochastic models of concentration (see lecture 5)
- Horizontal mergers are a major cause of high concentration (Bain 1959).
- Horizontal mergers departs from the desire to attain scale or scope economies.
- "Managerial motives" are an additional cause of concentration through mergers.
- The role of government policy

Measures of profitability e.t.c.

Distinct quantitative measures:

- Return on Investment, Return on Sales,
- Growth in Revenues,
- Cash Flow/Investment, Market Share,
- Market Share Gain, Product
- Quality Relative to Competitors,
- New Product Activities Relative to Competitors,
- Direct Cost Relative to Competitors,
- Product R&D,
- Process R&D,
- Variations in ROI,
- Percentage Point Change in ROI,
- Percentage Point Change in Cash Flow/Investment

Measures of profitability e.t.c.

The most important are (Chakravarthy, 1988 SMJ)

1. profitability,
2. relative market position,
3. change in profitability and cash flow,
4. growth in sales and market share.

Of these, again, the profitability factor demonstrated the highest factor magnitude.

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- Bresnahan, T.F. and P.C. Reiss (1990) "Entry in Monopoly Markets" *Review of Economic Studies* 57, 531-553.
- Berry, S. (1992) "Estimation of a Model of Entry in the Airline Industry", *Econometrica* 60, 889-917.
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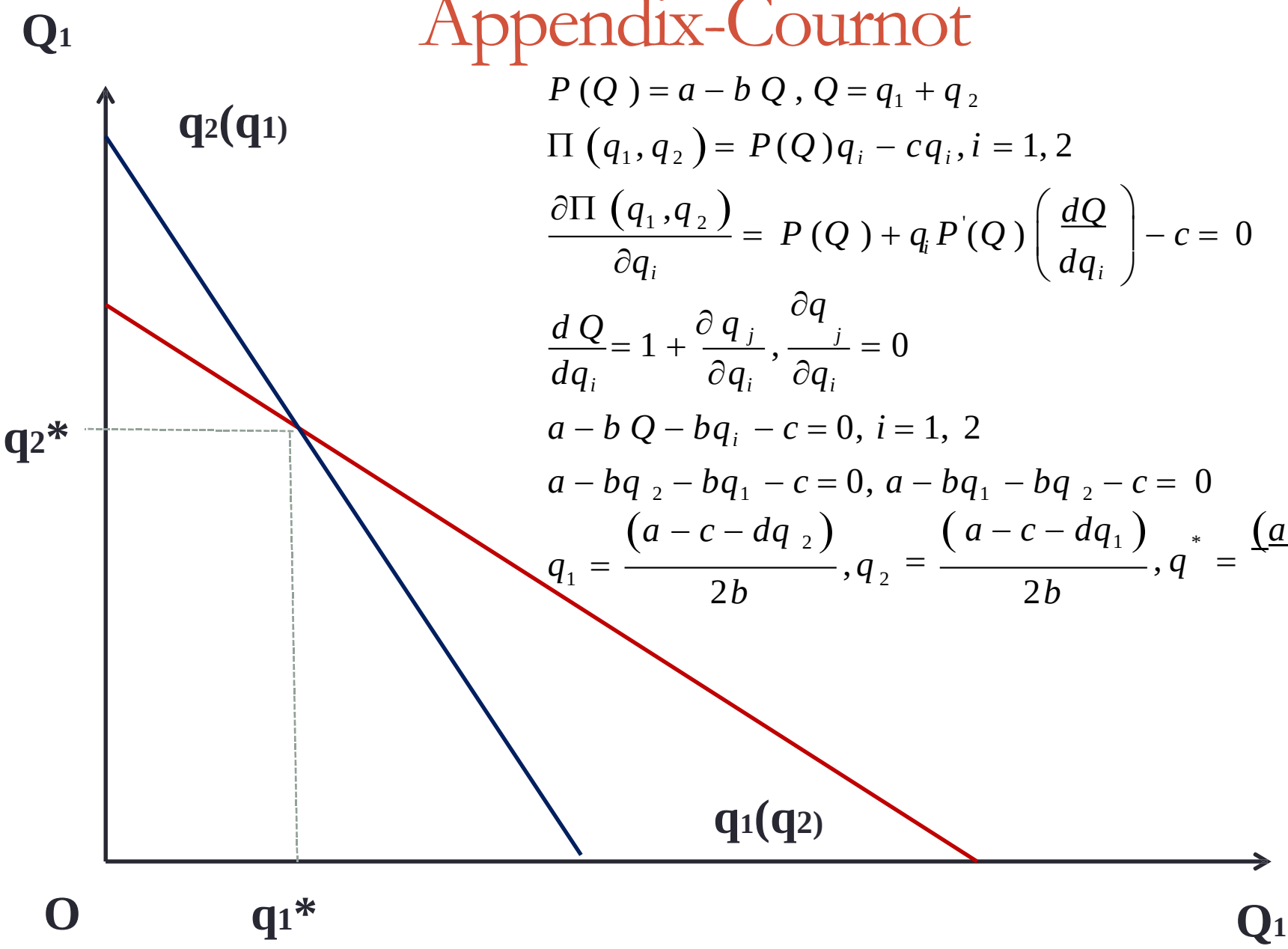
- Schmalensee, R.(1989) "Inter-industry differences of

Structure and performance". In: Schmalensee, R., Willig R. (Eds.) Handbook of Industrial Organization, vol. 2. North-Holland, Amsterdam, 951-1009.

Appendix-Cournot



$$P(Q) = a - bQ,\ Q = q_1 + q_2$$

$$\Pi(q_1, q_2) = P(Q)q_i - cq_i,\ i = 1, 2$$

$$\frac{\partial \Pi(q_1, q_2)}{\partial q_i} = P(Q) + q_i P'(Q)\left(\frac{dQ}{dq_i}\right) - c = 0$$

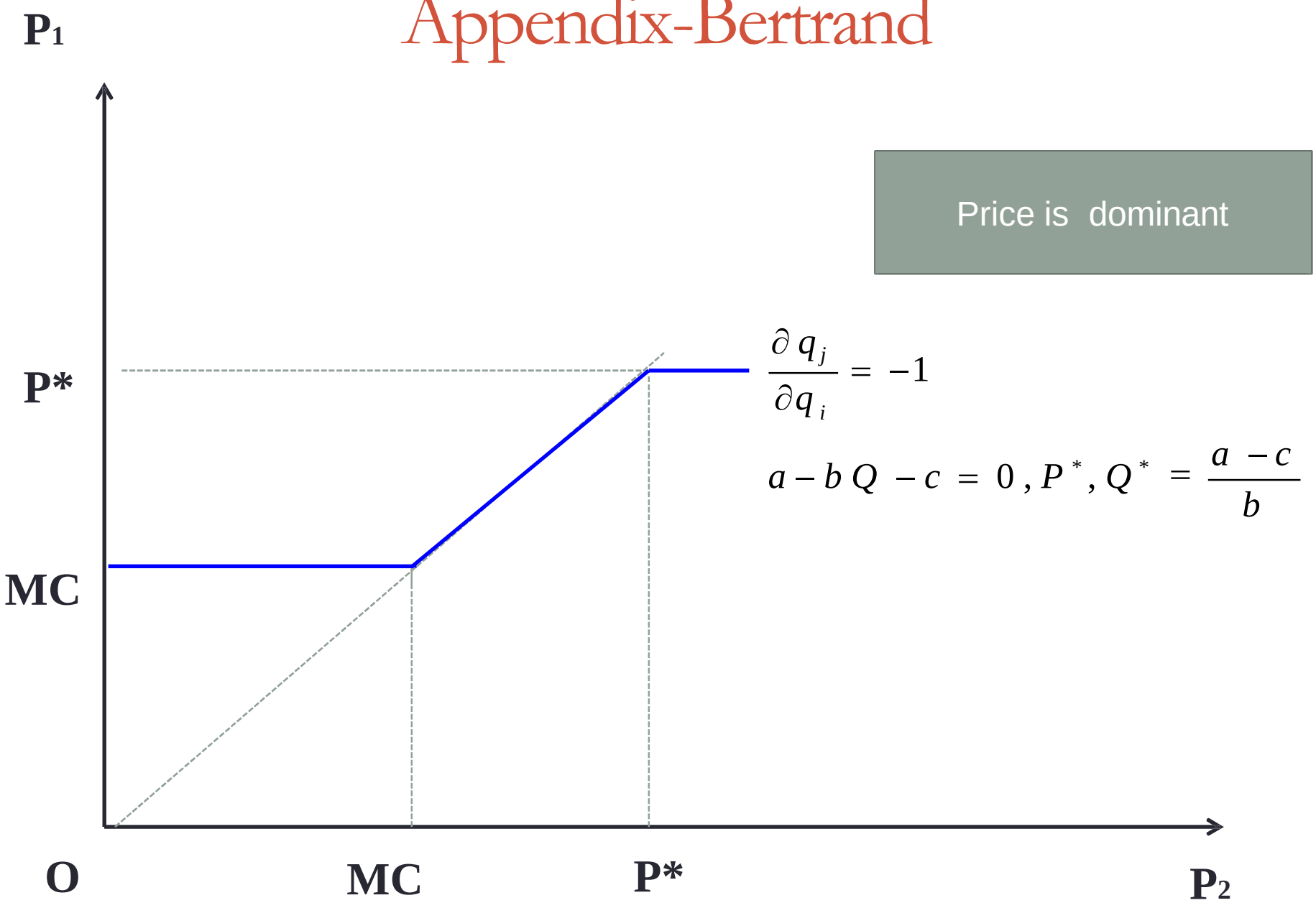
$$\frac{dQ}{dq_i} = 1 + \frac{\partial q_j}{\partial q_i},\ \frac{\partial q_j}{\partial q_i} = 0$$

$$a - bQ - bq_i - c = 0,\ i = 1,\ 2$$

$$a - bq_2 - bq_1 - c = 0,\ a - bq_1 - bq_2 - c = 0$$

$$q_1 = \frac{(a - c - dq_2)}{2b},\ q_2 = \frac{(a - c - dq_1)}{2b},\ q^* = \frac{(a - c)}{3b}$$

Appendix-Bertrand

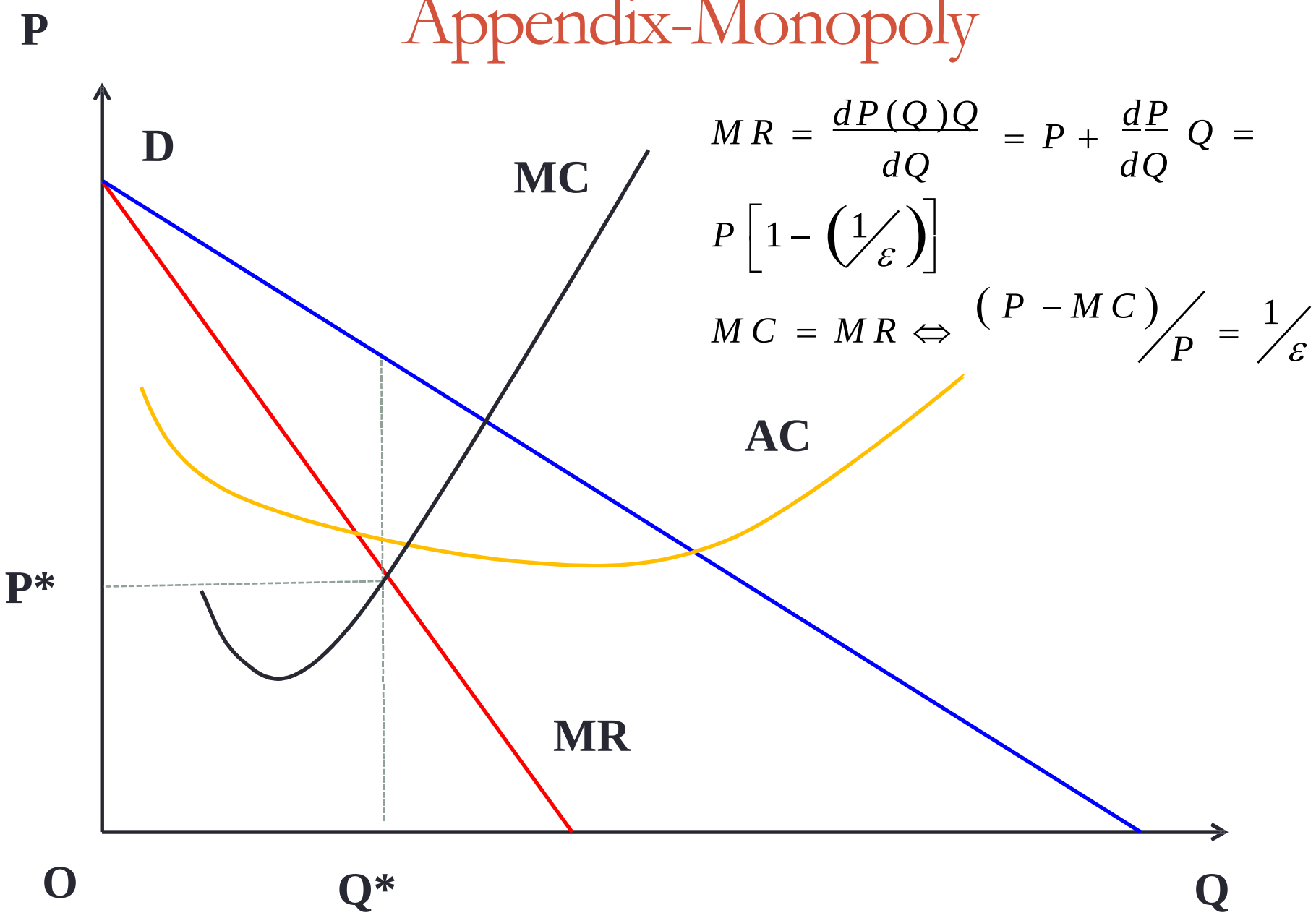


Price is dominant

$$\frac{\partial q_j}{\partial q_i} = -1$$

$$a - b\,Q - c = 0\,,\ P^*\,,\ Q^* = \frac{a - c}{b}$$

Appendix-Monopoly



$$MR = \frac{dP(Q)Q}{dQ} = P + \frac{dP}{dQ}Q = P\left[1 - \left(1/\varepsilon\right)\right]$$

$$MC = MR \Leftrightarrow (P - MC)/P = 1/\varepsilon$$

Bertrand vs Cournot vs Monopoly

The most appropriate model ?

1. Depends on the market,
2. Bertrand is more appropriate where we have no significant price changes,

$$P^M > P^C > P^B$$

$$Q^M < Q^C < Q^B = \frac{a - c}{b}$$

$$\Pi^M > \Pi^C > \Pi^B = 0$$