Unit 8.
Firm behaviour and market structure: monopolistic competition and oligopoly

In accordance with the APT programme the lecture is set to help You to:

- understand the interdependency of firms and their tendency to collude or to form a cartel;
- to use the basic game-theory model and a simple payoff matrix to study the interdependent behaviour of firms in an oligopolistic market and their dominant strategies;
- understand the importance of product differentiation and the role of advertising in the behaviour of firms under the market structure of monopolistic competition;
- to examine firm behaviour in the short run and in the long run and the existence of excess capacity and its implication for efficiency.

Required reading

Begg, D., R.Dornbusch, S.Fischer. Economics. 8th edition. McGraw Hill. 2005.

Chapter 9. Market structure and imperfect competition:

- **9.2. Monopolistic competition**
- **9.3. Oligopoly and interdependence**
- **9.4. Game theory and interdependent decisions**
- **9.5. Reaction functions**
- **9.6. Entry and potential competition**
- **9.7. Strategic entry deterrence**
- **9.8. Summing up.**

Questions to be revised

✓The relationships among the short-run and long-run costs: total, average and marginal;
✓The profit-maximizing rule;
✓Profit maximization by a competitive firm in the short run and in the long run;
✓Production and allocation efficiency.

Perfect Competition	Imperfect Competition	
	Monopolistic Competition	**Monopoly and Oligopoly**
Many buyers and sellers	Many buyers and sellers	One or few sellers (large)
Firms are too small to affect price	**Can affect price**	**Can affect price**
Identical (homogeneous) products	Goods are close substitutes	Homogeneous or heterogeneous goods
Free entry and exit	Free entry and exit	Big entry costs
Zero profits in the long run	Zero profits in the long run	Profits can be positive

Monopolistic Competition and Oligopoly

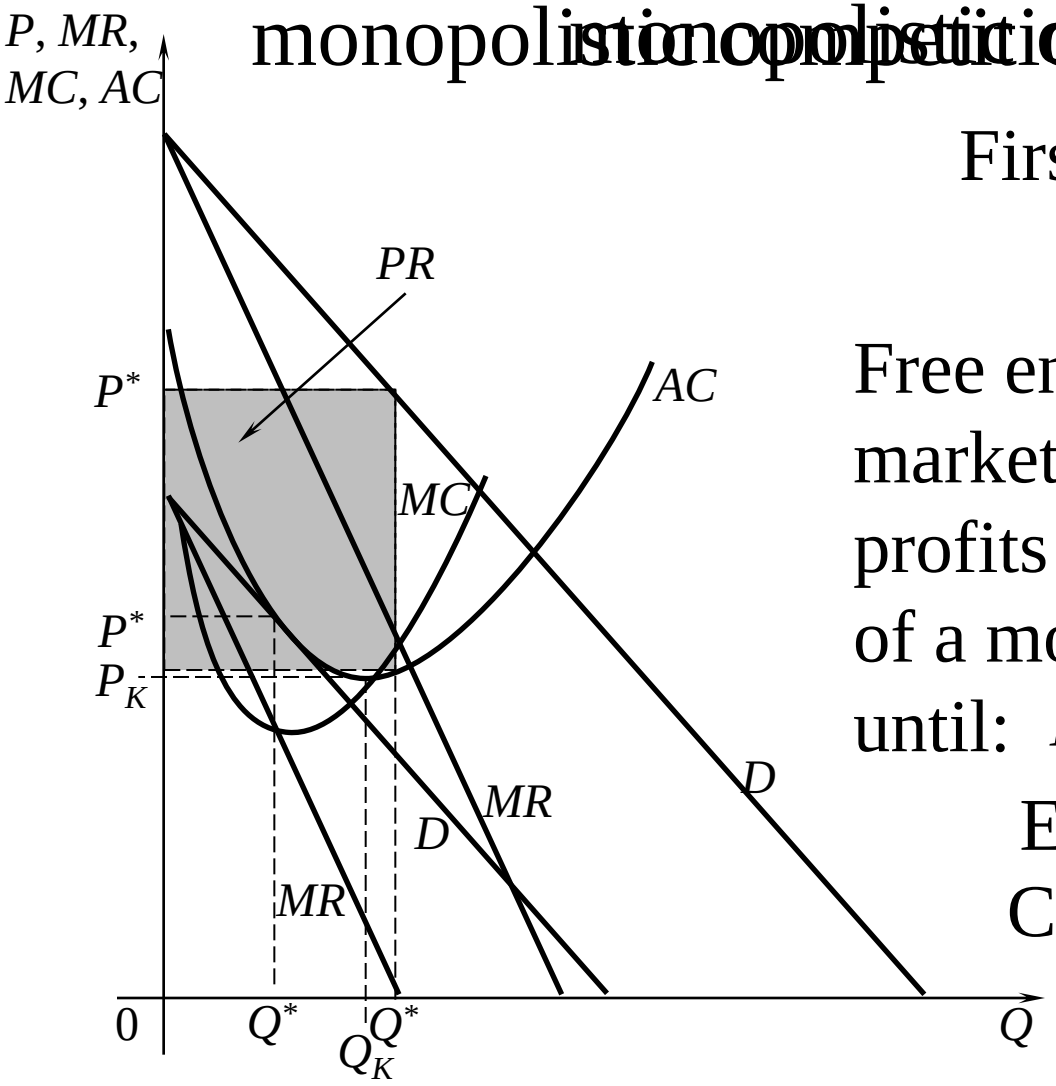
- Monopolistic competition: many sellers produce products that are close (but not perfect!) substitutes for one another. Example: beer market.

- Oligopoly: few producers, each recognizes that its own price depends on the actions of other firms in the industry. Example: aircraft manufacturing (Boeing and Airbus).

Monopolistic Competition

- Lots of small firms
- Downward-sloping demand curve
- Product differentiation (brand, location)
- Free entry
- Zero profits in the long run

Long run equilibrium of a firm under monopolistic competition



Short run equilibrium of a firm under monopolistic competition: economic profits

First order condition:

$MR=MC$

Free entry of new firms to the market with positive economic profits shifts residual demand of a monopolistic competitor until: $P=AC$

Excess capacity: $Q_K - Q^*$

Cost of product diversity:

$P^* - P_K$

Monopolistic Competition in the LR

Note:

1. Firms are not producing at lowest point of AC curve;

2. Price exceeds MC.

Example: APT 2007 (Form B)

1. Assume that the cellular telephone industry is monopolistically competitive.
   (a) Assume that cellular telephone manufacturers are earning short-run economic profits. Draw a correctly labeled graph for a typical firm in the industry and show each of the following.
      (i) The profit-maximizing output and price
      (ii) The area representing economic profit
   (b) At the profit-maximizing price you identified in part (a), would the typical firm's demand curve be price inelastic? Explain.
   (c) Given the information in part (a), what happens to the demand curve for the typical firm in the long run? Explain.
   (d) Using a new correctly labeled graph, show the profit-maximizing output and price for the typical firm in the long run.
   (e) Does the typical firm produce an output level that minimizes its average total cost in the long run?
   (f) In long-run equilibrium, does the typical firm produce the allocatively efficient level of output? Explain.

Example: APT 2002 (Form B)

1. Assume that two firms are operating with identical cost schedules, but one firm is in a perfectly competitive industry, and the other is in a monopolistically competitive industry.
   (a) Using two correctly labeled graphs, show the long-run equilibrium price and output levels for each of these two firms.
   (b) Compare the long-run equilibrium price and output levels for these two firms.
   (c) What level of economic profit will each firm earn in the long run? Why do these results occur?
   (d) For each of the two firms at the equilibrium quantity, indicate whether the firm's demand curve is perfectly elastic, elastic, unit elastic, inelastic or perfectly inelastic. How can you tell?

Profit maximization by a monopolistic competitor in long run

First order condition:

$$\frac{dPR}{dQ} = \frac{dTR}{dQ} - \frac{dTC}{dQ} = \frac{d(Qp)}{dQ} - \frac{d(Q \cdot AC)}{dQ} = P + Q\frac{dP}{dQ} - AC - Q\frac{dAC}{dQ} = 0$$

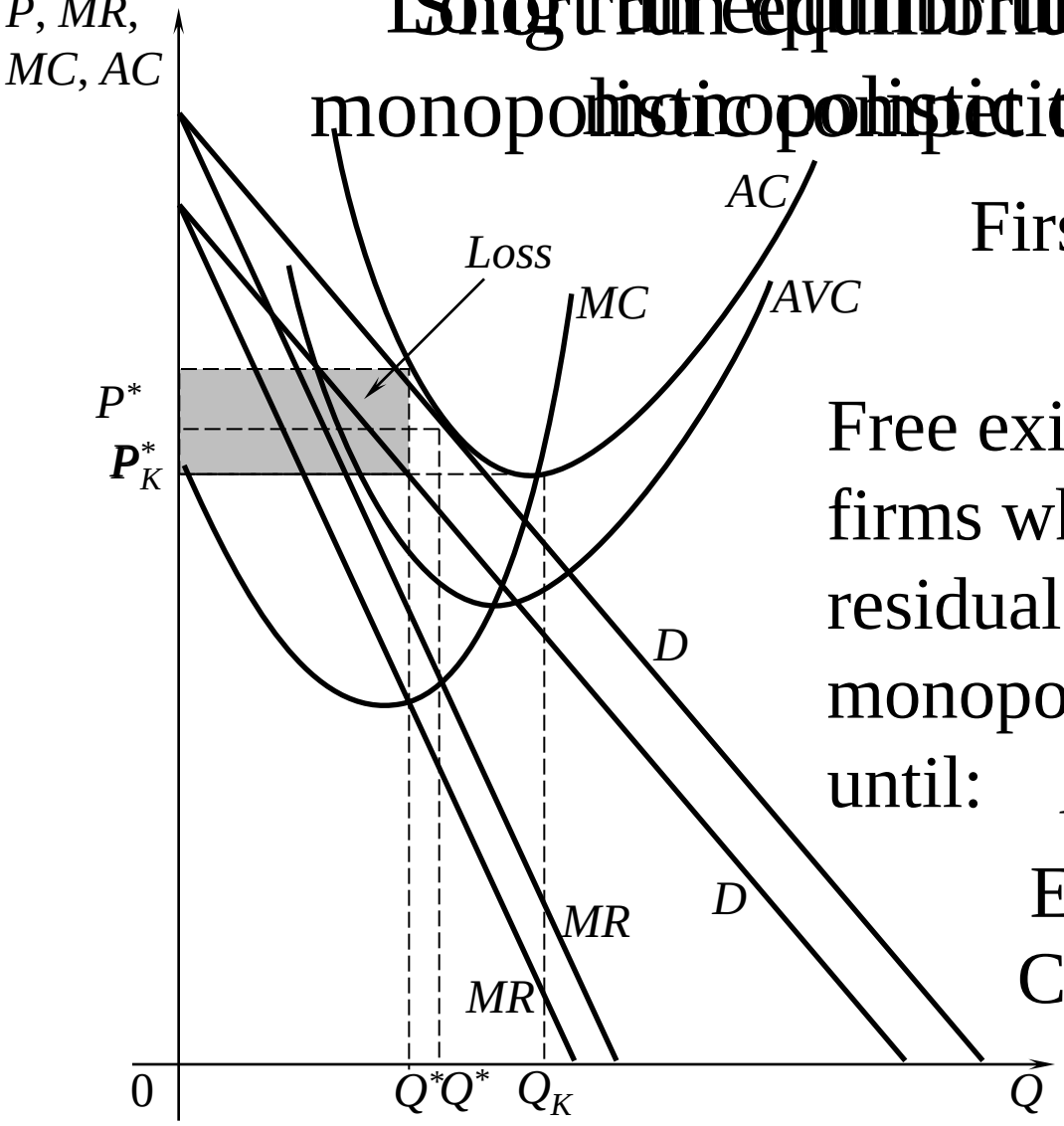
It follows that: $P + Q\frac{dP}{dQ} = AC + Q\frac{dAC}{dQ}$

Apply zero profit condition $P=AC$

to get $\frac{dP}{dQ} = \frac{dAC}{dQ}$

Consequently, average cost and residual demand curves for a monopolistic competitor are tangent in long run.

Short run equilibrium of a firm under monopolistic competition: economic losses



Long run equilibrium of a firm under monopolistic competition:

First order condition:

$MR=MC$

Free exit from the market of firms which meet a loss shifts residual demand of a monopolistic competitor upwards until: $P=AC$

Excess capacity: $Q_K - Q^*$

Cost of product diversity:

$P^* - P_K$

Example: APT 2009 (Form B)

1. Mary & Company, operating in a monopolistically competitive industry, produces a cleaning product called BriteKlean. The company currently produces the profit-maximizing quantity of BriteKlean but is operating at a loss.

   (a) Draw a correctly labeled graph for Mary & Company and show each of the following.

      (i) The profit-maximizing output and price, labeled as Q_M and P_M, respectively

      (ii) The area of loss, shaded completely

   (b) What must be true in the short run for the company to continue to produce at a loss?

   (c) Assume now that the demand for cleaning products increases and that the company is now earning short-run economic profits. Relative to this short-run situation, how does each of the following change in the long run?

      (i) The number of firms

      (ii) The company's profit

   (d) In the long run, if the company continues to produce, will it produce the allocatively efficient level of output? Explain.

   (e) In the long run, will the company be operating in a region where economies of scale exist? Explain.

Interdependent Decisions

Monopolistic competition – each firm is too small and there are too many firms. Assume decisions of firms are not interdependent.

Oligopoly – few large firms. Need for **strategic behaviour**. Need for each firm to consider how its own decisions affect the decisions of its competitors.

Game Theory

Analysis of interdependent decisions: actions of one decision maker affect payoffs of another decision maker.

Three elements of any game:

- Players (participants);
- List of possible actions (strategies);
- Payoffs of players (depend on player's own actions AND actions of other players); measured as utilities/profits.

Game models of oligopoly can be classified according to:

- Number of players (classical optimization is a single player game)
- Number of strategies: finite or infinite
- Properties of payoff functions: zero sum (antagonistic), nonzero sum, constant difference (surpluses and losses at the same time)
- Possibility of pre-game negotiations and interaction during the game (cooperative or noncooperative)
- Temporal profile of decision making (simultaneous move or sequential moves)
- Number of interactions (single move or repeated games)

Games with **simultaneous** moves

Each player makes a decision independently (not knowing what the other decides), and then the payoffs are realized.

Players have complete information or common knowledge of all factors of the game.

Payoff matrix – a table that describes the payoffs in a game for each possible combination of strategies.

Solution of a game

Nash equilibrium is a set of strategies such that no player has an incentive to deviate from his strategy, if all other players stick to their strategies.

Simplest game to solve:

Every player has a **dominant strategy** – one that yields a higher payoff no matter what the other players choose.

Prisoners' dilemma

Losses: a<b<c

		Player 1	
		Cheat	Confess
Player 2	Cheat	→ ↓ (a,a)	(0,c) ↓
	Confess	(c,0) →	(b,b)

- Each player has a *dominant* strategy;
- Payoff to each player would be higher if all players chose their *dominant* strategies.

Example: Prisoner's Dilemma

Gains: maximum loss – actual losses

	Prisoner 2 confesses	Prisoner 2 does not confess
Prisoner 1 confesses	1 1	3 0
Prisoner 1 does not confess	0 3	2 2

Multiple Nash equilibria: example

		Player 2	
		Strategy α	Strategy β
Player 1	Strategy α	3, 3	2, 4
	Strategy β	4, 2	1, 1

No dominant strategies

Multiple Nash equilibria: example

Street intersection and two cars

	Car 2 go	Car 2 wait
Car 1 go	-1, -1	1, 0
Car 1 wait	0, 1	0, 0

No dominant strategies

Application:
Entry into industry that is a natural monopoly

	Firm 2 enter (pay start up cost)	Firm 2 stay out
Firm 1 enter (pay start up cost)	-1, -1	1, 0
Firm 1 stay out	0, 1	0, 0

Example: APT 2007 (Form B)

2. Two airline companies, Airtouch and Windward, operate a route from City X to City Y, transporting a mix of passengers and freight. They must file their schedules with the National Transportation Board each year and cannot alter them during that year. Those schedules are revealed only after both companies have filed. Each airline must choose between a morning and an evening departure. The relevant payoff matrix appears below, with the first entry in each cell indicating Airtouch's daily profit and the second entry in each cell indicating Windward's daily profit.

		Windward: Morning	Windward: Evening
Airtouch	Morning	$1,000, $700	$700, $600
	Evening	$750, $950	$900, $800

(a) In which market structure do these firms operate? Explain.

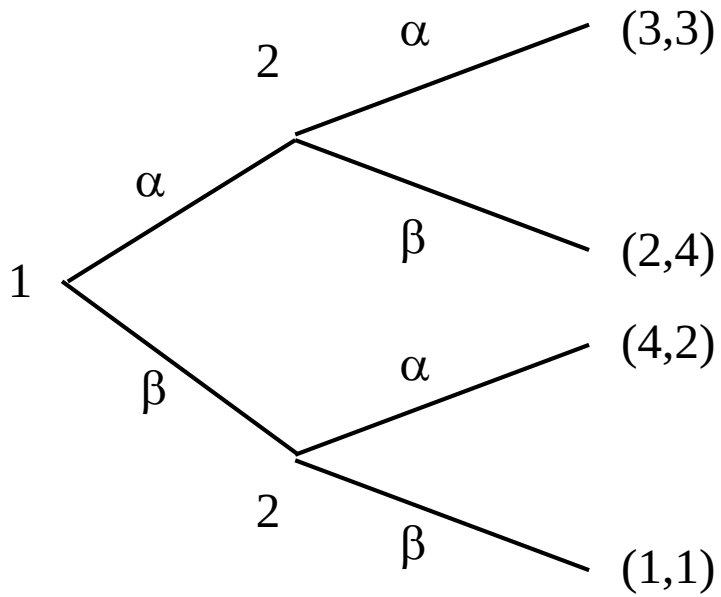
(b) If Windward chooses an evening departure, which departure time is better for Airtouch?

(c) Identify the dominant strategy for Windward.

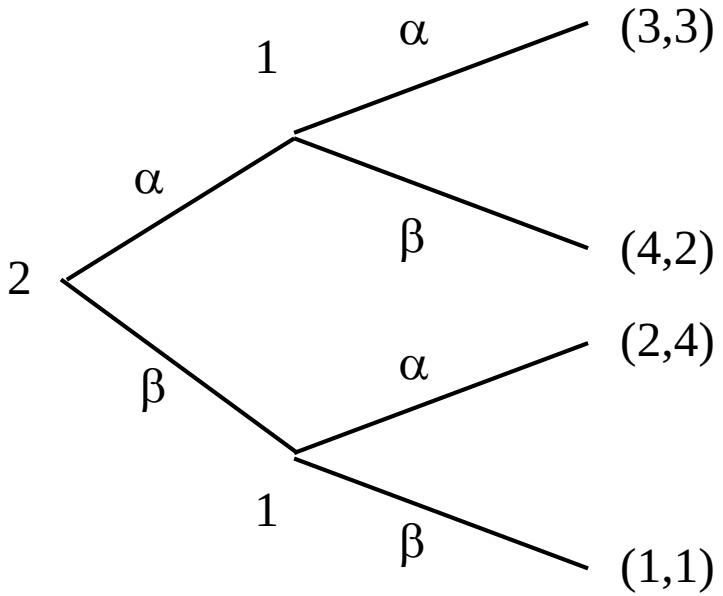
(d) Is choosing an evening departure a dominant strategy for Airtouch? Explain.

(e) If both firms know all of the information in the payoff matrix but do not cooperate, what will be Windward's daily profit?

Sequential moves games: example



Nash equilibrium (4,2)



Nash equilibrium (2,4)

Strategic Entry Deterrence

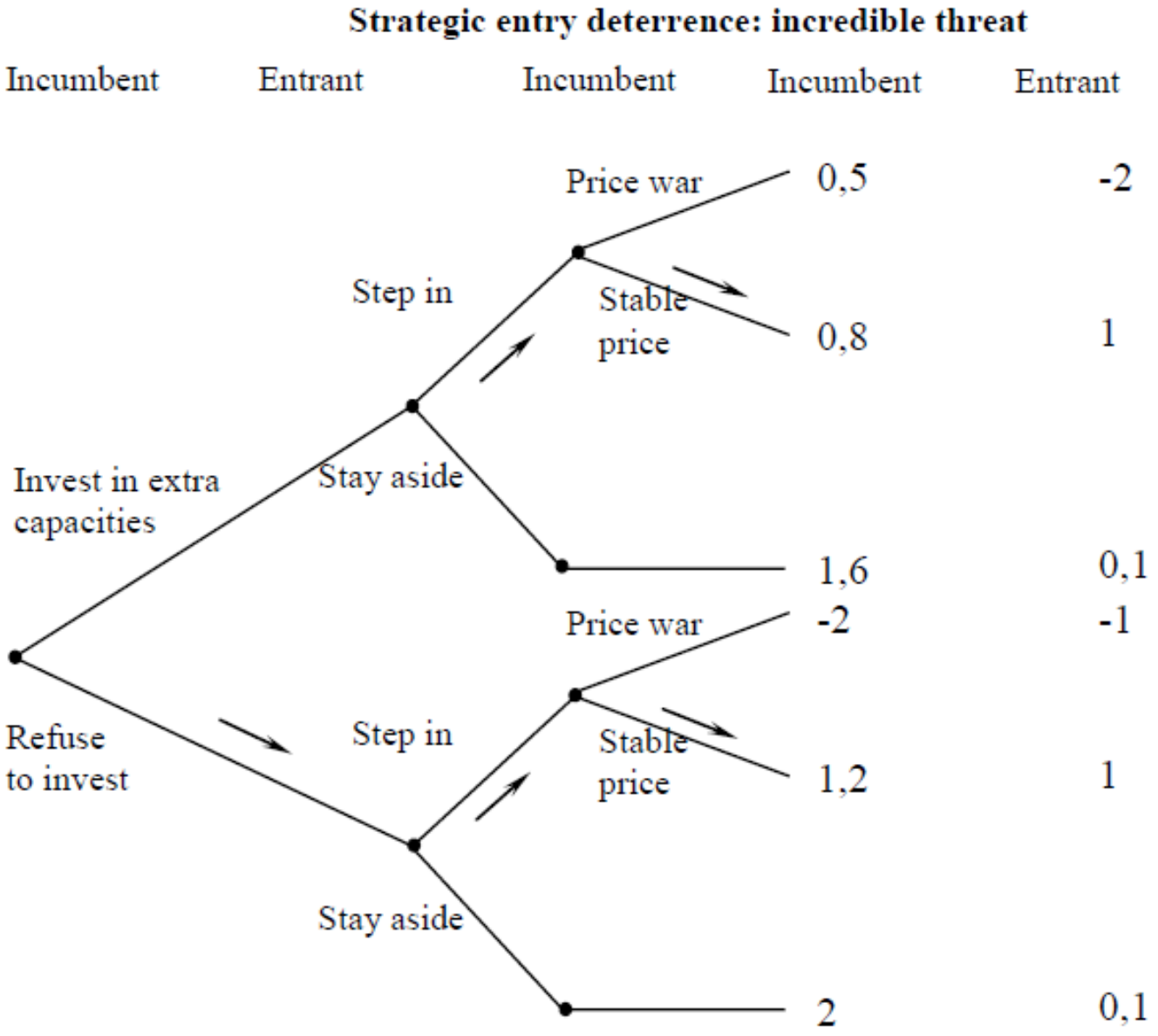
Suppose that before the game the incumbent invests in extra capacity, that is not used when he is not challenged, but can be used in case of entry.

Strategic entry deterrence - behavior by incumbent firms to make entry less likely.

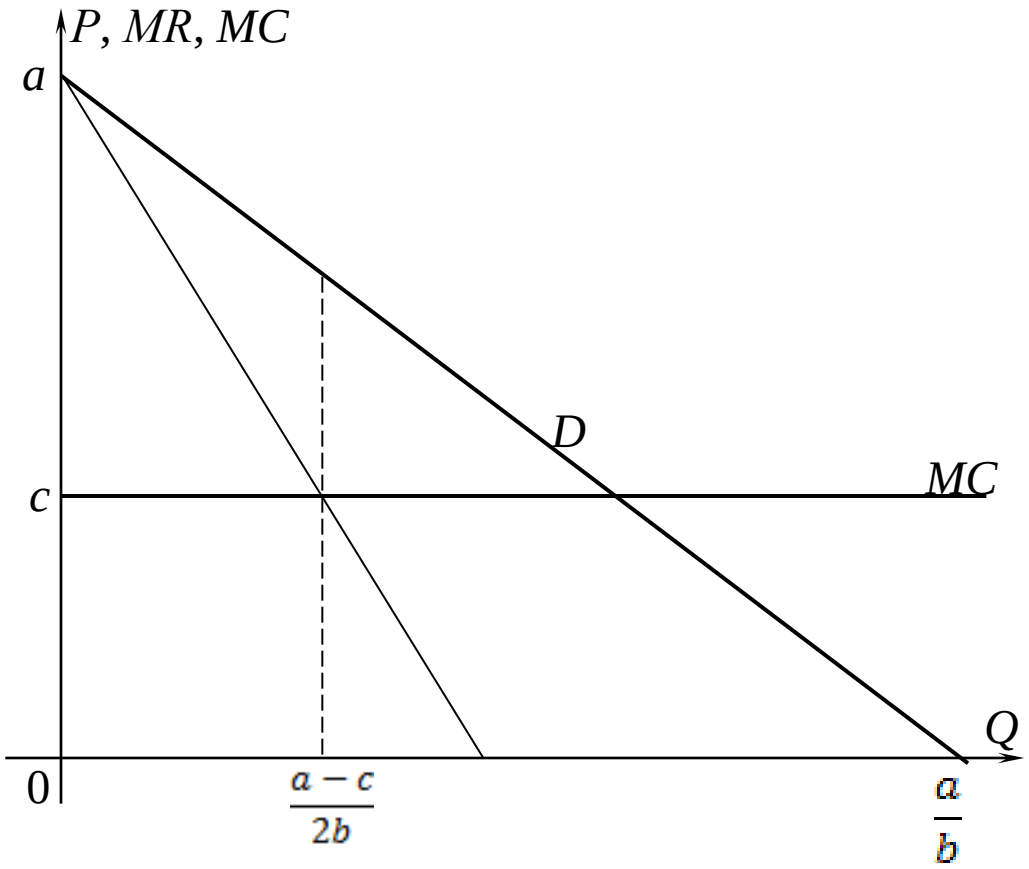
Potential entry affects behaviour of incumbent firms: they can erect entry barriers.

Credible threat – a threat to take an action that is in the threatener's interest to carry out.

Sequential moves game: example



Collusion as a cooperative equilibrium



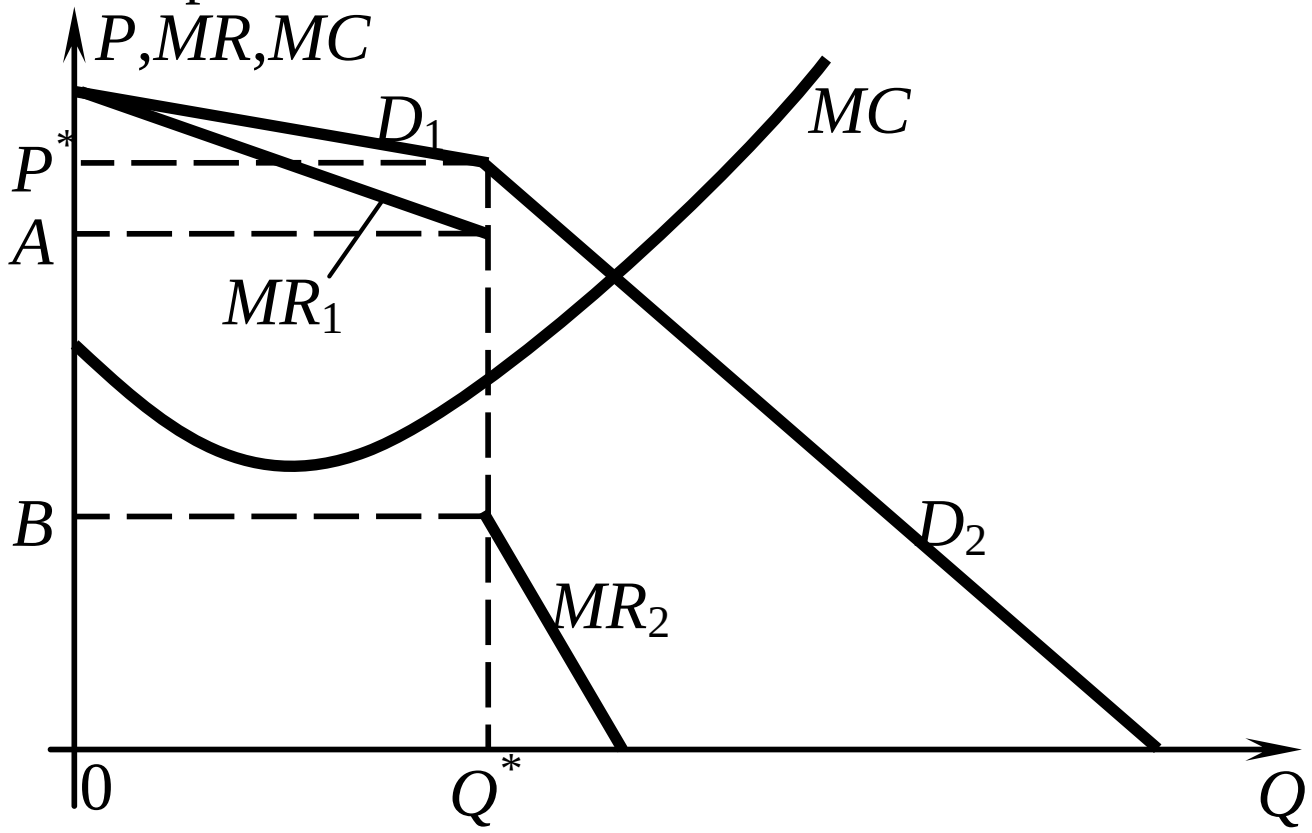
Application of prisoners' dilemma: Oligopoly and collusion

	Firm 2 competes (produces high)	Firm 2 colludes (produces low)
Firm 1 competes (produces high)	1 1	3 0
Firm 1 colludes (produces low)	0 3	2 2

Kinked demand curve and sticky prices

Elastic segment of demand: the firm raises the price and competitors neglect it.

Inelastic segment of demand: the firm reduces the price and competitors follow.



Price war: Bertrand equilibrium