

# Market Structures

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## 1 Competitive Markets

- Competitive markets

## 2 Imperfect competition

- Monopoly
- Monopolistic Competition
- Oligopoly

# Outline

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# Features of a competitive market

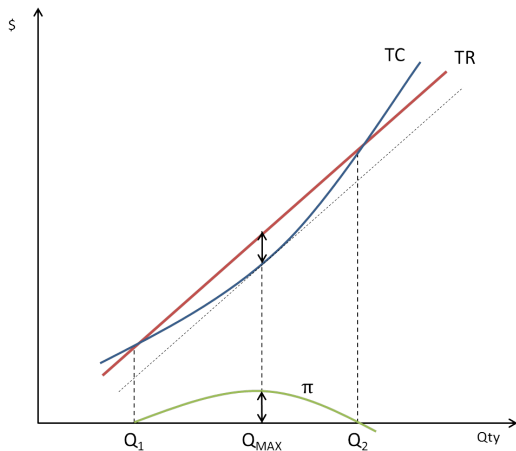
- Simple reference model (real world seldom resembles it, but still useful)
- Many buyers and sellers with insignificant market shares
- Homogeneous product
- Everyone is a *price-taker*, insignificant **market power** (to change the price) of the participants
- No entry-barriers (firms can enter or exit the market freely in the Long-run)
- No information barriers (so that information and technology improvements can spread freely (no patents, copyrights etc.))
- "Ideal situation" - efficient (recall the lecture on "Consumers, Producers and Efficiency of Markets")

## Variables (recall from *Theory of Firms*)

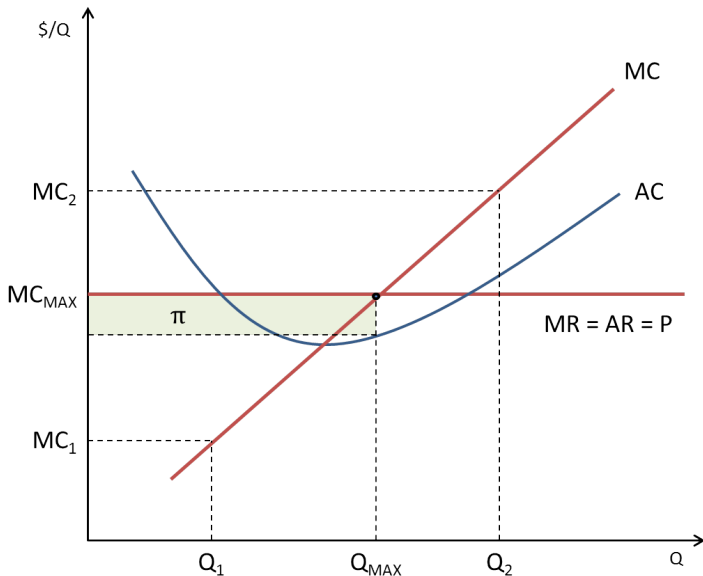
- Quantity produced ( $Q$ ), Price ( $P$ )
- Costs
  - **Variable Costs** ( $VC$ ) - associated with quantity produced (the more we produce, the more it costs), usually cost of labor, every factor in the Long Term (LR)
  - **Fixed Costs** ( $FC$ ) - payed once in Short Run (SR) and cannot be spared (the more we produce, it costs the same), usually cost of capital
  - **Total Costs** ( $TC$ ):  $TC = VC + FC$
  - **Average values** of  $VC$ ,  $FC$  and  $TC$  ( $AVC$ ,  $AFC$ ,  $AC$ ) -  $AVC = \frac{VC}{Q}$ ,  
 $AFC = \frac{FC}{Q}$ ,  $AC = \frac{TC}{Q}$
  - **Marginal Costs** ( $MC$ ) - change of  $TC$  with additional  $Q$ ,  $MC = \frac{\delta TC}{\delta Q}$
- Revenues
  - **Total Revenues** ( $TR$ ) - all items sold,  $TR = P \cdot Q$
  - **Average Revenue** ( $AR$ ) -  $AR = TR / Q$
  - **Marginal Revenue** ( $MR$ ) - change of  $TR$  with additional  $Q$ ,  
 $MR = \frac{\delta TR}{\delta Q}$

# Maximizing Firm's Profit

- Profit:  $\pi = TR - TC$
- Firm maximize its profit when  $MC = MR \Leftrightarrow \frac{\delta TC}{\delta Q} = \frac{\delta TR}{\delta Q}$

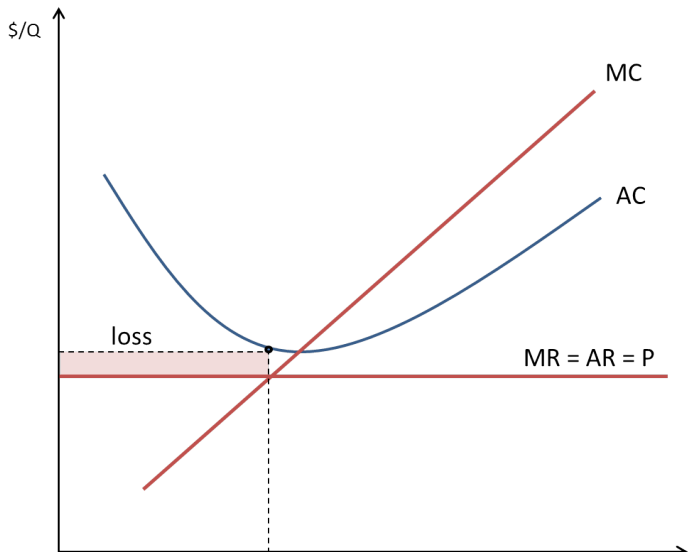


# Maximizing Firm's Profit (Marginal Values)



# Short Run - Shut down decision when facing a loss

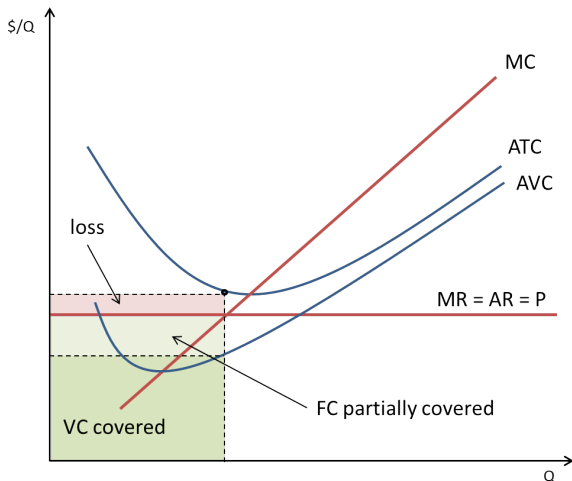
- Should the the firm shut down facing a loss?





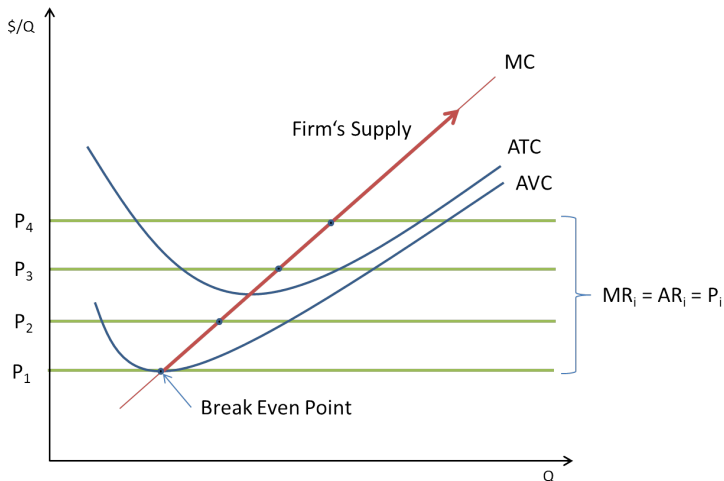
## Short Run - Shut Down Decision

- Loss does not necessarily lead to shut down - if revenues cover at least *variable* costs (because fixed costs have to be paid anyway) - anything above helps the firm pay a part of the fixed costs



# Firm's Supply

- A link between *price* and *quantity* produced can be seen (recall Law of Supply)

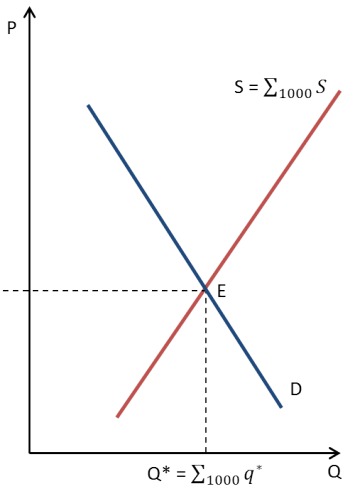
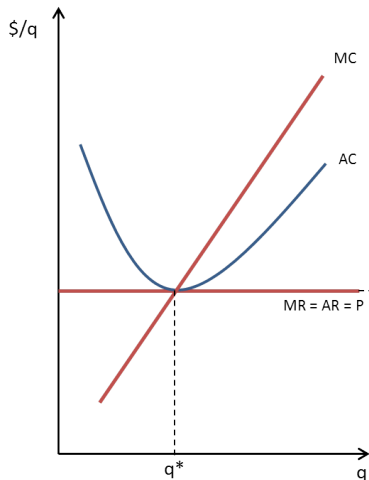


# Market Equilibrium

- There are no entry-barriers or information constraints in competitive market (insignificant transaction costs)
- When price is set (sellers are price-takers), only *costs* determine the profit
- Costs are determined by production function, i.e. *technology*
- But with free information exchange, every firm can acquire the best technology to achieve high profit!
- What happens? New producers (firms entering the market) increase the total quantity (even if they are small individually - the assumption of insignificant or no market power), which leads to decrease in the price (remember Supply and Demand) so that:  
$$P = AVC = MC = MR$$

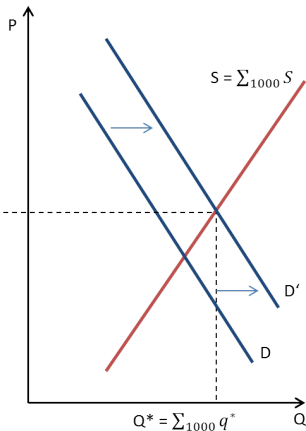
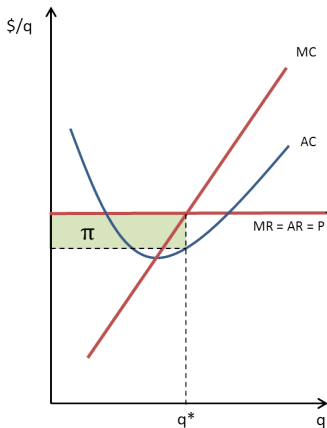
# Market and Firm's Equilibria in LR

- All firms produce at minimum AC (optimal - production efficiency)



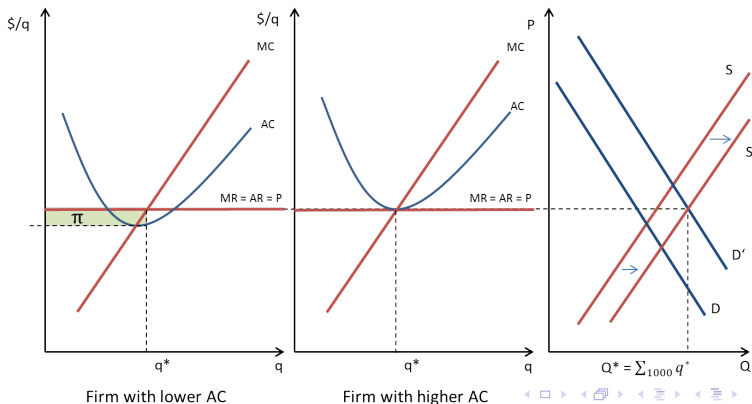
# Changes in the short run

- Rising market demand increases price so producers are willing to produce more and make a profit



# Market Equilibrium in Oil Producers Market

- When efficiency throughout the industry is not the same (various AC), then final price doesn't have to return to previous equilibrium
- There might be producers with substantial profits (e.g. Saudi Arabia) and no profits (e.g. Canadian oil sands)



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# Assumptions

- Monopoly represents a market with just **one seller** (and many buyers) (from Greek *mónos* ("sole") and *pōléō* ("I barter / I sell"))
- Seller (the monopolist) is a price-maker, buyer is a price-taker
  - Significant **market power** of the monopolist (and insignificant market power of the individual buyers)
- Monopolist may set price and/or quantity produced - but still has to take the market demand into consideration
  - in addition, presence of one seller in the market does not necessarily mean the monopolist will exercise its market power (theory of **contestable markets**)



# Sources of a monopoly

- **Natural monopoly**

- based on the **economies of scale** (decreasing  $ATC$ ) - i.e. two firms servicing whole market are **less efficient** than just one (typically network industries)

- **Resource monopoly**

- The monopolist own unique resource that noone else has

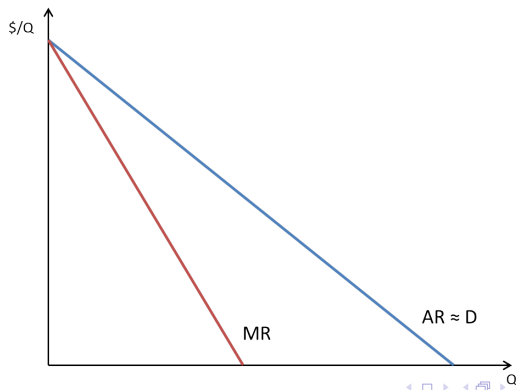
- **Government-created**

- granted by government power - determined by politics (e.g. railways); public interest (army, police), copyrights, patents

- Monopoly is difficult to maintain (apart from those granted by the government) - technological advance, competition, reverse engineering etc.

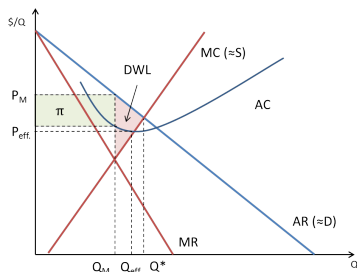
# Revenues

- Monopoly  $\rightarrow$  market demand is the firm's demand
  - A monopolist faces downward-sloped (market) demand ( $P \uparrow \Rightarrow Q \downarrow$ )
- This demand equals monopolist's  $AR$  (because each unit is sold at the same price)



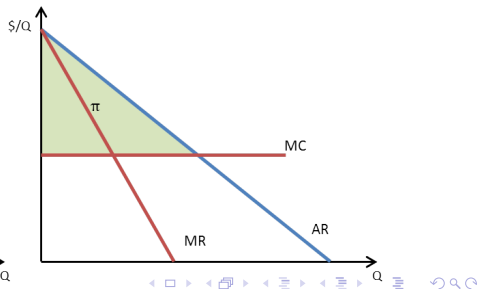
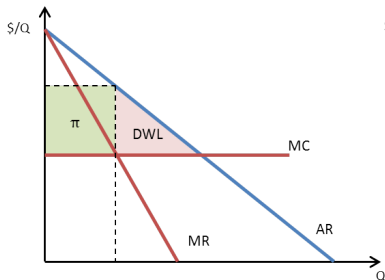
# Profit Maximization

- Monopolist maximizes its profit when  $MR = MC$  (a monopolist behaves like any other firm - i.e. solves the problem:  
 $\max \Pi = TR - TC$ )
  - This solution generates Dead Weight Loss ( $DWL$ ) ( $MR < AR \Rightarrow Q_M < Q^*$  and  $P_M > P^*$ ) and
  - Price of the product is higher than  $MC$  and  $AC$  (inefficient - additional quantity could be produced - but all units sold at the same price! Recall there is the output effect AND the price effect)



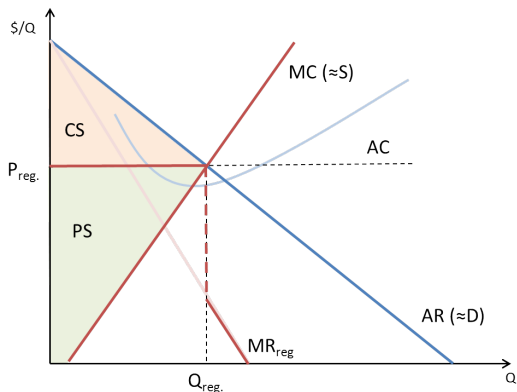
# Monopoly - Issues

- Government attitude towards monopolies
  - Avoiding monopolies - antitrust laws
  - Regulating natural monopolies
  - Public ownership
- Price discrimination - Monopolist is able to sell at various prices (separate customers) - increase its profit and reduce *DWL* (but appropriating the consumer surplus)



# Price Regulation - Monopoly

- Price regulated exactly at  $P = AR = MC$  (and  $= MR_{reg}$ ) which leads to  $DWL = 0$
- Monopolist's profit depends on its  $AC$



# Price Regulation - Monopoly

- Actual regulation lot more complicated!
  - Difficult to observe  $MC$  for external subject
- Regulatory lag
- Red tape
- Costs of regulation
- Regulation can limit or inhibit innovation and growth
- Regulatory capture (close relationship between regulators and business)

# Overview

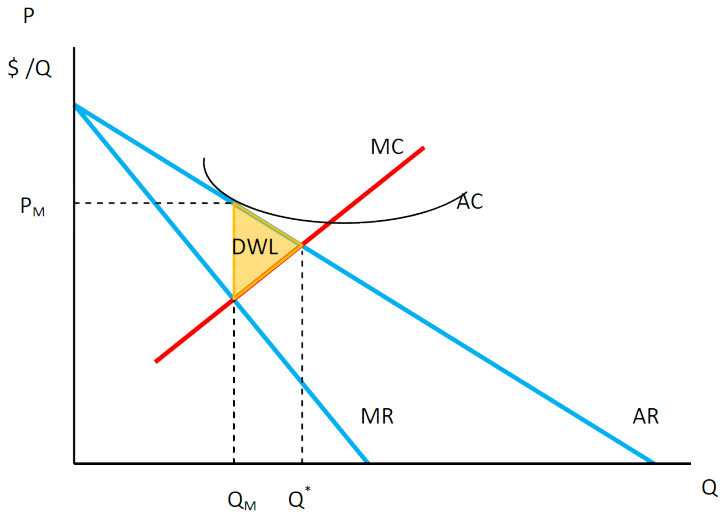
- Many sellers, many buyers (lot more realistic than both perfect competition and pure monopoly (depends how close substitutes are available))
- Free entry (and exit)
- **Product differentiation** - each seller meets downward-sloped demand with its special product - but the slope is relatively low (which also means *DWL* is not as large)
- Price setting - similar to a monopolist's BUT **free entry** → profitable markets attract new entrants (increasing market supply)
  - new entrants reduce the demand for the particular product of the original firm → it shifts the demand curves faced by the incumbent firms to the left
  - long-run profits tend to zero (like in competitive markets) - production not at minimum *AC* (but close)
    - no incentives to enter for new firms + incumbents have no incentive to exit

# Overview

- Excess capacity (production efficiency below the optimum; production costs higher than technologically possible (minimum  $AC$ ))
- $P > MC$ , so firms **want** new customers
  - Advertising expenses (BUT certain theories can explain this - value of a brand as a sum of previous expenses - **a commitment** to maintain the quality - lower the quality to get a little more and you will lose much more "invested" in building the brand)
  - There is non-zero  $DWL$  - some people value the production higher than  $MC$  (so they should be able to get it), yet lower than  $P$  (they won't buy it)
- Examples:
  - Books, Movies, Restaurants, Fashion, Shoes, Food etc. (+ marketing is all about product differentiation and product's unique selling proposition)



# Profit and Equilibrium in LR



# Overview

- **Few** sellers (with substantial market share, i.e. with significant market power)
- Each seller may set its production quantity and price, given the demand
- Product of each seller is similar if not the same (you can substitute the product from the other seller)
- Important: *Action of one seller may have a large impact on the others*
- Examples: Crude oil, Car makers, Aviation industry, Airlines. . .
- Popular oligopoly models (often simplified to duopoly): Bertrand and Cournot (see chap. 27 in Varian 2010)
  - Bertrand competition: firms set prices and the consumers choose quantities at the prices set
  - Cournot competition: firms set the amount of output (setting the output independently of each other and at the same time - **no collusion**)

# Game Theory

- *How people behave in strategic situations*, i.e. anticipating how others will behave
- Firms in competitive markets (and monopolists) do not care about other firms - they were insignificant
- Firms in Oligopolies must take it into account  $\Rightarrow$  they are playing strategic game
  - game theory explains their behavior

# Prisoners' Dilemma

- Two suspects under arrest deciding *separately* strategy for interrogation.
- Dilemma: Confess or Silence with different outcomes depending on others choice

		B	
		Confess	Silence
A	Confess	8 / 8	0 / 20
	Silence	20 / 0	1 / 1

- The best outcome (1/1) cannot be achieved even if players act in collusion - they risk long sentence + the other player can **improve** his situation by confessing

# Dominant Strategy and Nash Equilibrium

- When there is a best solution for a player regardless of opponents choice it is called *dominant strategy*

		B	
		Confess	Silence
A	Confess	8* / 8*	0 / 20*
	Silence	20* / 0	1 / 1

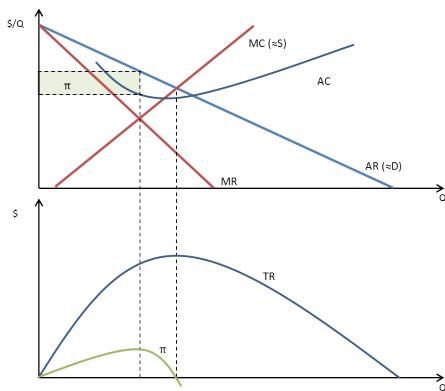
- In this particular game, dominant strategy for both players is to confess - this is called *Nash equilibrium*
  - it is not necessarily the most efficient outcome, but definitely one that *can* be reached in strategic encounter
  - If the first payoff number (row player) in the payoff pair of the cell is the **maximum of the column of the cell** AND if the second number (column player) is the **maximum of the row of the cell** → then the cell represents a Nash equilibrium
- Even though being silent  $\Rightarrow$  less time spent in prison, precaution and self-interest (or simply assuming others moves) lead to opposite strategy (both confess)

# Cartel

- Limited number of sellers on the market may deliberately (in *collusion*) decrease their output in order to increase the market price and their collective profit
- Sellers cooperate in order to act as a monopolist - and they maximize profit as such
- When the demand elasticity is low, price increase might be substantial
- Cartels generally frowned upon by law - extensive search for possible collusion and consequent bans and penalties

# Cartel

- Cartel members seeking monopolist's profit:
  - Is this really the best solution for all cartel members?



## Example

- Imagine two oil producers with no marginal costs (additional barrel is filled with oil spouting from the ground); total production capacity of each producer is 6 mbpd; demand schedule might look like this:

<b>Price (\$/b)</b>	0	10	20	30	40	50	60	70	80	90
<b>Q (mbdp)</b>	12	11	10	9	8	7	6	5	4	3
<b>Profit (m\$)</b>	0	110	200	270	320	350	360	350	320	270

- In comp. market with  $MC = 0$  price would be 0 and all 12 mbpd would be produced.
- Monopolist would certainly choose  $Q = 6$  with highest revenue/profit
- Duopolistic cartel face a dilemma:
  - While producing 3 mbpd each with equal profit 180 m\$ each producer is tempted to increase Qty
  - With total production 7 mbpd divided 4:3, producer with higher share enjoy 200 m\$ profit vs 150 m\$ of the other



# Oil Producers' Game

		Iraq	
		3	4
Iran	3	180 / 180	150 / 200*
	4	200* / 150	160* / 160*

- What quantity to produce? Two dominant strategies - to increase output (even if they decide to cooperate, there is an incentive to increase)
  - It is difficult to maintain low production and high price - if we consider it as "one-shot" situation (a **simultaneous** game)
  - Sequential games and repeated games yield different outcomes
- NOTE: cooperative games = the players are able to form **binding commitments** (externally enforced, e.g. by law)
  - **non-cooperative games** = the players cannot make contracts OR if all agreements need to be self-enforcing (e.g. through credible threats)

# Oil Producers' Game - Cartel

- Cartels represent **non-cooperative games** (can be only enforced by (credible) threats, not externally (by law))
- Cartel can survive as long as punishments are harsh enough so that the benefits of deviation (not colluding) are smaller than the benefits of colluding (see folk theorem) - but it depends on:
  - The **credibility of the threat** of such punishment
  - The **discount factor** of individual members (see time value of money - "a dollar today is better than a dollar tomorrow")
- Effective cartels: when the cartel **can** actually influence the price (increase the price) AND the demand is relatively stable
  - Advantageous: inelastic demand and inelastic supply response of non-cartel members and producers of close substitutes

# Oligopoly remarks

- Cartel members have incentives to cheat (for repeated game that is NOT infinite - it is rational to cheat in the "last round")
  - There are coordination costs (e.g. time)
- *Game Theory* can be (successfully) applied when inspecting oligopolies and cartels
- Comparison of oligopoly with a competitive market and monopoly:
  - Price ( $P$ ):  $CM < Oligopoly < Monopoly$
  - Quantity ( $Q$ ):  $CM < Oligopoly < Monopoly$

# References

Hal R. Varian. *Intermediate Microeconomics. A Modern Approach*. W. W. Norton & Company, 2010.