Session #7

Fundamentals of Microeconomics

Oligopoly & Monopolistic competition

November 18, 2019

In previous lectures, we discussed monopoly as compared to perfect competition

- In the monopolistic regime, only one firm is present in the market and there is no substitute for the product it offers.
- In the perfect competition regime, an infinite number of firms are present in the market and their products are perfect substitutes.
- In the perfectly competitive market, each firm is price taker and is not able to influence the equilibrium price
- Monopolist is a price maker and the only factors influencing his decisions are his own technology and the market demand curve.

In previous lectures, we discussed monopoly as compared to perfect competition

- Both monopoly and perfectly competitive firm maximize their profit by choosing the optimal quantity of product sold.
- In the case of monopoly, such optimal quantity of product sold defines its optimal price conditional on the demand curve.
- In the case of perfect competition, the price equals firms' marginal costs resulting thus in zero profit.
- Monopolist sets always a price that is higher than his marginal costs, which implies positive profit. Higher price compensates lower quantity produced.

In today's lecture, we will discuss the oligopolistic regime

- Oligopoly as a market regime can be positioned between monopoly and perfectly competitive market.
- In oligopolistic market regime, several competing firms are present in the market.
- Such situation arises usually when significant barriers to enter the market are present.
- We wil study Cournot and Stackelberg oligopoly, where firms sell the same product at the same price.
- We will explain that in Bertrand oligopoly, firms set different prices because they offer differentiated products.
- We will see that if there are no barriers to entry, market with differentiated products leads to monopolistic competition.

- Cartel
- Oligopoly
- Cournot model
- Stackelberg model
- Bertrand model
- Monopolistic competition

If the firms do not compete in oligopoly, but rather cooperate, cartel is established

- In cartel agreement firms cooperate by decreasing their production, which consequently increases the price as well as firms' profit.
- Cartel is typically established in oligopolistic markets, but in theory, it can be observed in perfectly competitive market as well.
- Under a cartel agreement, the production has to be decreased by all firms, otherwise resulting effect may not be sufficient to lead to higher profits.
- If the production is decreased by one firm only, the price change would be negligible and the firm would lose part of its profit.

Governments try to prevent cartel formation by legislation and thus to protect costumers

- Cartel agreement leads to suboptimal production and higher price, decreasing thus consumer surplus.
- To protect costumers, majority of states employ antitrust codes forbidding cartel formation.
  - The first antitrust code was adopted in the US in 1890 ("Sherman Antitrust Act"). In the EU, competitive market support is embedded in the Treaty of Rome, signed in 1957.
- Nonetheless, cartel agreements are present even nowadays. In particular in cases when
  - international cartels that form on country level (for example OPEC),
  - financial penalty in case of revealed cartel agreement is significantly smaller than the profit arising from it,
  - cartel agreement is not possible or very hard to reveal.

If cartel agreement is revealed, participating firms can be sentenced to heavy fines

- In 2004, the model Carolyn Fears accused ten most significant NYC modeling agencies of forming cartel agreements.
- Agencies were accused of collectively agreeing to require 20% commission from both models as well as clients.
- The court declared them guilty and sentenced them to fines of millions of USD to be paid.

It is difficult to sustain cartel agreement, due to the outside as well as inside pressures

- Cartel agreement may fail due to the increased competition from outside firms (when such competition is strong enough).
- Cartel agreement may fail as well since it is profitable for its participants to violate it.
- When all members of cartel agreement produce limited amount of product, keeping thus market price high, it is profitable for each of the participating companies to deviate and increase their own production.
- If all cartel members followed this strategy, price would decrease and diminish thus the cartel benefit.

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We use three different models to describe the oligopolistic regime

- If firms do not cooperate within a cartel agreement but compete with each other, they do so in different ways.
- We represent these different types of competition by different models. It depends on the characteristics of the given market which model is the most suitable for the given situation.
- Cournot model: firms decide simultaneously about quantity sold.
- Stackelberg model: the leading firm decides about the quantity first, followed by its competitors.
- Bertrand model: firms decide simultaneously about prices at which they will sell.

We use three different models to describe the oligopolistic regime

- We will present all the three models in a simplified case when:
  - all firms have the same costs and produce the same good,
  - oligopoly is reduced to duopoly - there are only two firms in the market,
  - each decision is made only once and it is not repeated in subsequent periods.
- We compare the models based on equilibria to which they lead.
- We define the equilibrium as a situation in which none of the firm can reach higher profits unless its competitors change their decision.

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The idea of the Cournot model is based on the best response concept

- Two firms (A and B) compete in a duopoly.
- Firm A has to take into account each possible decision of firm B (which influences the price and thus also the situation of the firm A) and decide what will be its optimal response to such decision.
- Firm B proceeds in the same way and defines its optimal response to each possible decision of firm A.
- Cournot's equilibrium is given by the intersection of optimal responses of the two firms.
- It can be found using the game theory concept of Nash equilibrium.

Example of Cournot model can be solved as a simultaneous game

- Suppose that two companies (United Airlines and American Airlines) are competing for passengers on the line Los Angeles - Chicago.
- If both companies sell high quantity of tickets, price would be low and so would be their profit.
- If both companies sell low quantity of tickets, price would be high and so would be their profit.
- If one company sell low quantity and one sell high quantity, price is relatively high and increases the profit of the company selling higher quantity.

Example of Cournot model can be solved as a simultaneous game

- Each of the companies has only 3 options - transport 96, 64 or 48 thousands of passengers per quarter. Profits of the two companies (in millions USD) can be written in a table for all possible combinations.

		American Airlines		
		$q_A = 96$	$q_A = 64$	$q_A = 48$
United Airlines	$q_U = 96$	0 , 0	3.1 , 2.0	4.6 , 2.3
	$q_U = 64$	2.0 , 3.1	4.1 , 4.1	5.1 , 3.8
	$q_U = 48$	2.3 , 4.6	3.8 , 5.1	4.6 , 4.6

- The equilibrium is $q_U = q_A = 64$ (see Lecture 6).

Example of Cournot model can be solved as a simultaneous game

- In this equilibrium, none of the companies wants to deviate (change its action), because, given the action of its opponent, it would get lower profit.
- Note that this equilibrium is not cooperative - it does not maximize the joint payoff.
- If the firms formed a cartel (illegally), they could both produce only 48, which would bring them higher profit.
- However, this would not be a duopoly equilibrium - each firm would be motivated to deviate.

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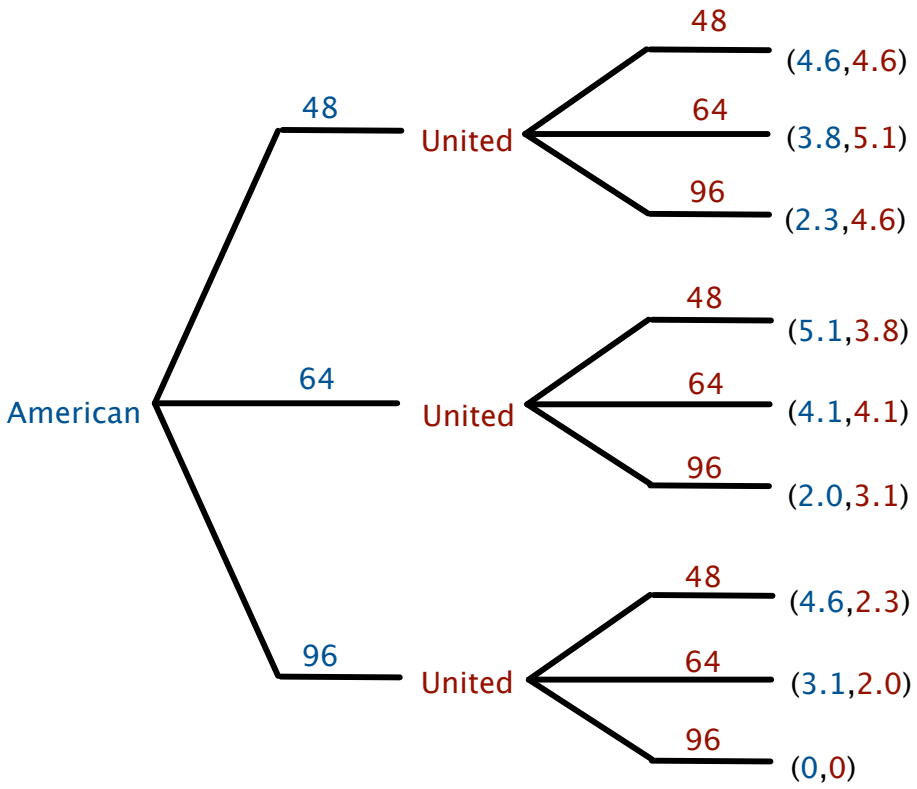
Stackelberg model assumes that firms decide about production sequentially

- Stackelberg model is similar to Cournot model, but the timing of firms' decisions is different.
- In this model, we assume that one of the firms (the leader) can decide first and the second firm (the follower) has to react to this decision.
- The leader knows what the follower's optimal reaction will be and makes his own decision accordingly.
- The equilibrium can be found using extensive form of the game and the concept of sub-game perfect Nash equilibria.

Example of Stackelberg model can be solved as a sequential game

- We can revise the example of two airline companies. Now we will suppose that one of the companies (American airlines) will decide first about its production and the second one (United airlines) will follow.



Example of Stackelberg model can be solved as a sequential game

- We show that under this setup, American produces 96 and United produces 48 (see also Lecture 6).
- American gets higher profit in Stackelberg model than in Cournot model (United gets lower profit).
- American could never produce such high quantity in the Cournot model because if United did it as well, they would both get zero profit.
- In sequential setup, American can produce such quantity because it knows that United will observe this decision and will react to it (it will be a credible threat).

Stackelberg equilibrium leads to a higher consumer surplus than Cournot equilibrium

- In Stackelberg equilibrium, the production of the leader is twice as large as in Cournot equilibrium.
- Therefore, the total production is larger in Stackelberg equilibrium than in Cournot equilibrium, which leads to lower price.
- Consumers thus should prefer Stackelberg equilibrium over Cournot.
- Stackelberg equilibrium can be achieved only if the firms decide sequentially.

If decisions are simultaneous, Stackelberg equilibrium can be reach by subsidies

- When deciding simultaneously, only Cournot equilibrium can be achieved:
  - If firm A declared that it will be Stackelberg leader and it will produce more, it will not be a credible threat.
  - If firm B produced the quantity corresponding to Cournot equilibrium, Stackelberg level of production will not be efficient for firm A, and therefore, firm A has to produce the quantity corresponding to Cournot equilibrium.
- If firms A and B are from two different countries, then the government of one of the countries can help its firm by giving it a subsidy and make it a Stackelberg leader.
  - Such decision has to be unilateral (only in one country), has to precede the decision making process of the firms and has to be credible.

Governments can help firms in international oligopoly using subsidies

- In 1992, US and EU signed a treaty limiting subsidies to aircraft industry.
- Subsequently, airplane prices rose by 3.7%, which corresponds to the increase of marginal costs of Airbus and Boeing by 5%.

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In Bertrand oligopoly model, firms decide simultaneously about price at which they sell

- We showed that a monopoly can maximize its profit by setting the quantity sold or the price at which it is sold and that in both cases, the result is the same.
- In oligopoly, firms can also set quantity or price, but the resulting equilibria are not the same.
- In Cournot and Stackelberg model, firms set the optimal quantity.
- In Bertrand model, firms set the optimal price.
- When Joseph Bertrand (1822-1900) presented his model, he argumented that firms set the price and consumers then decide about the quantity they will buy at this price.

Bertrand model does not explain oligopoly structure when firms are identical

- Bertrand model assumes that firms decide simultaneously about the price they will ask so that their profit is maximized.
- If the firms sell identical products, consumers are indifferent between buying the good from one or the other firm.
- Whenever one of the firms decreases slightly the price, all consumers will buy from this firm, whose profit thus rises.
- The price will be thus gradually decreased to the level of marginal costs.
- Bertrand model applied on identical firms leads to the same result as perfect competition and thus it is not suitable for explaining creation of oligopoly in such case.

Bertrand model is optimal for firms selling differentiated products at different prices

- On the other hand, Bertrand model gives good results for markets with differentiated products.
- For such markets, it seems more intuitive to set the price and not the quantity.
- In such markets, it is natural that firms set different prices.
- Even though products are differentiated, they are substitutable to some extent - if one firm sets a price that is too high, part of its customers will rather buy the good from the other firm.

Bertrand model is based on the optimal response concept

- Firm A sets the price based on the price that firm B sets and vice-versa.
- Both firms have incentive to set rather a high price to increase the profit.
- Since products are differentiated and there is only a limited number of firms, each of them has a market power and can set a price that is higher than its marginal cost.
- However, this market power is limited by the fact that customers are able to substitute even differentiated goods.
- If firm A sets a low price, firm B also has to set a low price and vice-versa.

Despite increasing price, product differentiation has positive impact on welfare

- In Bertrand equilibrium, product differentiation leads to higher prices and positive profit of both firms.
- Product differentiation has a positive profit on consumer surplus. This surplus is decreased due to higher prices, but consumers benefit from larger choices of available goods.
- Since consumers are willing to pay higher price for the possibility to chose, consumer surplus (difference between willingness to pay and the actual price) increases despite increasing price.

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Monopolistic competition is a regime with free entry and differentiated products

- In models of oligopoly, we assumed that the number of firms in the market is limited since there are barriers to entry.
- In such regime, firms achieve positive profits.
- In monopolistic competition model, we assume that there are no barriers and firms can enter the market as long as they can make positive profit.
- We further assume that firms are selling differentiated products.

In monopolistic competition regime, the entry in the market is limited only by firms' costs

- Difference between monopolistic competition and perfect competition is that in monopolistic competition regime, firms face downward-sloping (not horizontal) demand.
- Difference between monopolistic competition and oligopoly is that in monopolistic competition regime, firms are making zero profits: if positive profits were generated, new firms would enter the market because there are no barriers other than the condition that revenues have to be at least as large as costs.