**ECO 2306 – Principles of Microeconomics**

Week 17

**Hello and Welcome to the weekly resources for ECO 2306 – Principles of Microeconomics!**

**This week is Week 17 of class, and typically in this week of the semester, your professors are covering these topics below.**  If you do not see the topics your particular section of class is learning this week, please take a look at other weekly resources listed on our website for additional topics throughout of the semester.

We also invite you to **look at the group tutoring chart on our website to see if this course has a group tutoring session offered this semester**.

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Our main resource is going to be Principles of Microeconomics by N. Gregory Mankiw.

**Topic of the week**

**Oligopoly**

**Keywords:** oligopoly, game theory, collusion, cartel, Nash equilibrium, prisoners’ dilemma, dominant strategy

**Concepts:**

Sometimes there are a small number of firms competing in the market, and they sell the same product. These firms determine the price of that product. Such a market is called an oligopoly and we are going to discuss it in this chapter.

**Markets with Only a Few Sellers**

An **oligopoly** is a market with only a few sellers who offer similar or identical products. The small number of sellers makes them interdependent and they always have a tension between cooperation and competition. Oligopolies are very prevalent in society. For example, Apple, Samsung, and LG control 80% of the market for smartphones.

Analyzing oligopolies requires a different technique than what we’ve seen so far, because the actions of each firm make a big impact on other firms. This technique is known as **game theory,** which is the study of how people behave in strategic situations. If firms decide to cooperate (**collusion**), they act like a monopoly. But they also have an incentive not to cooperate, because each firm only cares about its own profit.

A **duopoly** is an oligopoly with only two firms. Each firm has to decide what quantity to sell and the price is determined according to the demand curve. If they decide to compete, price will equal marginal cost and quantity will be efficient. However, they can decide to collude and form a **cartel**, which acts like a monopoly and agree on the perfect quantity. Now their collective profits are maximized. This practice is illegal in the US.

Beside the fact that forming a cartel is illegal, it’s also hard to keep a cartel together. Imagine Coke and Pepsi collude to sell a fixed number of soda cans. What is each company’s incentive now? The first company to break the agreement and sell more soda cans will increase its market share, but since the other company is not reducing production, there will be a surplus of soda which leads to lower prices. So, the company that breaks the agreement might make less profit.

What should each firm do in this situation? **Nash equilibrium** is a situation in which economic actors interacting with one another each choose their best strategy given the strategies that all the other actors have chosen. In the example above, without any collusions, Coke and Pepsi will each assume the other company is rational, and each focus on maximizing their profits assuming the other firm plays its best strategy. Once they reach Nash equilibrium, they will have no incentive to change their respective strategies.

Firms in a Nash equilibrium produce a higher quantity compared to a monopoly, but lower than perfect competition. Similarly, the price is going to be less than the monopoly price and more that the perfect competition price. So, the price is going to be greater than marginal cost.

The size of an oligopoly affects the market outcome. The higher the number of firms, the harder it’s going to be to collude and form cartels. Therefore, an increase in the number of firms will make the market look more like a competitive one. Price will approach marginal cost and the quantity produced will approach the socially efficient amount.

**The Economics of Cooperation**

In order to learn about game theory, let’s start with a very common game. **Prisoners’ dilemma** is a particular “game” between two captured prisoners that illustrates why cooperation is difficult to maintain even when it is mutually beneficial. Imagine two criminals who are captured by the cops and are each given two options: confess or remain silent. As you can see in figure 1, if they both confess, they each get 8 years and if they both remain silent, they each get 1 year.



Figure 1 The Prisoners' Dilemma (source: Mankiw)

What happens if Bonnie remains silent and Clyde confesses? Clyde goes free and Bonnie gets 20 years in prison. What would you do in this situation? In a game, a **dominant strategy** is a strategy that is best for a player in a game regardless of the strategies chosen by the other players. In this case, the dominant strategy for both players is to confess. This way, they will spend less time in jail regardless of the other player’s decision.

As you can see, playing the dominant strategy does not necessarily lead to the most efficient outcome. Even if the players cooperate before being detained, they still worry that the other player might cheat, and still play their dominant strategy. In real life, cooperation between self-interested firms is very difficult to maintain.

Firms in an oligopoly play a similar game to prisoners’ dilemma. Consider the game in figure 2. The most efficient outcome is for Jack and Jill to produce a low amount and make the most profit. But since each is worried that the other one may produce a high amount, the dominant strategy for either is to produce a high amount and make sure they don’t get the worst outcome. This game explains why OPEC (which is technically a cartel) cannot control the international price of oil, despite owning 75% of the world’s oil resources.



Figure 2 Jack and Jill's Oligopoly Game (source: Mankiw)

Firms in an oligopoly sometimes cooperate. This cooperation is possible when they play a repeated game for a long period of time. In this case, the two parties agree on penalties if either of them cheats. Because of the penalty, both have an incentive to cooperate. As long as the players care about future profits, they choose to forgo the one-time gain from defection.

**Public Policy toward Oligopolies**

We learned that in case of perfect competition, government interference is not necessary, with a monopoly it’s most likely necessary and with monopolistic competition it’s most likely not necessary (that is if there are no externalities).

With an oligopoly, the government’s role is to induce the firms to compete rather than cooperate, and move the allocation of resources closer to the social optimum. Therefore, the government prevents mergers of big players in the market. It’s hard to catch oligopolists and investigate their illegal actions, because when two people do something illegal, they both have a good incentive not to report the other.

One controversial practice of oligopolies is **resale price maintenance** which is also known as *fair trade.* Through this policy, the firm requires its retailers to charge a given price for their goods. The problem with this policy is it prevents competition and the mandated price might be higher that the market price. However, many economists believe this practice has a legitimate goal. For example, the firm might ask its retailers to provide customers with certain services and those services might require a set amount of profit.

Another issue is **predatory pricing**, which is the practice of charging prices that are too low to drive others out of business. It does not work in the long run, since it will lead to a price war and drive prices below cost. Another practice of this kind is **tying**, which is to offer two goods together at a single price to enhance the firm’s market power. Sceptics argue that the consumer’s willingness to pay does not change with tying, and market power cannot be enhanced by this practice.

**Check your learning**

1. Synergy and Dynaco are the only two firms in a specific high-tech industry. They face the following payoff matrix as they determine the size of their research budget:



a. Does Synergy have a dominant strategy? Explain.

b. Does Dynaco have a dominant strategy? Explain.

c. Is there a Nash equilibrium for this scenario? Explain. (source: Mankiw)

2. Consider trade relations between the United States and Mexico. Assume that the leaders of the two countries believe the payoffs to alternative trade policies are as follows:



a. What is the dominant strategy for the United States? For Mexico? Explain.

b. Define *Nash equilibrium*. What is the Nash equilibrium for trade policy?

c. In 1993, the U.S. Congress ratified the North American Free Trade Agreement, in which the United States and Mexico agreed to reduce trade barriers simultaneously. Do the perceived payoffs shown here justify this approach to trade policy? Explain.

d. Based on your understanding of the gains from trade (discussed in Chapters 3 and 9), do you think that these payoffs actually reflect a nation’s welfare under the four possible outcomes?

3. A large share of the world supply of diamonds comes from Russia and South Africa. Suppose that the marginal cost of mining diamonds is constant at $1,000 per diamond and the demand for diamonds is described by the following schedule:



a. If there were many suppliers of diamonds, what would be the price and quantity?

b. If there were only one supplier of diamonds, what would be the price and quantity?

c. If Russia and South Africa formed a cartel, what would be the price and quantity? If the countries split the market evenly, what would be South Africa’s production and profit? What would happen to South Africa’s profit if it increased its production by 1,000 while Russia stuck to the cartel agreement?

d. Use your answers to part (c) to explain why cartel agreements are often not successful. (source: Mankiw)

4. Two athletes of equal ability are competing for a prize of $10,000. Each is deciding whether to take a dangerous performance-enhancing drug. If one athlete takes the drug and the other does not, the one who takes the drug wins the prize. If both or neither take the drug, they tie and split the prize. Taking the drug imposes health risks that are equivalent to a loss of *X* dollars.

a. Draw a 2×2 payoff matrix describing the decisions the athletes face.

b. For what *X* is taking the drug the Nash equilibrium?

c. Does making the drug safer (that is, lowering *X*) make the athletes better or worse off? Explain. (source: Mankiw)

**Answers**

These are my answers. You should be able to come up with your own arguments that may or may not differ from mine.

1. a. yes, Synergy has to play large budget, otherwise it would gain zero in case Dynaco plays large budget.

b. yes, Dynaco has to play large budget, otherwise it would gain zero in case Synergy plays large budget.

c. both play large budget and make 20 and 30 respectively.

2. a. high tariffs for both in order to avoid losing.

b. in a Nash equilibrium, each player choses its best strategy based on available information. Here, both play high tariffs and make 20 billion each.

c. yes, with an agreement both societies receive higher payoffs. The equilibrium without the agreement was not efficient.

d. under a high tariff regime, there are some gains for both countries, but the total surplus is not maximized. With cooperation, the total surplus should increase, which is what we see in the optimal game.

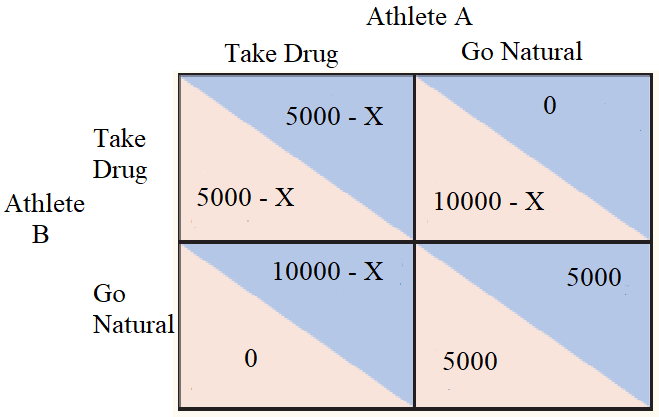
3. a. price will equal marginal cost, so $1000 and 12000 diamonds.

b. one supplier would maximize profit, so $7000 and 6000 diamonds (profit would be $36000)

c. a cartel would act like one supplier. They would each take half the profit. If South Africa increases its production by 1000, the excess quantity would push the price down (from 7000 to 6000). South Africa would increase its profit, but not as much as it would have hoped.

d. one party can increase its profit by cheating, so there’s always a good incentive to break the agreement.

4. a.



b. X<5000 (for athlete A, we want the left option (5000-X) to be better than the right option (0))

c. better off, they take more money home. (for X=0, there is no Nash equilibrium)

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