Lesson 10 - Monopolistic Competition and Oligopoly

Section 1 - Characteristics of Monopolistic Competition

Characteristics

We now turn our attention to one of the industry structures that fall between pure competition and monopolies. In **monopolistic competition**, there are a large number of firms with lower barriers to entry. Each firm's product is unique but very similar to those produced by other firms. For example, only one firm produces the Big Mac or the Whopper but there are many products similar to each. Since the barriers to entry are low and the products each firm produces are similar, firms have a limited degree of market power. With a large number of firms there is no mutual interdependence among firms so each firm acts independently. The demand curve for each firm is highly elastic, since there are many close substitutes but not perfectly elastic, since each product is differentiated. Firms undertake substantial non-price competition or advertising in monopolistic competition allowing them to compete on the features of their product rather than solely on price.

Characteristics of Monopolistic Competition
The graphic below shows the characteristics of Monopolistic Competition.

Monopolistic Competition

Market Power - Limited

Large Number of Firms

Low Barriers to Entry

Differentiated Products

Examples: Restaurants, Hotels, etc.

Coded by David Barrus.

Firms in monopolistic competition may attempt to create a **niche market** and service only a small segment of the entire market. Some firms in pure competition attempt to move into the monopolistic competition by differentiating

their product. For example, Reed's Dairy in Idaho Falls has successfully moved into the monopolistic competitive market by offering hormone free milk and home delivery milk, cheese, and ice cream.

So how can a firm in monopolistic competition, differentiate their product?

The more a firm is able to differentiate its products from those of competitors, the greater its ability to set the price above marginal cost. If the market niche is too narrowly defined, the firm may not be able to attract enough customers; too broad and the firm faces greater competition. Product differentiation can be real or perceived.

Real Product Differentiation

Real product differentiation can take place in a variety of different methods: First, a product can be differentiated based on its physical characteristics, such as liquid gel tablets pain medication or a perfume that has a different smell. The location of the product, such as locating a gas station or hotel close to the interstate, differentiates the good from other competitors located in more remote areas and allows the firm some additional price control. A firm may also differentiate the product by the other features or service it provides. For example, a furniture store might offer free delivery and set up of its furniture or offer warrantees or money back guarantees if not satisfied with the product. A food company may offer its products in ready to serve packages or easy open cans. A firm may differentiate its product based on the method of production it employs, such as using a certain percentage of recycled material or pursing other environmentally friendly methods to produce a "green" product.   Buc-ee's, a chain of gas stations in Texas, for example, has successfully differentiated itself by providing clean private bathrooms. Watch the following video clip: http://abcnews.go.com/Video/playerIndex?id=8999959.

Perceived Product Differentiation

Other product differentiation is not real but perceived in the minds of consumers which is often accomplished through advertising and celebrity endorsement. To the extent that firms are able to convince consumers that their product is different even if it is only in the minds of the consumers, they are able to charge a different price. Although real and perceived product differentiation often increase the firm's costs, consumers focus more on the features of the product than the product price making the product demand more inelastic. To the degree that they are successful, firms have greater ability to set price above marginal cost. Consumers also benefit from product differentiation since it allows them greater choice in selecting products.

What are the different ways you could differentiate a hotel? When differentiating your product, it is important to remember that it can't be everything to everyone. Creating a market niche implies that the product focuses on meeting the particular needs of a segment of the market. A hotel located close to the airport or interstate is designed to meet the needs of individuals traveling, while a hotel located in a quite remote area focuses more on serving the needs of vacationers or honeymooners. A hotel may focus on the experience that consumers have providing luxurious accommodations, theme rooms, or private spas. Other hotels are more cost conscious and focus on providing "a good nights sleep" with few amenities. A hotel may offer a variety of services such as Wi-Fi, an exercise room, a business office, a pool, newspaper, breakfast, or shuttle to the airport. Think of four different hotels and identify the type of consumers the firm is targeting. Think of how the Ritz-Carlton differs from Motel 6.

Some firms will differentiate their products to service different markets. Hyatt Resorts and Hotels offers a variety of different hotels each focusing on a different market segment: the Hyatt Regency focuses on business meetings; the Grand Hyatt offers larger public space with a large number of rooms; and the Park Hyatt is more exclusive, having fewer rooms, and focuses on discrete pampering of their clientele. Room rates differ among these different market segments, and the hotel is able to charge each market segment based on their respective demands.

Holiday Inn researched their customer base and found that 80 percent were men and 74 percent liked to watch basketball. Instead of pillow mints or fruity hair conditioners, the hotel entered customers into a drawing for NCAA tournament tickets. The hotel also targets soccer moms offering free storage of equipment and ice for their coolers. (Source: Business Week Feb. 19, 2001 p. 16)

What are ways to differentiate beef? Beef exhibits more of the characteristics of pure competition, thus consumers tend to focus on the price for a given quality or cut of meat. However, the Black Angus Breed Association has successfully convinced many consumers that the black angus breed is a higher quality meat than other breeds, thus differentiating its product. Restaurants will often advertise that they serve only certified black angus. Even if there are only perceived differences in the mind of the consumer, firms gain greater price control. Kobe beef is renowned for its quality and tenderness as the wagyu breed of cattle are at times fed beer and given massages to produce meat that sells for a premium at fine restaurants in Japan and in the United States.

Others have successfully differentiated their product by certain characteristics such as organic or hormone free meat. Regional branding is another way firms have been able to differentiate their product, such as Montana Legend or Pure Wyoming Beef, Inc. Grocery stores and restaurants may differentiate beef using special seasonings, marinates, cuts or by providing the meat in special packages.

Ponder and Prove - Section 1 - Characteristics of Monopolistic Competition

---

Section 1 Questions

Instructions: Click on the button that represents the correct answer. After you select an answer, click on the 'Grade My Answer' button.

| Question 1 | Question 2 | Question 3 | Question 4 |

What is monopolistic competition?

◯ A market where there are a few firms that sell similar but differentiated products

◯ A market where there are many firms that sell similar but differentiated products

◯ A market where there are many firms that sell unique products

◯ A market where there are few firms that the same products

| Grade My Answer | | Reset |

"Results"

Original source code for problem above from Craig Bauling. Modified by David Barrus, Victoria Cole, and Brent Nicolet

---

Section 2 - Monopolistic Competition in the Short-run and Long-run

Short-run

In the short run, firms in monopolistic competition may earn economic profits or losses. Firms still follow the decision rule to produce where marginal revenue equals marginal cost, provided the price is above average variable cost.

Due to the low barriers to entry, if firms are making an economic profit, other firms will enter into the market driving the profits to zero. However, because the products are differentiated, the demand curve is not perfectly elastic and

so the long-run price will not equal the minimum of average total costs (as was the case in pure competition). But as entry happens, the demand for an individual firm will shift left and become more elastic (see the graphic below). This will continue until the average cost curve just touches the demand curve in one spot (i.e. it is tangent to it). This will happen exactly at a quantity where marginal revenue equals marginal cost (Pmc, Qmc). For example, if a hotel is making an economic profit since it offers a swimming pool, other hotels will start to offer swimming pools, thus in the long run economic profits will be zero. Firms that continue to innovate can maintain short run profits but there are always pressures in the market for those profits to dissipate in the long run, leaving the firm with a normal profit.

Short−run and Long−run Profits for a Monopolistically Competitive Firm

The graph on the left shows a monopolistically competitive firm in the short−run. If there is positive economic profit, firms will enter the market. As these additional firms enter the market, it will cause there to be less demand for one particular firm. This causes the demand curve to decrease (shift left) for one firm in the short−run. Eventually the firm will end up with zero economic profit. The monopolistically competitive firm is in the long−run. Move the slider to change demand in the short−run.
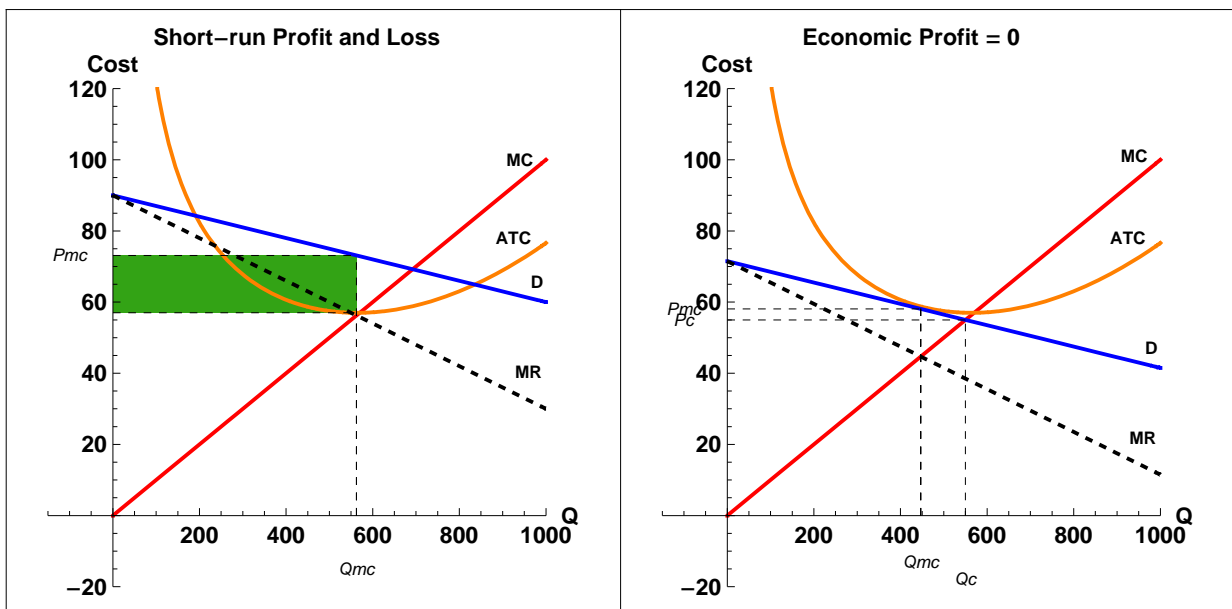
Demand Curve   Reset

Original source code by William J. Polley. Modified by David Barrus, Victoria Cole, and Brent Nicolet

Long-run

Compared to the benchmark of pure competition, monopolistically competitive markets produce a lower quantity and charge a higher price. Firms in monopolistic competition are not productively efficient since they are not producing at the minimum average cost. Firms have excess capacity, which is the difference between the profit maximizing quantity and the productively efficient quantity that would allow them to produce at the lowest average cost. A firm could expand its output and lower the average cost per unit. Firms are also not allocatively efficient since price is greater than the marginal cost on the last unit produced. In spite of these losses, society does benefit from being able to purchase a range of differentiated products, real or perceived.

Ponder and Prove - Section 2 - Monopolistic Competition in the SR and LR

Section 2 Questions

Instructions: Click on the button that represents the correct answer. After you select an answer, click on the 'Grade My Answer' button.

| Question 1 | Question 2 | Question 3 | Question 4 |

Which of the following statements about
monopolistically competitive firms in the short−run is true?

○ Firms will always have negative economic profit in the short−run

○ Firms will always have zero economic profit in the short−run

○ Firms cannot enter or exit in the short−run

○ Firms can have postitive economic profit in the short−run

| Grade My Answer | Reset |

"Results"

Original source code for problem above from Craig Bauling. Modified by David Barrus, Victoria Cole, and Brent Nicolet

Section 3 - Characteristics of an Oligopoly

Characteristics of an Oligopoly

Characteristics of an Oligopoly
The graphic below shows the characteristics an oligopoly.

Oligopoly

Market Power - Interdependent

A Few Large Firms

Significant Barriers to Entry

Homogeneous or Differentiated Products

Examples: Steel, Oil, Automobiles, etc.

Coded by David Barrus.

Oligopolies have a few large firms and may produce either a standardized product, such as steel, or a differentiated product, such as automobiles. There are significant barriers to entry which limit the number of firms that can enter the market often due to the cost structure of the industry. Since there are only a few firms, the market power of a firm depends on the actions of the other firms in the industry. Consequently, firms tend to compete heavily on non-price items, such as the features of the product. Oligopolies fall between monopolistic competition and monopolies on the industry structure continuum.

View the following video discussing the auto industry. Although the video is dated, the concepts are still relevant.

Video on oligopolies in the auto industry (about 6 minutes; must log-in to BYU-Idaho account to watch.)

Behavior of Oligopolies

No one model explains the behavior of oligopoly. Oligopolies can cooperate and collude with each other, and set prices like a monopolist, or they can be competitive. Each case will be briefly described below, and analyzed more indepth in the next sections.

Collusion/Cooperation

Explicit: Overt or Covert collusion: Firms directly communicate with each other to coordinate bids, pricing, or production, etc.

Implicit: Tacit or Price leadership: Firms coordinate bids and pricing without communicating directly.

Non-collusion/ Non-cooperation: Firms compete against each other, but they must be aware that what one firm does impact the other firm. This is what is called mutual interdependence of firms.

Constestable Markets: Firms are competitive to prevent other firms from entering the market.

Ponder and Prove - Section 3 - Characteristics of an Oligopoly

Section 3 Questions

Instructions: Click on the button that represents the correct answer. After you select an answer, click on the 'Grade My Answer' button.

| Question 1 | Question 2 | Question 3 | Question 4 |

What is an oligopoly?

- ◯ A market with a few firms that are interdependent
- ◯ A market with a few firms that are independent
- ◯ A market with many firms
- ◯ A market with one large firm and many small firms

Grade My Answer   Reset

"Results"

Original source code for problem above from Craig Bauling. Modified by David Barrus, Victoria Cole, and Brent Nicolet

Section 4 - Oligopoly - Collusion

Collusion

Firms may collude to set price or output levels and act like a monopoly to maximize the joint profits of firms (see graphic below). Collusion may be **formal** and **explicit** as is the case with Organization of Petroleum Exporting Countries (OPEC) where members formally hold meetings to determine output levels of oil. Firms may set prices, determine output levels, or divide the market into separate geographic regions and agree not to compete with each other.

Collusion

When multiple firms coordinate their pricing, bidding, or
  anything else, they are colluding. They coordinate their behavior to act like a monopolist.
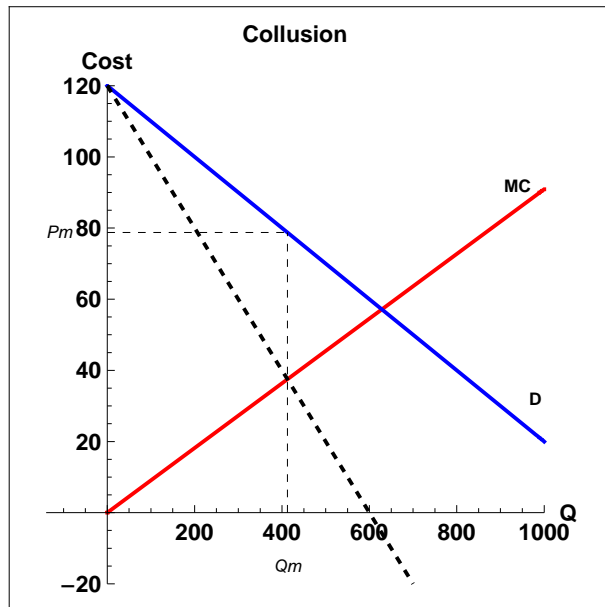
Collusion

Original source code by William J. Polley. Modified by David Barrus, Victoria Cole, and Brent Nicolet

Since, collusion is illegal in the United States, Canada, and the European Union, firms may choose to secretly get together or communicate to set prices and divide up the markets, hoping to avoid the scrutiny of the government. For an example of this, view the following video:

Identical Bidding on Contracts with Tennesee Valley Authority (About 9 minutes)

In the United States in the 1970s asphalt paving companies met before bidding day to determine who would be allowed to win the bids the next day. At time it appeared that the bidding was competitive, but in fact the bids were rigged and the winner was predetermined by the firms. The result of this overt or covert collusion and the main reason firms coordinate is so they can act like monopolists. It results in higher prices or costs (in the form of higher bids). In recent years, a group of firms producing and selling laundry detergent in Europe secretly met to determine the pricing of the laundry detergent. Firms can still cooridnate bids, pricing, and production without communicating with each other. (Source: http://online.wsj.com/article/SB10001424052970203413304577086251676539124.html); The following web page contains an example of price fixing in chocolate: http://www.msnbc.msn.com/id/23148938/

Price Leadership and Tacit Collusion

In certain industries, firms choose to legally collude by following the behavior of the dominant firm, also called **price leadership**. The airlines industry is a prime example, where a certain carrier will announce a price increase on tickets during certain days around holidays, a fee per suitcase or for meals. Often the price increase, will not take place for several months allowing other carriers to also announce price increases. If other carriers fail to raise their prices, the dominant firm will typically recall the price increase, not wanting to charge a higher price than competitors. These price increases may be made through the public media or in industry publications. Firms are not illegally colluding but may be able to signal their desire to raise prices.

According to Jonathan B. Baker, market coordination can lead to profits similar to those of collusion. "Ironically, antitrust enforcement against traditional conspiracy has produced a teaching device that business schools routinely

use to show budding executives exactly how to coordinate without reaching agreements. I refer to the government's famous Electrical Equipment cases of 35 years ago. After their indictments and convictions, the firms introduced a number of practices, unilaterally, to improve their prospects of reaching consensus by simplifying their strategies and to discourage deviation. No longer were bids assigned by the phases of the moon and a series of secret meetings. But by standardizing product definitions, distributing price books, and committing to "most favored customer" protections, they succeeded in lifting prices back up toward where they had been when the firms were conspiring overtly." (Source: http://www.ftc.gov/speeches/other/confbd4.shtm.)

Another name for this type of behavior is **tacit collusion**. The firms do not directly communicate with each other, but they rely on focal points to coordinate bids, pricing, or production. A **focal point** is an item that allows firms to coordinate their behavior. It could be a specific price or a county boundary. In Kentucky asphalt paving firms did not bid on projects that where in a competitor's county. While they did not specifically talk with each other, the firms were able to observe where projects were going to be and chose not to bid on those projects. This type of coordination requires a focal point or something that is known to all parties and can be observed by every firm. This focal point allows firms to coordinate behavior.

In addition to the antitrust laws, making collusion illegal, an industry may have difficulty trying to collude if the firms have a different demand or cost structure. If a firm is able to produce at a lower per unit cost than others, it has less of an incentive to collude. Although substantial profits may be earned by colluding, there are potentially even greater profits if firm fails to stick with the agreements. We will demonstrate when we discuss game theory. We will discuss game theory and antitrust laws in the next lesson.

Ponder and Prove - Section 4 - Collusion

Section 4 Questions

Instructions: Click on the button that represents the correct answer. After you select an answer, click on the 'Grade My Answer' button.

| Question 1 | Question 2 | Question 3 | Question 4 |

OPEC engages in what type of collusion?

○ Tacit

○ Price Leadership

○ Overt

○ They do not collude. They are competitive

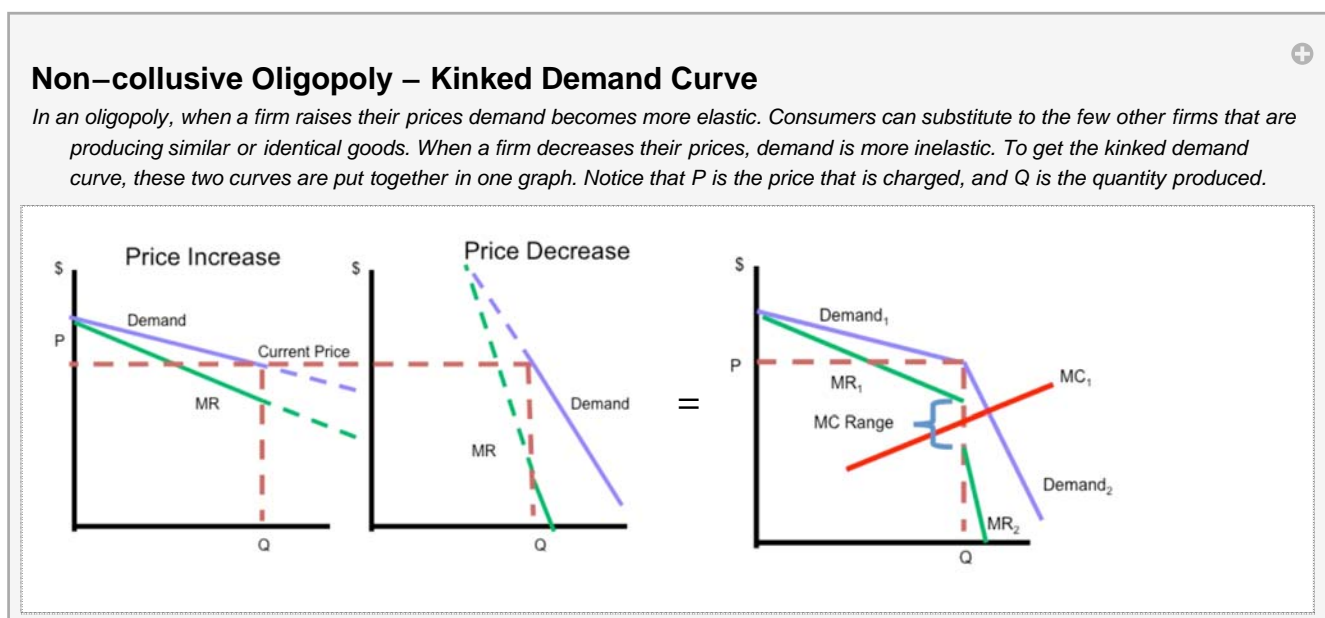| Grade My Answer | Reset |

"Results"

Original source code for problem above from Craig Bauling. Modified by David Barrus, Victoria Cole, and Brent Nicolet

Section 5 - Oligopoly - Competition

Non-collusive Oligopolies

Since there are only a few firms in an oligopoly, their profits are **interdependent** which means the firms profits rise and fall based on the choices of the other firm. The **kinked-demand theory** explains the behavior of a firm in a non-colluding oligopoly. The assumption is that the firm faces two demand curves. If the firm were to raise its price, other firms would choose not to increase their price and would take a large portion of the market share away from the higher priced firm. Thus the demand curve, if the price is increased, is very elastic, as shown on the left (see graphic below). If the firm decided to decrease its price, other firms would follow the price cut and decrease their price. Thus the demand would be relatively inelastic, as demonstrated in the graph in the middle.

Combining these two demand curves yields a **kinked-demand curve**. If the firm raises prices, it faces the highly elastic demand (D1) and if it lowers price it will face a more inelastic demand curve (D2). Profit maximization still occurs where marginal revenue equals marginal cost, so the firm will produce quantity Q and charge price P. Note that given the disjoint marginal revenue curve, the marginal costs for the firm could increase or decrease a small amount (denoted by the MC Range) and the firm would continue to produce the same quantity and charge the same price. Thus prices are "sticky" at the original prices. How firms find the original price and quantity is a question asked by critics of the model.

Non−collusive Oligopoly − Kinked Demand Curve

In an oligopoly, when a firm raises their prices demand becomes more elastic. Consumers can substitute to the few other firms that are producing similar or identical goods. When a firm decreases their prices, demand is more inelastic. To get the kinked demand curve, these two curves are put together in one graph. Notice that P is the price that is charged, and Q is the quantity produced.

Coded by David Barrus.

Contestable Markets

One of the assumptions of an oligopoly is that there are substantial barriers to entry. If the barriers to entry were low, how would a firm behave? The **contestable market** argues that if the barriers to entry are low, oligopolies will behave more competitively with lower prices and greater quantity. This acts as a deterrent and discourages other firms from entering the market. In general for markets to be contestable, there must be relatively low start up costs (including sunk costs) for new entrants; the technology to produce the product must be available to new entrants, and there can't be significant brand loyalty to the existing products in the market. In a contestable market, there may only be a few firms and yet they behave competitively due to the potential threat of new entrants. For example, although there may only be one or two gas stations in a small town, they may choose to keep their price of gas lower to deter other businesses from opening up.

Ponder and Prove - Section 5 - Competition

Section 5 Questions   ⊕

Instructions: Click on the button that represents the correct answer. After you select an answer, click on the 'Grade My Answer' button.

| Question 1 | Question 2 | Question 3 | Question 4 |

A kinked demand curve results because
      firms in an oligopoly are competitive and are _____.

○ Price Leaders

○ Independent

○ Interdependent

○ Colluding

| Grade My Answer | | Reset |

"Results"

Original source code for problem above from Craig Bauling. Modified by David Barrus, Victoria Cole, and Brent Nicolet

---

Section 6 - Introduction to Game Theory

Introduction

Game theory analyzes the best way for two or more players to play a game. In a game, what one player does affects the outcome of the other player. For example, when two people play "Rock, Paper, Scissors" if a player chooses rock and the other player chooses paper, the paper wins. So each player must analyze the possible outcomes and then choose an option based on what they think the other player will choose. Firms do this when they determine how much of a good to produce, how much they should advertise, and what price they should charge. Politicans also try to figure out what their competitor is going to do or how they will react to a specific campaign ad. We even do this when we date. A man may try to determine whether he should kiss a girl on the first date and what her reaction will be. We are constantly making descisions that are affected by the choice of someone elses. Game theory analyzes these decisions and all of the strategies and the potential payoffs.

Imagine you had been taken to New York with a friend and told that there are two other people in New York who are looking for you, but you don't know who they are or what they look like. How would you go about finding them? Where would you go and at what time would you meet? This is an example of game theory--where you are trying to make the best choice based on what you think will be the actions of others.

This experiment was actually tried by ABC Primetime (March 16, 2006) with a group of people. If you would like, you may view the video using the link below. This video is about 40 minutes long, so it is optional viewing and not required. However, you may find it a very useful resource for understanding some of the basic ideas of game theory.

ABC Primetime (March 16, 2006) video on game theory. You can also read a transcript of this video at ABC News / Primetime: Mission Impossible: In Search of Strangers in New York City.

Since oligopolies are interdependent, game theory can be a useful tool in analyzing the strategic behavior of firms. Analyzing strategic behavior is useful in sports, politics, business, war, and even dating. In game theory, the payoff or reward to the firm depends on its actions as well as the actions of the others.

Think of the game of paper, rock, and scissors. What wins depends on what you choose and the choice of your competitor as demonstrated in the following article:

"Listen To The Children" by Lloyd de Vries (May 18, 2005);

A story about Christie's, Sotheby's, and more than $20 million worth of art. Takashi Hashiyama, president of a Japanese electronics firm, couldn't decide which auction house to use to unload the company's art collection. Did he ask them to enter a bidding war? Did he split the collection between the two auction houses? Did he ask around to find out which one had the fastest-talking auctioneer? No. He decided to use a decision-making process that kids have been using for generations: rock, paper, scissors.

Sotheby's decided to leave its decision to chance, and had no particular strategy. Christie's, on the other hand, turned to some experts: the children of their international director of the impressionist and modern art department. The 11-year-old twin daughters immediately told their dad to go with scissors. Their reasoning was that, "Rock is way too obvious, and scissors beats paper." So, Christie's chose scissors, Sotheby's chose paper, scissors "cut" paper and Christie's got the deal.
(Source: http://www.cbsnews.com/stories/2005/05/18/opinion/garver/main696175.shtml)

The media is full of examples of game theory. Watch the following clip from The Princess Bride: The Princess Bride: Never go in against a Sicilian when death is on the line! (About 5 minutes)

GameTheory.net has additional examples of game theory in film.

Payoff Matrix

The basic components of a game include the **rules**, **players**, **strategies**, and **payoffs**. These need to be clearly defined in order to determine optimal strategies and outcomes. We can illustrate these components best though a simple demonstration of a simultaneous, one-shot, duopoly game (see graphic below). By definition, the **rules** of this game are that the **players** simultaneously choose their strategies (i.e. they cannot wait to see what the other will do). Once the **strategies** are revealed, the **payoffs** are determined and the game is over – no repeats or mulligans! The players in our game are two firms: Yellow and White. They each can choose one of two strategies: high output or low output. Finally, their payoffs are the profits they earn as a result of their strategy and that chosen by the rival.

Payoff Matrix

Below is a payoff matrix. There are two players Yellow and White. Each player has two strategies they can play. They can either play high or low. The payoff for Yellow is the triangle on the left, the yellow triangle. The payoff for White is the triangle on the right, the white triangle. Each players potential payoffs is impacted by the strategy the other player chooses.

Original source code by Javier Puertolas. Modified by David Barrus, Victoria Cole, and Brent Nicolet

A **payoff matrix** is a simplified representation that shows the possible payouts to each firm based each potential outcome. If both firms select the low output level (upper left-hand quadrant), each firm will make $120 million. If each firm opts for a high output level (lower right-hand quadrant) each will make $100 million. If White chooses a low output level and Yellow chooses a high output level (lower left-hand quadrant), White will make $50 million and Yellow will make $160 million. The reverse is true if Yellow chooses a low output level and White chooses a high output level (upper right-hand quadrant). Where payoffs are identical like this, we call them symmetric games. Since firms are choosing their output levels at the same time, they are unable to detect beforehand the decision of the other. In trying to anticipate the actions of the other, a firm evaluates the payoff matrix.

If Yellow chooses a low output level, White's best choice would be a high output level since $160 million is greater than $120 million. If Yellow chooses a high output level, White's best choice is again a high output level since $100 million is greater than $50 million. Thus regardless of Yellow's decision, White's best choice will be to produce a high quantity. This is known as a **dominant strategy**, since White's best choice is a high level of output regardless of Yellow's decision. Recognizing that White has a dominant strategy to choose a high output level, Yellow's best choice is then choose a high output level since $100 million is greater than $50 million (you can also see that Yellow has a dominant strategy to choose a high output level due to the symmetric nature of the game). As a result, both firms will choose a high output level earning $100 million. Since neither firm can change its strategy to obtain a better payoff, given what its rival does, this is the rational outcome! When such an outcome is obtained, this situation is referred to as a **Nash equilibrium**. Now let's be very clear, in this case White and Yellow both have dominant strategies and the Nash equilibrium is (high output, high output) with payoffs ($100M, $100M). Note, the Nash equilibrium is not the payoffs; it is the optimal strategies.

Ponder and Prove - Section 6 - Introduction to Game Theory

Section 6 Questions

Instructions: Click on the button that represents the correct answer. After you select an answer, click on the 'Grade My Answer' button.

| Question 1 | Question 2 | Question 3 | Question 4 |

What is game theory?

◯ A way to analyze the behavior of two or more people, and see how their choices impact the other player(s)

◯ A theory that explains why people win the lottery or other games of chance

◯ The theory behind why people play games

◯ A methodology to study people and why they do not purchase certain goods or services

| Grade My Answer | | Reset |

"Results"

Original source code for problem above from Craig Bauling. Modified by David Barrus, Victoria Cole, and Brent Nicolet

Section 7 - Simultaneous Games

Prisoner's Dilemma

A common example used to game theory is the **prisoner's dilemma**. For example, say that Mrs. White and Colonel Mustard (using two characters from the board game Clue) are both accused of murder. They are apprehended and each placed in a different room and unable to communicate with each other. The payoff matrix in the graphic below indicates the number of years, each will have to serve based on outcomes. If neither confesses, they will be charged with a lesser crime and each serve two years. If one confesses and agrees to testify against the other, he or she will only serve one year while the other will serve 15 years. If they both confess, they will each serve 7 years. Analyze the payoff matrix and determine the expected outcome.

Prisoner's Dilemma

The payoff matrix below indicates the number of years, each will have to serve based on what the other player chooses to do. For example, if both choose to confess then they will both spend 7 years in prison. The result of this game is a prisoner's dilemma. Both end up confessing, but they would be better off not confessing.

Original source code by Javier Puertolas. Modified by David Barrus, Victoria Cole, and Brent Nicolet

This is a one time or non-repeated, simultaneous game. A **simultaneous game** is a game where the players choose their strategies at the same time. In analyzing the payoff matrix, we find that there is a dominant strategy and an incentive for both individuals to confess, even though they would collectively be better off by remaining silent. This simple example of the prisoner's dilemma demonstrates why the outcome will be worse for each individual than if they had cooperated and not confessed.

Structure of the Games

The structure of these games can be very complex or relatively simple. A simple game consists of **perfect information** with each individual knowing the payoffs and unable to cooperate or collude with the other party, a discrete set of choices, i.e., confess or don't confess, and a single round. A game can also repeat and go multiple rounds. This is called a **repeated game**.

In more complex repeated games, firms are able to punish those who fail to cooperate with strategies such as **tit-for-tat**, where one firm does what the other firm did in the previous round or the **grim trigger**, where a firm will seek to punish the other firm forever if there is any noncooperation. **Asymmetric information**, where information is known to one party but not to another, also makes the game more complex. In dynamic games, one firm is able to see the actions of the other then respond. Price match guarantees or 110% of the difference if another firm has a lower price discourages other firms from reducing their prices.

Credible Threat

An important component in game theory is knowing that the payoff or penalty for an action is real. A child who misbehaves and is threatened by a parent with a particular punishment will find out if the parents threat is credible. A parent who fails to carry out an announced punishment, quickly losses credibility and often control of the child.

In war the threat must be credible even if the results can be dire. Go to http://www.gametheory.net/popular/film.html

and watch the video clip of Dr. Strangelove. As demonstrated in this clip, the threat, in this case the use of nuclear weapons has to be credible and convincing and out of the control of "human meddling."

In 2002, war between Pakistan and India was averted due to Pakistan's threat to use nuclear weapons if India attacked with their conventional forces, which were superior to Pakistan's conventional forces. "Pakistan does not abide by a no-first-use doctrine, as evidenced by President Pervez Musharraf's statements in May, 2002. Musharraf said that Pakistan did not want a conflict with India but that if it came to war between the nuclear-armed rivals, he would "respond with full might." These statements were interpreted to mean that if pressed by an overwhelming conventional attack from India, which has superior conventional forces, Pakistan might use its nuclear weapons." Source: http://www.fas.org/nuke/guide/pakistan/nuke/

Ponder and Prove - Section 7 - Simultaneous Games

Section 7 Questions

Instructions: Click on the button that represents the correct answer. After you select an answer, click on the 'Grade My Answer' button.

| Question 1 | Question 2 | Question 3 | Question 4 |

White's Output Strategy

	Low	High
Low	$100 / $120	$60 / $50
High	$40 / $160	$200 / $100

Yellow's Output Strategy

(in millions of dollars)

What is the Nash Equilibrium?

○ Yellow: Low, White: Low

○ Yellow: High, White: High
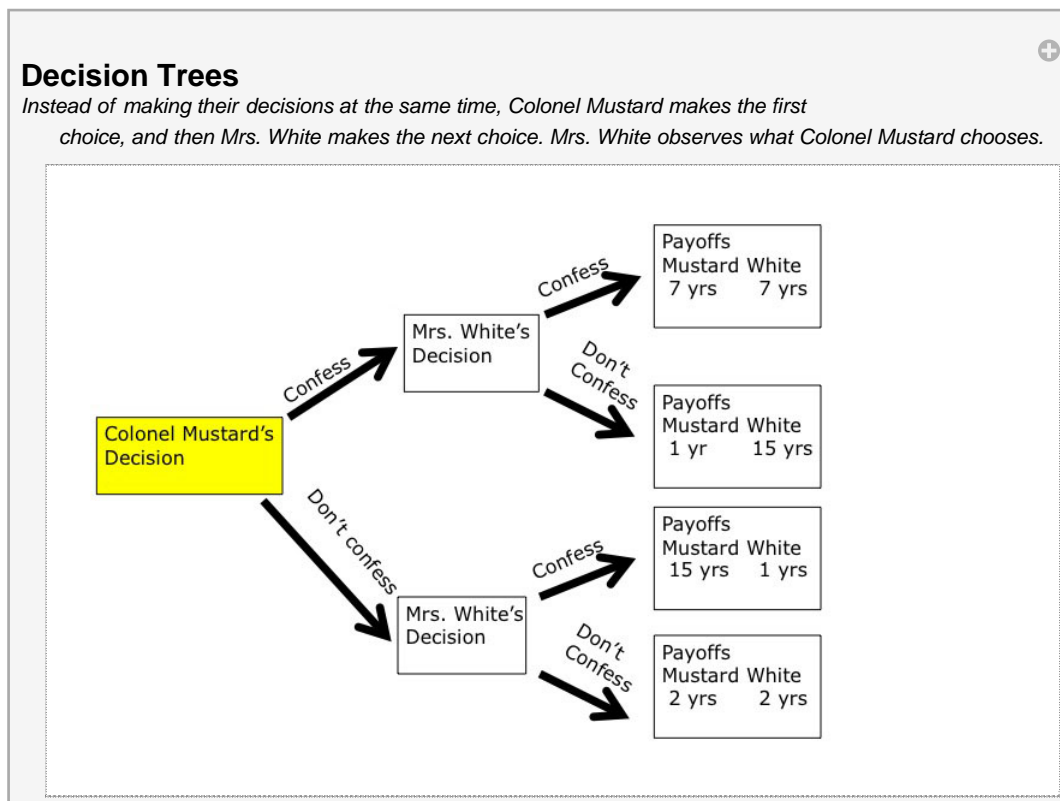
○ Yellow: Low, White: High

○ Yellow: High, White: Low

| Grade My Answer | | Reset |

"Results"

Original source code for problem above from Craig Bauling. Modified by David Barrus, Victoria Cole, and Brent Nicolet

Section 8 - Sequential Games

Decision Trees

When games are sequential in nature, rather than simultaneous, we can represent them using decision trees. A **sequential game** is a game where one firms chooses a strategy and then the other firm observes the strategy and chooses their strategy. They're also useful when analyzing more complex games. This tree can be used to consider the case of a sequential game when Colonel Mustard must make his choice first, and Mrs. White gets to know his decision before she determines hers. Notice that all the components are again included: the rules – sequential decisions and one shot game, the players – White & Mustard, the strategies – confess and not confess, and the payoffs – years in prison.

Decision Trees
Instead of making their decisions at the same time, Colonel Mustard makes the first choice, and then Mrs. White makes the next choice. Mrs. White observes what Colonel Mustard chooses.
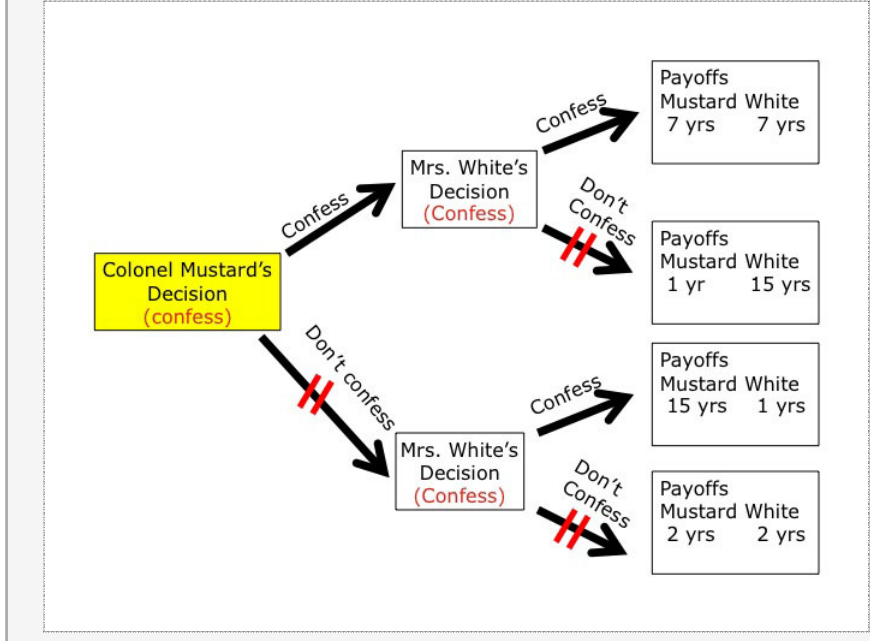

Original source code by Javier Puertolas. Modified by David Barrus, Victoria Cole, and Brent Nicolet

When solving the tree, we start at the right-hand side (or the end of the game) and work to the left (or back to the beginning). This is called **backward induction**. If Colonel Mustard confessed, Mrs. Whites best choice would be to confess, since 7 years of prison is less than 15 years. If Colonel Mustard does not confess, the best choice for Mrs. White is again to confess. Recognizing the rational choices of Mrs. White, Colonel Mustard need only consider the payoffs that remain (i.e. he can ignore those associated with Mrs. White not confessing). He therefore compares the payoffs of 7 years versus 15 years, and will opt to confess. The Nash equilibrium is (confess, confess) with payoffs of (7,7).

Decision Trees
They still end up with the same outcome as the simultaneous game. They both confess.

Sequential games like this help illustrate when there are first and second mover advantages. What do you think about this case? Does Colonel Mustard have a first mover advantage or does Mrs. White have a second mover advantage?

Game theory is an extremely powerful tool that can be used to analyze and predict the behavior of others when there are few parties involved and their payoffs are interdependent. It is particularly of interest when examining the behavior of oligopolies and their decisions to price, advertise, and produce.

Ponder and Prove - Section 8 - Sequential Games

Section 8 Questions

Instructions: Click on the button that represents the correct answer. After you select an answer, click on the 'Grade My Answer' button.

| Question 1 | Question 2 | Question 3 | Question 4 |

What is Mrs. White's best choice if Mustard confesses? Doesn't confess?

○ Don't Confess; Don't Confess

○ Confess; Don't Confess

○ Confess; Confess

○ Don't Confess; Confess

| Grade My Answer | Reset |

"Results"

Original source code for problem above from Craig Bauling. Modified by David Barrus, Victoria Cole, and Brent Nicolet

Summary

Key Terms

Asymmetric Information: A situation where information is known to one party but not to another.

Backward Induction: The method of solving a sequential game starting the last player to go and then working to the beginning of the game.

Contestable Market: argues that if the barriers to entry are low, oligopolies will behave more competitively with lower prices and greater quantity

Covert Collusion: a type of explicit collusion where two or more firms secretly collude together in order to act like a monopoly

Credible Threat: A payoff or penalty resulting from an action is real.

Decision Trees: The visual representation of a sequential game.

Dominant Strategy: A strategy where one player will always choose one option no matter what the other player does.

Explicit Collusion: Firms directly communicate with each other to coordinate bids, pricing, or production, etc.

Focal Point: an item that allows firms to coordinate their behavior

Formal Collusion: an overt collusion between two or more firms to act as a monopoly

Game Theory : It analyzes the best way for two or more players to play a game

Grim Trigger: A strategy where a firm will seek to punish the other firm forever if there is any noncooperation

Interdependent: when a firm's profits depend on other companies' decisions

Kinked-Demand Curve: in a non-colluding oligopoly, when a firm raises its price, it faces a very elastic demand curve, but when it lowers its price, it faces a very inelastic demand curve

Kinked-Demand Theory: explains the behavior of firms in a non-colluding oligopoly. When a firm raises its price, other firms do not match its new higher price. But when a firm lowers their price below its competitors, the competing firms lower their prices to match the new lower price

Monopolistic Competition: A market system where there are a large number of firms with lower barriers to entry, and where each firm's product is unique but very similar to those produced by other firms.

Nash Equilibrium: An optimal outcome where neither firm can change its strategy to obtain a better payoff, given what its rival does.

Niche Market: Only a small segment of the entire market

Oligopolies: when a few firms produce either a unique or homogenous product

Overt Collusion: when firms in an oligopoly publically collude on prices and quantities for the market

Payoff Matrix: A simplified representation that shows the possible payouts to each firm based each potential outcome.

Payoffs: What the player gets from the game. Sometimes it is money or market share, etc.

Perceived Product Differentiation: This type of product differentiation is not real but perceived in the minds of consumers which is often accomplished through advertising and celebrity endorsement.

Perfect Information: A situation where each individual knows the payoffs. Each players have the same information the other player has.

Players: Individuals or firms, etc. who are playing the game.

Price Leadership: when firms in an oligopoly legally collude by following the behavior of the firm with the largest market power

Prisoner's Dilemma: A game where the outcome will be worse for each individual than if they had cooperated and not confessed.

Real Product Differentiation: Actual differences between products.

Repeated Games: A game can also repeat and go multiple rounds.

Rules: Set of guidelines on what the players can do.

Sequential Games: A game where one firm/individual chooses a strategy and then the other firm/individual observes the strategy and chooses their strategy.

Simultaneous Games: A game where the players choose their strategies at the same time.

Strategies: What the players choose to do.

Structure of Games: How a game is structured

Tacit Collusion: when firms do not directly communicate with each other, but they rely on focal points to coordinate bids, pricing, or production

Tit-for-Tat: Where one firm does what the other firm did in the previous round.

Objectives

Section 1

1. Explain the behavior of firms in monopolistic competition including a description of the products, quantities, and

prices of products supplied to the market.

2. Discuss the characteristics of a monopolistic competitive market.

3. Discuss how and why the demand curve of the monopolistic competitor's product differs from that of the perfect competitive firm.

Section 2

1. Explain the relationship between the demand curve for the monopolistic competitor's product and its marginal revenue curve

2. Determine the quantity produced, the price charged, and the profit earned by a profit maximizing monopolistic competitor.

3. Graphically show what happens in the long-run to demand for the monopolistic competitor's product and its profits.

4. Show how advertising impacts the monopolistic competitor's demand and cost curves and how advertising can decrease the firm's average cost at the profit maximizing output.

Show graphically why the monopolistic competitor is neither allocatively efficient nor productively efficient, its excess capacity, and how product differentiation impacts the monopolistic competitor's demand.

Section 3

1. Explain the behavior of firms in oligopolies including a description of the types, quantities, and prices of products supplied to the market.

2. Discuss the characteristics of an oligopoly market.

3. Identify the possible sources of barriers to entry and why barriers to entry are important in an oligopoly.

4. Explain the importance of strategy and the interdependence between firms in an oligopolistic industry.

Section 4

1. Define a cartel and demonstrate the behavior of firms with collusion.

2. Explain why collusion is often difficult even in a market where collision is not legally prohibited.

Section 5

1. Demonstrate the behavior of firms in an oligopoly with no collusion.

2. Demonstrate the behavior of firms given a price leader in the market.

3. Explain the contestable market theory.

Section 6

1. Explain the concept of game theory and demonstrate its use in oligopolies.

2. Use game theory to show the interdependence between firm's decisions and solve for the Nash equilibrium

Section 7

1. Explain the prisoner's dilemma.

2. Explain the difficulties that a cartel faces to collude and maximize joint profits.

3. Explain how game theory is used to determine the behavior of competitors in an oligopoly.

4. Know the difference between simultaneous and sequential games, and how to solve each type.

Section 8

1. Know the difference between simultaneous and sequential games, and how to solve each type.