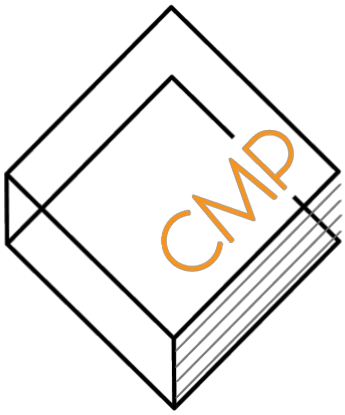

COMM 295

2018W1 Final Review Package

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Monopoly & Pricing with Market Power

Monopoly:

- As a single supplier, a monopolist faces the entire (downward sloping) market demand.
- However, MR is not equal to price as the monopolist must reduce price to sell more (due to downward sloping demand).

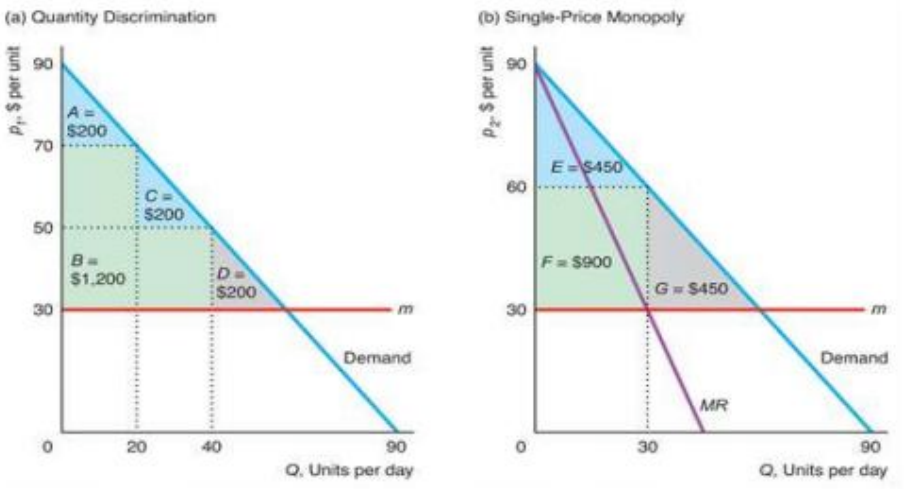
Pricing with Market Power

- Perfect price discrimination: Monopolist charges the maximum price that each consumer is willing to pay.
- Multi-Group price discrimination: Splitting consumers into two or more groups based on their demand curve and charging different prices to each group. $MR_1 = MR_2 = MC$
- Quantity-Based price discrimination (or non-linear price discrimination): Charging different prices based on the quantity
- Two-Part Tariff: Charging an entry fee and a usage fee
    - Identical consumer:
        - Single consumer:
            - usage fee of P = MC
            - entry fee = entire CS
        - Many consumers:
            - usage fee of P = MC
            - entry fee = entire CS/(# of consumers)
    - Different Consumers:
        - charge same entry fee:
            - usage fee P > MC
            - entry fee = CS of the consumer with lower demand
        - charge different entry fee:
            - usage fee P = MC
            - entry fee = CS of the consumer

A consumer has a demand curve given by p = 90 – Q. In the following pictures:

(a) shows the outcome of quantity-based price discrimination if the firm charges $70 each for the first 20 units and $50 each for additional units.

(b) Shows the outcome of profit-maximizing single price monopoly. The marginal cost is $30.



Which of the following statements is true:

A. The average price paid under situation (a) is the same as situation (b)
B. Revenue under situation (a) is double the revenue of situation (b)
C. Profits are higher in situation (b) than with situation (a)
D. None of the above

	Textbook	MyEconLab code	Bundle
Consumer 1	120	30	150
Consumer 2	110	90	200
Consumer 3	90	110	200
Consumer 4	30	120	150

a) What is the revenue using stand-alone pricing textbook = $90, code = $90
b) What is the revenue using pure bundling pricing bundle = $150
c) What is the maximum revenue if you are able to use stand-alone pricing, pure bundling, or mixed bundling

Given the following situation where a monopoly can charge different usage and different entry fees to the two different consumer types.

Consumer Type A has a demand curve: $p = -0.5q + 12$
Consumer Type B has a demand curve: $p = -0.5q + 10$
The firm has a marginal cost of $6 per unit

What is the profit maximizing usage fee?
What is the profit?

11.1 Cartel

- Oligopolistic firms have incentives to form **cartel** (collude) to increase their profits.
- Cartels can increase profits by **limiting the production** and **raising the price** (like a **monopolist**).
- Producers in a cartel **explicitly agree or collude** to cooperate in setting **prices and output** to make more profits.

Collusion/Cartels

- If demand is sufficiently **inelastic** and cartel is enforceable, prices may be well above competitive levels.
- Since price is higher than competitive price, cartels leads to **DWL** in the economy.
- **E.g.** OPEC, Mercurio Europeo, NCAA.

Why Cartels Fail?

- Antitrust Laws (US) or Competitive Laws (Canada) **prohibits** the formation of cartels. The motivation behind such laws is to **foster competition** in the market.
- A **cartel may fail** if **non-cartel members** can readily **undercut prices** or can replace **the supply reduction** undertaken by cartels.
- It may also fail when members **cheat**. In a cartel, members have incentives to cheat as they can gain by cheating.

Maintaining Cartels – 4 Conditions for Success

1. **Enforcement and detection**: Temptation to cheat may be deterred by **threat of retaliation**. There must be a mechanism for detection of cheating and punishment for violators.
2. **Potential for monopoly power**: Cartels can be more successful when demand is more **inelastic**. **Government support** or exemption from competition laws can help foster cartels.
3. **Barriers to entry:** Detection of cheating and punishment becomes easier with fewer firms. When new firms enter the market, the cartel is likely to fail.
4. **Fringe firm consideration:** Members of cartel must consider the actions of **non-members** (fringe firms) when making pricing decisions.

11.2 Oligopoly

- **Management challenges:** Strategic actions to deter entry.
  - **E.g.** Threatening to decrease price against new competitors by keeping excess capacity.
- **Rival behavior:** Each firm must consider how its actions (pricing or output decisions) will affect its rivals and in turn how these rivals will react.

Oligopoly – Equilibrium

- **Nash Equilibrium**
  - Each firm is doing the best it can **given** what its competitors are doing.
- **Cournot Duopoly**
  - Markets in which **two** firms compete in choosing **quantities**.
  - Each firm will adjust its **output** based on its belief about its rival's output.

Oligopoly

Cournot Duopoly: two firms compete in choosing quantities (more realistic)
Bertrand Duopoly: two firms compete in choosing prices

Solving Cournot Model:

1. Find MR equation of each firm
- Remember to use the Q_A for Quantity of Firm A but the Price equation uses Q which is equal to $Q_A + Q_B$
2. Set MR = MC for both firms
3. Solve for Q_A and Q_B using the 2 questions.
4. Use Q to find price

Solving Cournot Model with first mover advantage:

1. Find MR equation of the following firm and set MR = MC
2. Find MR equation of the leader firm using the response function in step 1
3. Solve MR = MC for leader firm for the leader's Q
4. Solve for following firm's Q
5. Use Q to find the solution

Oligopoly

Two firms in a cournot duopoly have an inverse demand of P = 500 – 50Q and a cost function of C = 20Q. Find the equilibrium price, the quantity produced by each firm, and the profit of each firm.

Oligopoly

Assume that firm A is the first mover and firm B is the follower. Find the equilibrium price, the quantity produced by each firm, and the profit of each firm.

Topic 12: Game Theory (12.1-12.3)

Games and Strategic Decisions

- **Game** is a situation in which **players** (the participants) make strategic decisions.
- **E.g.** firms compete by setting prices, group of consumers auctioning against each other.
- Strategic decisions result in **payoffs** (rewards or benefits) to the players.
- Game theory tries to determine the **optimal strategy** for each player.
- **Optimal strategy** for a player is the one action that maximizes his/her expected payoff.
- We consider players are **rational**, meaning they try to maximize their own profits/payoffs.

Non-Cooperative vs. Cooperative Games

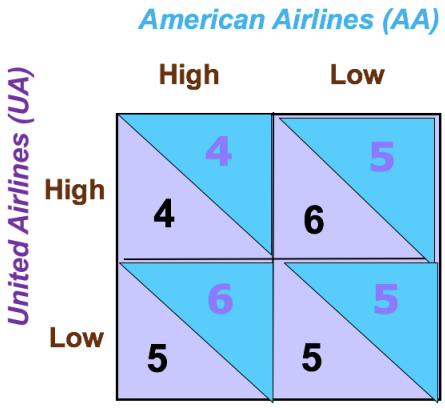
- **Cooperative Game**: Players negotiate binding contracts that allow them to plan join strategies.
  - **E.g.** Buyer and seller negotiating the price of a good/service or a joint venture by two firms.
- **Non-Cooperative Game** Negotiation or enforcement of binding contracts between players is not possible.

Static vs. Dynamic Games

- **Static Game**
  - Each player acts only once and simultaneously (or without knowing rival's action).
- **Dynamic Game**
  - Players move either sequentially (Stackelberg Model) or repeatedly (Cournot many times).

12.1 Oligopoly Games

- A **normal form** of a game specifies players' possible strategies and their payoffs.
- **E.g.** when UA plays Low and AA high, UA gets 6 and AA gets 6.

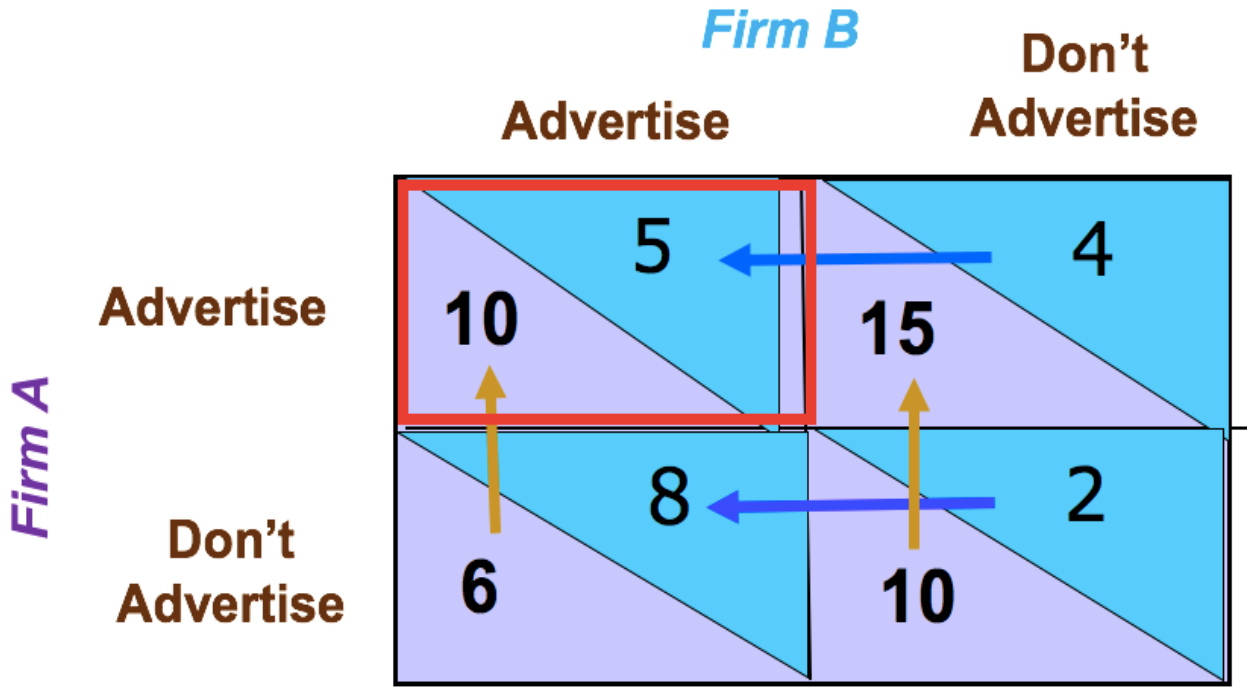


Dominant Strategies

- **Dominant strategy** is the one that is optimal no matter what an opponent does.
- A dominant strategy is **stable**, in the sense that players will choose this strategy and will not deviate from it.
- In the following advertising game, Firm A always chooses "Advertise" (no matter what Firm B does). Therefore, "Advertise" is Firm A's dominant strategy.
- By the same token, "Advertise" is also Firm B's dominant strategy.
- Since both firms choose "Advertise", (Advertise, Advertise) is this game's **Nash equilibrium**.
- In the **modified advertising game**, Firm B has "Advertise" as the dominant strategy.
- Given that Firm B chooses "Advertise", Firm A will choose "Don't Advertise.
- Thus, (Advertise, Don't Advertise) is the Nash equilibrium of the modified advertising game.

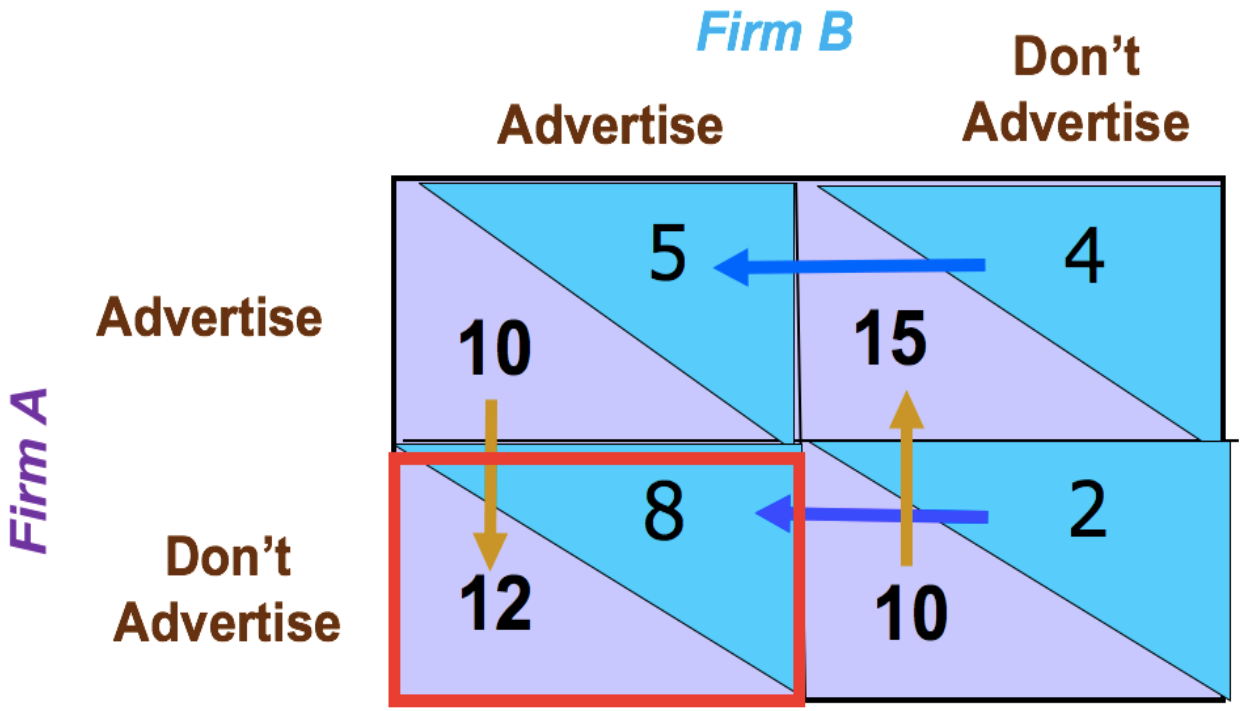
Advertising Game

- Both firms have “Advertise” as the dominant strategy.



Modified Advertising Game

- Firm B has “Advertise” as the dominant strategy, but Firm A has no dominant strategy.



Repeated Game

- If a rival player defects from a collusive outcome, that can trigger a punishment.
- Tit-for-tat is one **example** of such a trigger strategy.
- **Tit-for-Tat Strategy:** A player responds in kind to an opponent's previous play, cooperating with cooperative rivals and retaliating against uncooperative ones.
- **Unless the potential defector discounts the future** substantially, this strategy can **sustain cooperation** as a Nash equilibrium.

Infinite Game

- If the game is **infinitely repeated**, **tit-for-tat strategy is rational**. If a competitor undercuts its rival, it will get high profits that month but knows the rival firm will lower price next month.
- As a result, both will get lower prices. This shows that it is **not rational to undercut**.
- Thus, in an **infinitely repeated** game, **Prisoner's Dilemma can have cooperative outcome**.

Finite Game

- What if the game is **repeated a finite number** of times once every month?
- After the last month, there is no retaliation possible. But, in the last month before last month, knowing that the rival would defect in the last month, it will defect in the month before.
- Going backwards, the only rational outcome is for both firms to **defect every month**.

13.2 Sequential Games

- **Sequential Game:** Players move in turn, responding to each other's actions and reactions.
- **E.g.** Stackelberg Model, responding to rival ads, entry decisions, responding to regulation.
- In the product choice game, if both the firms announce their decisions simultaneously, there is **multiple** Nash equilibrium.
- What if Firm 1 speeds up production and introduces new cereal **first**?
- In this sequential game, Firm 1 (the leader) considers Firm 2's (follower) potential reaction before making its own choice (**Stackelberg Model**).

Game Theory

Static Game:

- each player acts once and at the same time

Dynamic Game:

- Stackelberg: Sequentially, one player goes first followed by the other
- Cournot: Repeatedly, multiple rounds of the game

When at least one player has a dominant strategy then the outcome is a unique Nash equilibrium.

Tit-for-Tat Strategy: A player responds in kind to an opponent's previous play, cooperating with cooperative rivals and retaliating against uncooperative ones.

- Infinitely games: Tit-for-Tat is rational
- Finite games: Defect from the start is rational

Game Theory

What is the nash equilibrium?

	Firm B			
		Large	Small	None
Firm A	Large	4, 4	12, 8	16, 9
	Small	8, 12	16, 16	20, 18
	None	9, 16	15, 20	18, 18

Game Theory

		Player 2: Cheat	Player 2: Cooperate
Player 1	Cheat	5 5	-20 50
	Cooperate	50 -20	20 20

1. What is the nash equilibrium if the game is played only once?
2. What is the nash equilibrium if the game is played 2 times?
3. What is the nash equilibrium if the game is played 10 times?

Game Theory

Firm A and Firm B are competing in a game that can go on infinitiely.

(A payoff, B payoff)		Firm B: Defect (Low Price)	Firm B: Cooperate (High Price)
Firm A	Defect (Low Price)	50,50	100,25
	Cooperate (High Price)	25,100	75,75

Which of the following is true?

1. Tit-for-tat is a rational strategy
2. The sum of payoffs is maximized if they both cooperate
3. They will never defect

Uncertainty

Uncertainty
• Unlike the choice under certainty, choice under uncertainty is risky and so is difficult to make.
• How do we make choices when certain variables such as income and prices are uncertain?

• To measure risk, we must know:

1. All the possible outcomes.
2. The probability that each outcome will occur.

• Two measures to help describe and compare risky choices are:
1. Expected value.
2. Variability.

Expected Value E(X): The weighted average of the values resulting from all possible outcomes.

Assume n possible outcomes:
Values of possible outcomes: $X_1, X_2, \ldots, X_n$.
Probability of each outcome: $P_1, P_2, \ldots, P_n$.

$E(X) = P_1 X_1 + P_2 X_2 + \ldots + P_n X_n$

Describing Risk: Variability
• Variability: Variability comes from deviations in actual payoffs relative to the expected payoff.
• Greater variability of actual payoffs the expected value signals greater risk.
• Variance or Standard Deviation measures variability.

Variance: $\sigma^2 = P_1(X_1-E(X))^2 + P_2(X_2-E(X))^2 + \ldots + P_n(X_n-E(X))^2$

Standard Deviation: Take the square root of variance

Attitude Towards Risk
• You choose depending on your attitude towards risk as reflected in your utility function.
• If you dislike risk, then you may choose a riskier job only if it gives you sufficiently higher
expected value than the risky job.
• In other words, you choose the option that gives you the highest expected utility.

3 Ways to Avoid Risk

1. **Diversification** or risk pooling.
2. Buy **insurance**.
3. Obtain more **information**.

Diversification

- **Diversification:** "Don't put all your eggs in one basket".
  - Allocating resources to a variety of activities whose outcomes are not closely related.
  - Diversification can **eliminate** risk if two events are **perfectly negatively** correlated.
- If government offers a lucrative contract to either Firm A or B with 50-50% probability, then **investing in both the firms eliminates the risk**. In this case, the two events are perfectly negatively correlated.

Diversification Example

- The stock of winning firm is worth $40 and the loser is worth $10.
- Then, if you invest two $20 in the same first your EV = 0.5*80 + 0.6*20 = 50 with variance = 900.
- But if you invest $20 in each firm, then your EV = 50 no matter which firm wins. Notice that return from each firm (win or lose) = 0.5*40 + 0.5*10 = 25 for the total of $50.
- Thus, no matter who wins your return is 50 and hence variance is 0.
- Even if the two events are **imperfectly negatively correlated**, risk will be **reduced**.
- But if the events are **perfectly positively correlated**, diversification **cannot reduce** risk.

Reducing Risk: The Stock Market

- If you invest all money in one stock, then you take on a lot of risk.
- If that stock loses value, you lose all your investments.
- You can spread risk out by investing in many different stocks or investments.
  - **E.g.** Mutual funds like the S&P 500 or NYSE.
- However, a **systematic risk** (price of all stocks falling during recession) cannot be avoided.

Reducing Risk: Insurance

- Risk averse people are willing to pay premium (and buy insurance) to avoid risk caused by bad outcomes (e.g. accidents, illness, thefts, etc.).
- If the cost of insurance (premium) equals the expected loss, risk averse will buy enough insurance to recover fully from a potential financial loss.
- A risk averse people is willing to pay a **risk premium** to avoid risk.

Insurance Example: Insuring Against Break Ins

- Assume wealth = $50K and loss = $10K in case break ins.
- If probability of break in 0.1, E(Loss) = 0.1*10 = 1K.
- Assume full insurance against loss and pay premium = E(Loss) = 1K.
- This is called **actuarially fair premium** (fair insurance). The insurance firm makes zero profits with this insurance premium.

The Decision to Insure

Insurance	Burglary (Pr = .1)	No Burglary (Pr = .9)	Expected Wealth	Standard Deviation
No	40,000	50,000	49,000	3000
Yes	49,000	49,000	49,000	0

- E(X) without insurance = 0.1*(50,000 – 10,000) + 0.9*(50,000) = 49,000.
- E(X) with insurance = 0.1*(50,000 – 1,000) + 0.9*(50,000 – 1,000) = 49,000.
- With insurance, **risk is eliminated** as variance or standard deviation = 0.
- For risk averse consumers, guarantee of same income regardless of outcome has higher utility than facing the probability of risk.
- For the same expected wealth, expected utility with insurance is higher than without (for a **risk averse** individual).
- Thus, when fair insurance is offered, the **risk averse person fully insures**.

Fair Insurance

- With fair insurance, total premiums raised = E(Loss) = E(coverage).
- So, insurance companies usually offer **less** than fair insurance to cover their operating costs.
- A **monopoly insurance** company could **charge up to the risk premium** – the maximum the policyholders are willing to pay.

Insurance for Diversifiable Risk

- Insurance companies know that although single events are random and largely unpredictable, the average outcome of many similar events can be predicted.
- When insurance companies sell many policies (**e.g.** fire insurance, health insurance, etc.) or the same policy to many individuals (**e.g**. health insurance to all employees from many firms), they face relatively little risk by "risk pooling".

Obtaining Information

- **Collecting accurate information** before acting can reduce risk and increase EV and EU.
- Investors look at **Moody's and S&P's ratings** before buying stocks and bonds. Their letter-grade ratings reflect whether a bond's issuer has made timely payments in the past, whether the issuer is in danger of becoming bankrupt, and other problems.
- The lowest ranked, junk bonds, are generally issued by new firms.

Uncertainty

Assume Galen has a utility function $U(X) = 3X^{0.5}$. They have the option between

job 1 which gives $65 with 0.6 and $25 with 0.4

job 2 which gives $48 with certainty

Which job does Galen take?

How much does a certain job need to pay to offer him the same utility as job 1?
What is his risk premium?

Asymmetric Information

• Asymmetric Information: a situation where one party knows more than others.

• Many markets such as insurance, financial credit and employment are characterized by asymmetric information about product quality.

• Such asymmetric information leads to opportunistic behavior:
  - Adverse selection or lemons problem.
  - Moral hazard.

Asymmetric Information Implications

- Many markets such as insurance, financial credit and employment are characterized by asymmetric information about product quality.
- E.g. in the case of employment, a potential candidate knows more about their skills than the prospective employer.
- Such asymmetric information leads to opportunistic behavior:
  - **Adverse selection** or **lemons problem**.
  - **Moral hazard**.

15.1 Adverse Selection

- Since the price offered is less than the value of the good cars, sellers of good cars will not sell their products.
- Similar situations also arise in many other markets: **Health Insurance**, **Auto Insurance**, **Financial Credit**, etc.
- When auto insurance companies cannot distinguish between good and bad drivers, they will base **premium** on the **average risk**.
- Good drivers will find the premium too high and choose not to insure.
- This results in a higher proportion of risky drivers in the pool of insured, raising the accident probability among the insured.
- In response to this (higher accident probability), insurance companies raise the premiums, driving low-risk drivers out of the market–**adverse selection**.

Lemons Problem: No Inefficiency

- Assume risk neutral potential buyers of used cars who value high quality cars at $2,000 and low quality at $1,000. If they cannot distinguish between high and low quality sellers, they offer $1,500 on the average.
- If high quality sellers are willing to accept $1,250 and low quality $750, all cars will be sold.
- In this case **asymmetric information** causes **no inefficiency** as all cars are bought by buyers who value them more than the sellers.

Lemons Problem: Inefficiency

- On the other hand, if high quality sellers need at least $1,750, then high quality cars will not be sold; only low quality cars will be sold.
- Knowing that only low quality cars are being sold at equilibrium, buyers pay $1,000, the price they are willing to pay.
- This is **inefficient** because high quality cars remain at the hands of the sellers who value them less (= $1,750) than potential buyers (who value them at $2,000).

Lemons Problem: Deadweight Loss

- **Deadweight loss** of high quality cars not being sold (adverse selection): 2,000 - 1,750 = 250/car.
- If both buyers and sellers know the quality of the cars, then good quality will be sold for 2,000 and bad quality will be sold for 1,000.
- In this case of **NO asymmetric information**, there is **not an adverse selection problem**.

Asymmetric Information

In a market of used gaming consoles, both good used gaming consoles and inferior used gaming consoles are available. Owners of those gaming consoles have information of the actual qualities of the gaming consoles, whereas the buyers do not. In the market, 50% of all used 3DS are good, and 50% are inferior. All buyers are risk neutral and are willing to pay $130 for a good used 3DS, but only $80 for an inferior used 3DS. The owners of the good used 3DS are willing to sell them at a price no lower than $120. The owners of the inferior used 3DS are willing to sell them at a price no lower than $60.

1. What is the equilibrium price?
2. For what relative fractions of good used 3DS and inferior used 3DS will adverse selection not occur?

Asymmetric Information

Suppose that half the population is healthy and the other half is unhealthy. If a healthy gets sick, the medical cost is $1,000; for an unhealthy this cost is $10,000. In each year, the probability that anyone gets sick is 0.4. Although each person knows whether he or she is healthy, the insurance company does not. Both the insurance company and the people are risk neutral.

If the insurance company offers complete actuarially fair (i.e. 0 profits for the company) insurance, what is the premium?
At the price that you determined in part a, do healthy people purchase the insurance?
If only unhealthy people purchase insurance, what is the price of insurance?