



commerce
undergraduate
society



COMM 295

MIDTERM REVIEW SESSION

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Introduction

An _____ refers to the development and use of a model to test hypotheses and form explanations for some phenomenon

- Useful theories are testable
 - example: if the price of a good increases, the quantity demanded of that product falls
 - Human behavior depends on tastes, and tastes change randomly at random intervals → not a useful theory

Type of Statement	Definition
Positive (descriptive) statement	a _____ assertion of fact; does not need to be true, only testable e.g. advertising on the internet will increase the amount of monthly sales at a car dealership
Normative (prescriptive) statement	A statement about whether something is _____ or _____; often a value judgment e.g. students <i>should</i> not skip class



Introduction

Question 1: Charging a luxury yacht tax is good for BC residents in the long run because the luxury yacht tax will provide a signal that disincentivizes the purchase of luxury yachts and help with fair income distribution.

This statement is _____ and therefore a _____ statement.

- a. Non-testable, positive
- b. Testable, positive
- c. Non-testable normative
- d. Testable normative



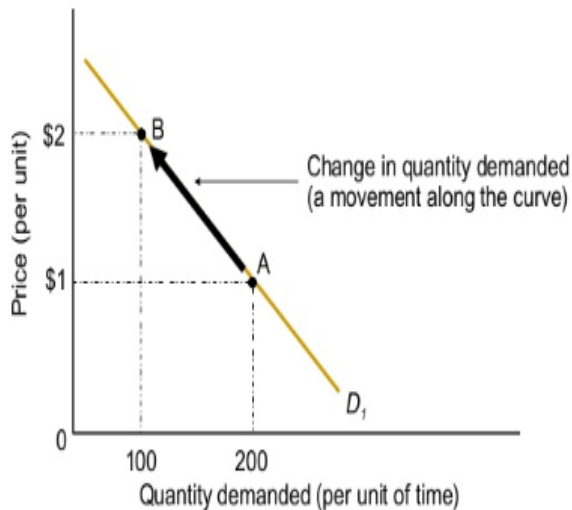
Supply and Demand

Law of Demand

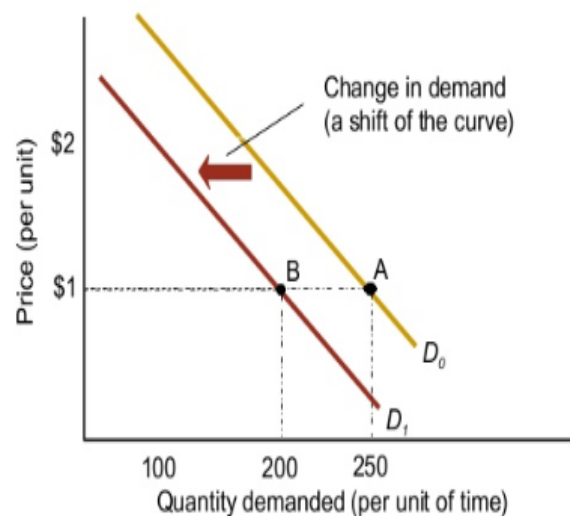
Quantity demanded _____ when price falls: Demand curve slopes downward
→ empirical statement (lots of evidence supporting this law from observation of real markets)

Type of Change	Result
Change in Quantity Demanded and Supplied	_____ from a change in price
Change in Demand and Supply	_____ in the curve

Change in Quantity Demanded and Supplied



Change in Demand and Supply



Demand and Supply Determinants: changes in the following factors will cause a change in _____

Demand Determinants

- Income
- Price of Related Goods
 - Substitutes/Complements
- Information
- Consumer Tastes
- Government Regulation
- Expectations

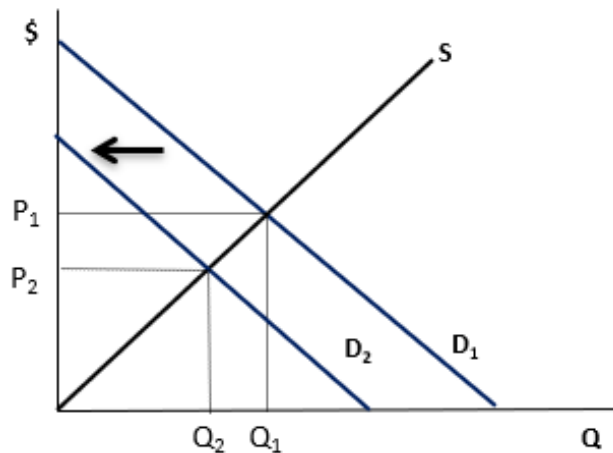
Supply Determinants

- Weather
- Input prices
- Number of producers
- Technology
- Expectations for future prices
- Government Regulation

Supply and Demand



Question 2: Consider the market for red apples in Edmonton as shown below. Red apples are a normal good (demand increases when income increases). Which of the following events might have caused the demand curve for red apples to shift to the left (D1 to D2)?



- A. An increase in consumer incomes
- B. A decrease in consumer incomes
- C. A decrease in the price of green apples
- D. An increase in the price of red apples
- E. B and C

Question 3: Suppose the market demand for coats is denoted by $Q=5000-5P+5P_R$, where Q and P denote quantity demanded and price of coats and P_R is the price of a related good R , and market supply for calculators is $Q=300+5P$

(a) What is the relationship between coats and R ?



(b) Suppose $P_R = 150$ initially. Calculate the equilibrium price and quantity for coats. Show this outcome in a clearly labeled diagram.

(c) Suppose the price of R increases to $P_R = 200$. Show this change in the diagram you drew for part (b), and calculate the resulting equilibrium price and quantity for coats.



Elasticity

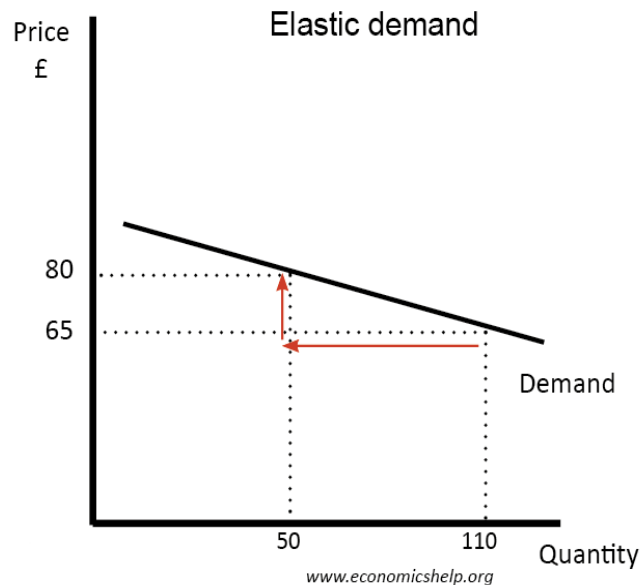
Price Elasticity of Demand

Textbook definition: measures the _____ in the quantity demanded resulting from a percentage change in price.

- In most cases, it is a negative number
 - As price increases, quantity demanded decreases
 - As price decreases, quantity demanded increases
- Another way of thinking: it is the _____ of quantity demanded to a change in price

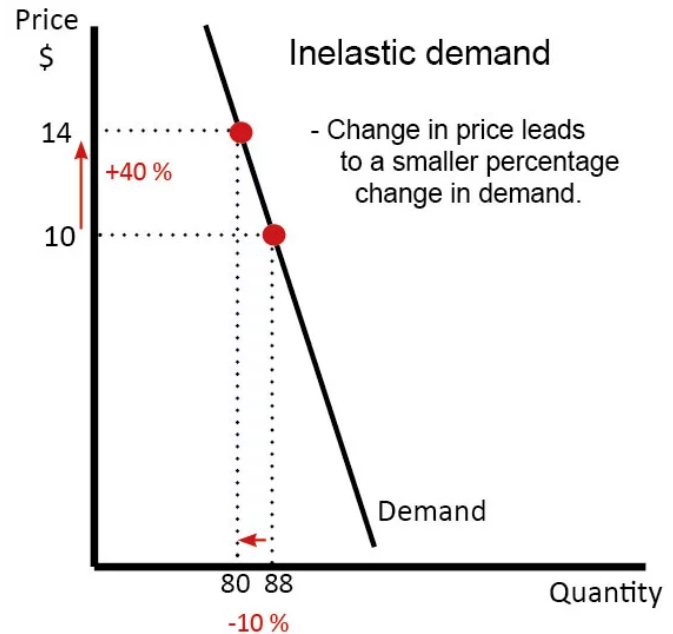
Elastic Demand: demand for which a percentage change in a product's price causes a larger percentage change in quantity demanded.

- Shown with a flatter curve
- When $|\epsilon| > 1$, it is price _____
- When demand is elastic, total revenue and the change in price have an _____ **relationship** → total revenue changes in the opposite direction to the change in price.

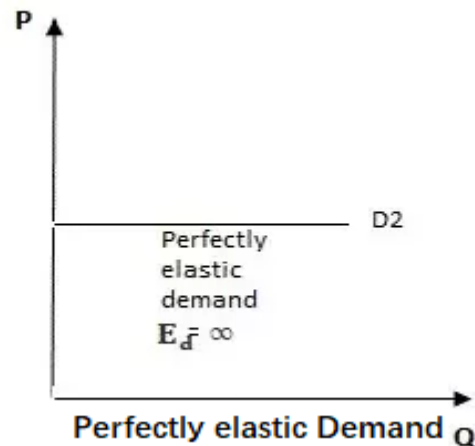
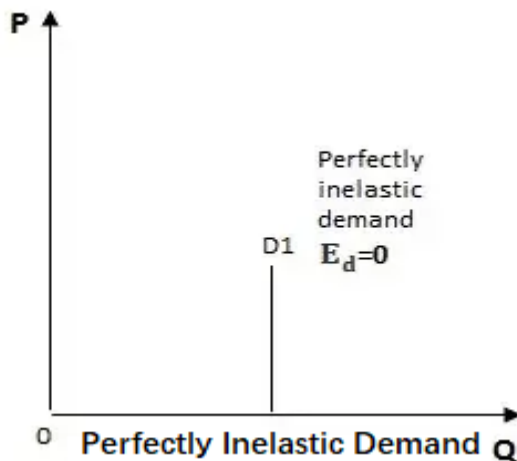


Inelastic Demand: demand for which a percentage change in a product's price causes a smaller percentage change in quantity demanded.

- Shown with a steeper curve
- When $0 < |\epsilon| < 1$, it is price
- When the demand is inelastic, the price and total revenue have a relationship → total revenue changes in the same direction as the change in price.



Perfectly Elastic and Perfectly Inelastic



Arc Elasticity

$$|E_d| = \frac{\frac{Q_2 - Q_1}{\left(\frac{Q_2 + Q_1}{2}\right)}}{\frac{P_2 - P_1}{\left(\frac{P_2 + P_1}{2}\right)}} = \frac{\% \Delta Q}{\% \Delta P}$$

Point Elasticity

$$E_p^D = \frac{\% \Delta Q}{\% \Delta P} = \frac{\frac{dQ}{Q}}{\frac{dP}{P}} = \frac{P}{Q} \cdot \frac{dQ}{dP}$$

- Even with a linear demand curve, the price elasticity of demand is NOT the same at all points along the curve because it is calculated using % change.

Income Elasticity of Demand

- Goods consumers regard as “necessities” tend to be income inelastic.
e.g. medicine
- Goods consumed regard as “luxuries” tend to be income elastic.
e.g. Luxury brands and expensive restaurants

Cross-Price Elasticity of Demand

- Measures the percentage change in the quantity demanded of one good that resulted from a percent change in the price of another good.

Substitutes

- Cross-price elasticity of demand is positive for substitute goods.
e.g. when the price of butter increases, quantity demanded of margarine rises.

Complements

- Cross-price elasticity of demand is negative for complementary goods.
e.g. when the price of cars increases, quantity demanded of tires decrease.



Elasticity

Question 4: Here is a table showing the percentage changes in price and quantity

Change in Quantity	Change in Price	Elasticity
-7%	7%	
-5%	3%	
20%	10%	

What are the elasticities?

When does the law of demand hold?



Production and Cost

Measures of Productivity

- Average Product of Labor: $APL = Q/L$
- Average Product of Capital: $APK = Q/K$
- Marginal Product of Labor: $MPL = dQ/dL$ (assuming K is constant)
- Marginal Product of Capital: $MPK = dQ/dK$ (assuming L is constant)

Returns to Scale

- Original function $Q = F(K, L)$
- Increase both inputs by a factor of c (where $c > 1$)
- New function $Q' = F(cK, cL)$
- If $Q' > cF(K, L)$ then there is increasing returns to scale.
- If $Q' < cF(K, L)$ then there is decreasing returns to scale.
- If $Q' = cF(K, L)$ then there is constant returns to scale.

Cost

Marginal Cost (MC): the cost of producing one more unit of Q

$$MC = \frac{dTC}{dQ}$$

Total Cost (TC) = Fixed Cost (FC) + Variable Cost (VC)

Average Cost (AC) = $FC/Q + VC/Q = AFC + AVC$

- The MC curve always crosses the ATC curve at the minimum ATC.



The Law of Diminishing Marginal Returns (Thomas Malthus)

If a firm keeps _____ an input, holding all other inputs and technology constant, the corresponding increases in output will eventually become _____

e.g. growing wheat requires suitable land, seeds, labor, capital in the form of machines, fertilizer, and possibly other chemical inputs. Increasing the amount of land, while holding all other inputs fixed, will eventually reach a point where additional land produces little additional output

Economies of Scale

- *Economies of scale* mean that the average cost falls as output rises.
 - *Constant costs* means average cost is constant as output rises.
 - *Diseconomies of scale* means average cost rises as output rises.
-
- Economies of scale are normally caused by increasing returns to scale.
 - Economies of scale is a _____; increasing returns to scale is a production concept. They are related but not the same thing.



Production and Cost

Question 5: Here are two production functions. K is fixed (and positive).

1. $q = 10K + 5L$
2. $q = 10KL^{0.5}$

- A. Both production functions satisfy the LDMR.
- B. Only production function 1 satisfies the LDMR.
- C. Only production function 2 satisfies the LDMR.
- D. Neither production function satisfies the LDMR.
- E. Not enough information is given to answer the question.

Question 6: The average variable cost of producing metal sunglasses is given by $AVC = 3 + 0.03q$. The total cost of producing 100 metal sunglasses is 1375. Find the:

- Marginal cost
- Fixed cost
- Total cost of producing 80 pairs of metal sunglasses



Question 7: If the production function of Pitt Meadows Bakery is $Q = K^{0.5}L^{0.8}$, assuming K is constant, what kind of returns of scale does Pitt Meadows Bakery have?

Question 8:

The table below shows the number of hockey sticks that Sher-Wood Hockey Inc. produces each day using various combinations of capital (K) and labour (L). The underlying production function has both:

	$K=1$	$K=1.5$	$K=2$
$L=1$	4	8	13
$L=1.5$	8	15	20
$L=2$	15	21	28

- A. Diminishing marginal returns to labour and increasing returns to scale.
- B. Constant marginal returns to labour and increasing returns to scale.
- C. Diminishing marginal returns to labour and decreasing returns to scale.
- D. Constant marginal returns to labour and decreasing returns to scale.



Estimation and Regression Analysis

Regression analysis: statistical technique used to estimate the mathematical relationship between a dependent variable and one or more explanatory variable

When estimating a demand curve, the points do not lie on the line precisely due to random error.

- The **residual** is the vertical distance between the estimated demand curve and the actual data points.

When we use Excel, the method of “**ordinary least squares**” is used

- This method makes the sum of squared residuals as small as possible to form an estimated regression line.

The degree to which a regression line is a “good fit” for the data can be measured by the **R2value**.

- **R2value:** measures how well the estimated regression line fits the data; the proportion of total variance (of the response variable) that is explained by the model (the explanatory variable)
 - When R2 is 1.0, 100% of the variation in the response variable is explained by the explanatory variable

Standard error: how much the estimated coefficient would vary in repeated samples

- Small standard errors indicate precise estimates
 - Various estimated coefficients are tightly bunched around the true coefficient

T-statistic: equals the coefficient divided by the standard error

- Larger t-statistics indicate greater confidence that the true coefficient differs from zero
- When the absolute value of the t-statistic is greater than 2, it is considered important or “statistically significant”

$$\text{estimated coefficient} \div \text{standard error} = t - \text{statistic value}$$



Estimation and Regression Analysis

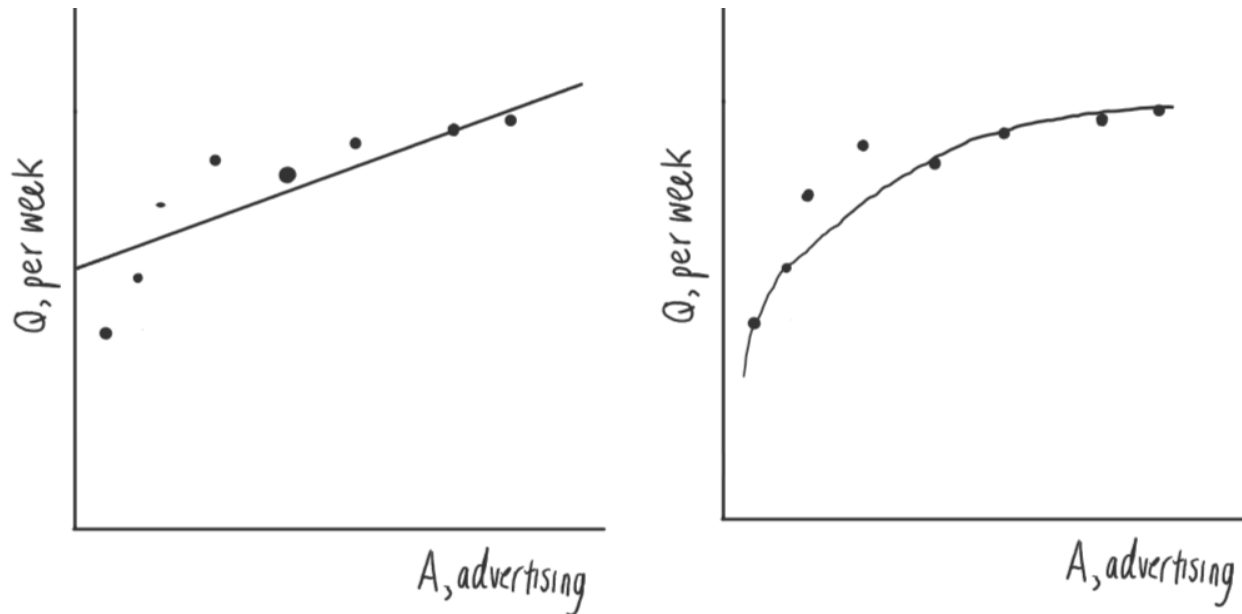
Question 9: Consider the following scatterplot outlining the salaries of executives.



- A) The linear OLS regression under-estimates the salary of younger executives.
- B) The linear OLS estimation is likely to show that marginal returns to age is diminishing.
- C) The R^2 value with linear OLS regression is likely to be higher than that with quadratic estimation.
- D) The quadratic OLS estimation shows that executive's salary increases with age at an increasing rate.



Question 10. Use the two regressions that illustrate the effect of advertising expenditure on quantity demanded below to choose the correct statement(s).



- A. The quadratic regression fits the data better and has a smaller R^2 statistic value.
- B. The coefficient for A^2 in the quadratic regression should be statistically significant.
- C. The quadratic regression curve underestimates the effect of A because the level of advertisement when $A=4$ actually generates a demand Q above what is predicted by the regression curve
- D. All of the above.



Question 11: Karen is selling strawberries outside of The Nest. She is curious about how the quantity of strawberries sold (Q_s) is affected by the temperature of the day (T) and the price he sets. After collecting information about Q , P , and T in a single day, she runs a regression of Q on P and T . The results from the regression are shown in the table below, with R-squared statistic being 0.91. Answer the following questions about this regression.

	Coefficients	Standard Errors
Intercept	-38.23	5.19
Price	-13.93	2.38
Temperature	8.38	8.23

1. The dependent variable is _____.
2. The estimated demand function is _____.
3. The t-stat for the coefficient of temperature (T) is _____ and the t-stat for the coefficient of price (P) is _____.
4. State whether the coefficients on temperature (T) and price (P) are statistically significant at the 5% significance level and explain how you know that.
5. After trying another regression specification by not including temperature (T) in the regression, the R-squared statistic changes to 0.73. Is this new specification better or worse than the original one?



Perfectly Competitive Markets

Characteristics of Perfectly Competitive Firms:

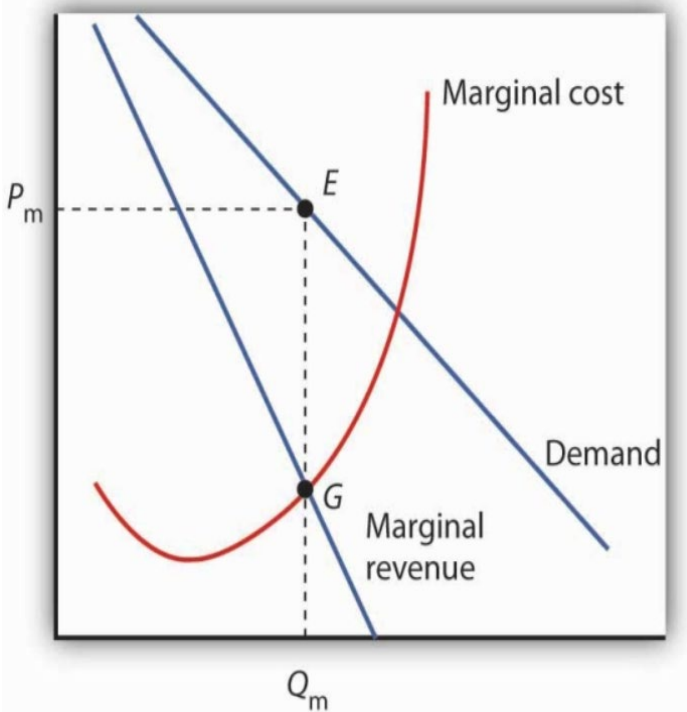
1. *Price-Taking*: The individual firm produces a very small share of the total market output and, therefore, cannot influence the market price.
2. *Product Homogeneity*: The products of all firms are perfect substitutes.
3. *Freedom of Entry and Exit*: There are no costs that make it difficult for a firm to enter or stay in the industry.
4. *Perfect Information*: Buyers and sellers have perfect information.
5. *Low Transaction Costs*: There are low transaction costs of buying and selling.

Profit for Competitive Firms: $\pi(q) = R(q) - C(q)$

Output Decision:

- The profit of competitive firms is maximized when **P=MR=MC**
 - For competitive firms, the *marginal revenue* is equal to *price*
 - MR=MC is the level of output where marginal profits are zero (or when there is no further room for increasing profits by producing more).





- When $Q < Q_m$, marginal revenue is greater than marginal cost, meaning that for each additional unit produced, revenue will be higher than the cost.
→ firms will produce more
- When $Q > Q_m$, marginal revenue is less than marginal cost, meaning that for each extra unit produced, the cost will be higher than revenue.
→ firms will produce less
- $Q = Q_m$ ($MR=MC$) is the sweet spot in between that allows a firm to maximize profit.

Short Run Shutdown Decision:

- If $P > AVC$, a firm will still produce even if it is experiencing a loss
 - This is because firms can reduce their losses by producing more when $P > AVC$
 - Revenue can cover all of VC and a portion of FC. As a result, by producing, the firm's loss $< FC$
 - In the short run, firms can avoid variable costs (VC) such as labor costs by shutting down, but not the (sunk) fixed costs (such as rent)
- If $P < AVC$, the firm will shut down
 - In this case, the firm cannot cover even its VC. By producing, the loss becomes greater than FC.
 - If it shuts down, then the firm's loss is limited to its FC

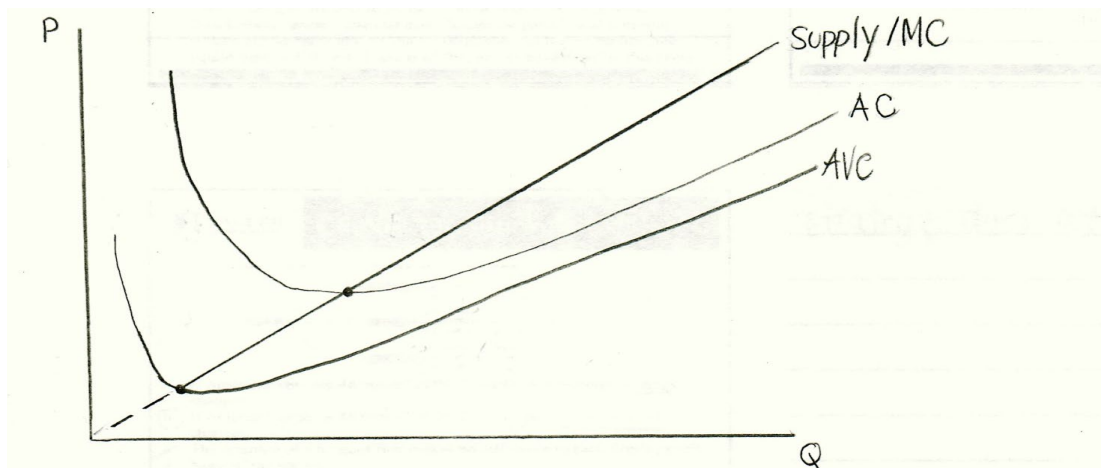


Long Run Shutdown Decision:

- In the long run, all costs (FC and VC) are avoidable
- If $P < ATC$, then the firm will shut down
- If $P > ATC$, then the firm will continue to produce

The Short Run Supply Curve

- The short run supply curve is the MC above the minimum AVC
 - Firms won't supply when $MC < AVC$ for the same reason why firms shut down when $P < AVC$; producing below the minimum of AVC increases firm's losses.



Short Run Market Supply Curve

- Horizontal sum of the supply curves of all individual firms
 - The maximum number of firms in a market is fixed in the SR
- Market supply curve at any price is n times the supply of an individual firm
- The larger the n , the flatter (more elastic) the SR market supply curve is at each price
 - More firms \rightarrow more responsive to changes in price \rightarrow more elastic



Perfectly Competitive Markets

Question 12: Which of the following is true for a perfectly competitive industry with identical profit-maximizing firms in a long-run equilibrium?

- A. Firms produce where $P = MC$.
- B. Firms produce where $P = AC$.
- C. Each firm produces at the minimum of its long run average cost curve.
- D. a and b.
- E. All of the above.

Question 13: Assume that the golden retriever adoption industry is perfectly competitive. There are n identical firms (n is limited). Each firm has the following total cost function in the short run and the long run: $C(q) = 25 + 5q + q^2$ where q represents the number of golden retrievers. The fixed cost is unavoidable in the short run but avoidable in the long run.



1. What is the marginal cost function for each firm?
2. What is the equation for the firm's supply function?



3. What is the average variable cost function for each firm? At what price should the firm shut down?

4. What is the average cost function for each firm? At what price will firms exit the industry in the long run?

5. Suppose that market demand is given by $Q = 200 - 2P$. The long run industry equilibrium price is _____ and the industry output quantity is _____

6. In the long run equilibrium, there will be _____ firms and each firm produces quantity _____



Monopoly and Pricing with Market Power

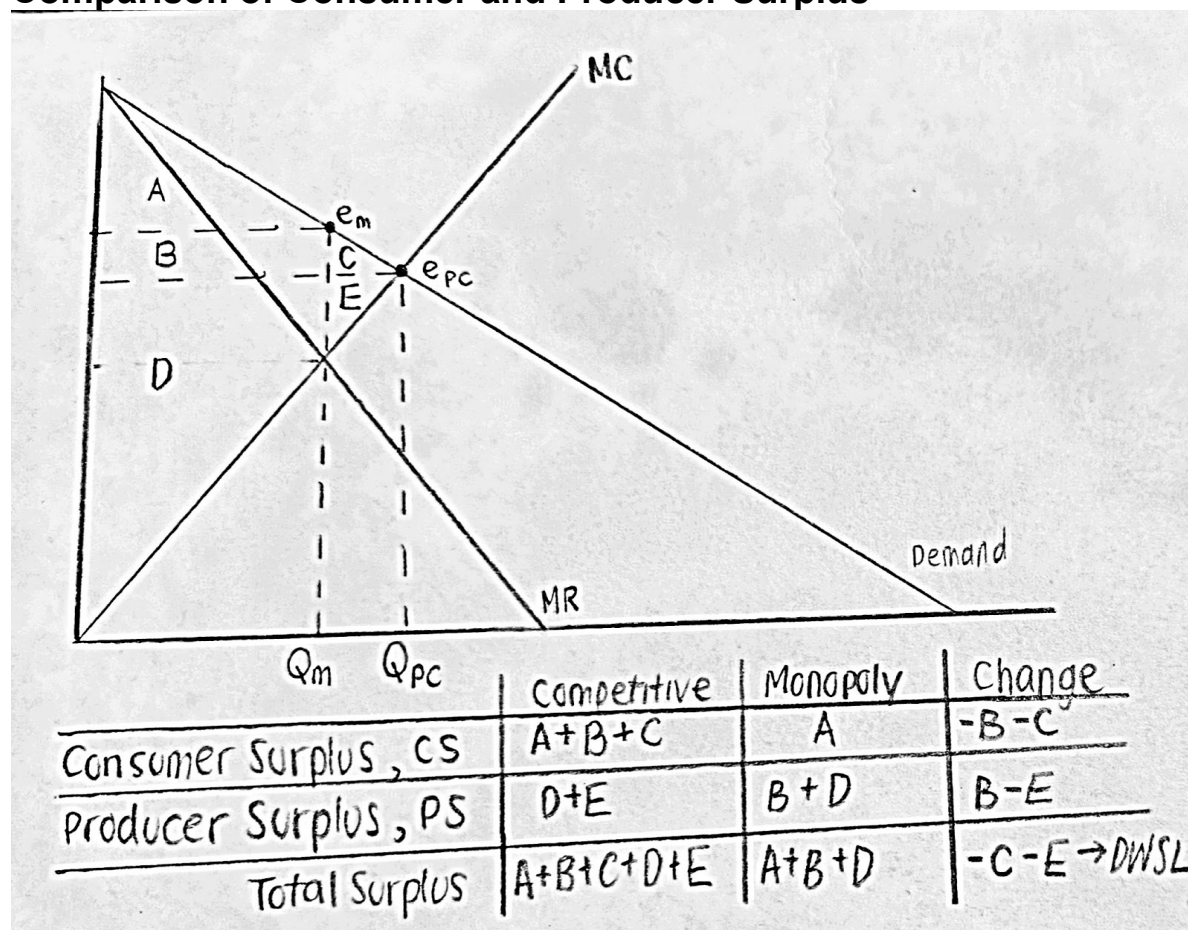
Monopoly: a sole supplier of a good for which there is no close substitute.

- As a single supplier, a monopolist faces the entire (downward sloping) market demand.
- A monopoly's output is the market output
- Profit Maximization: $MR=MC$

Profit-maximizing managers set their quantity according to this formula:

$$MR = p \left(1 + \frac{1}{\epsilon} \right) = MC.$$

Comparison of Consumer and Producer Surplus



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.

Non-linear price discrimination: Charging different prices based on the quantity

Two-Part Pricing: Charging an entry fee and a usage fee

Bundling: selling products together in sets

- Pure bundling: works when there is a negative correlation between the demands of consumers.
 - Changes lower price, but increases the number of consumers.
- Mixed bundling: allow the customer to buy the pure bundle or any of the bundle's components separately

Peak Load Pricing: charging higher prices during periods of peak demand in other periods

- used when there is a capacity constraint
- increases profits and spreads demand during off-peak time



Monopoly and Pricing with Market Power

Question 15: A monopoly faces a market demand curve given by $P = 15 - 0.25Q$. Its cost function is $C = 15 + 5Q$.

- a. Calculate the profit maximizing output and price for the monopolist (under uniform pricing strategy).
 - b. On a diagram, draw the demand curve, marginal revenue curve, and marginal cost curve. Clearly label the axes.
 - c. The deadweight loss under this uniform pricing strategy is _____.
- If the monopoly can carry out first-degree price discrimination, the deadweight loss in that case would be _____.



Question 16:

The table provides the reservation prices for three consumers who are deciding what to do during winter break. The consumers could travel to France or Germany. For this question, we will assume that these are the only consumers and the marginal cost is 0 for both choices. A travel agency is considering whether to use stand-alone pricing or pure bundling pricing strategy.

	France	Germany	Bundle
Jorge	110	100	
Travis	105	125	
José	100	150	

- a. Fill in the willingness to pay for the bundles in the above table.
- b. With stand-alone pricing, France should be priced at _____ and Germany should be priced at _____. The profit from both products is _____.
- c. With pure bundling, the profit-maximizing price for the bundle is _____, and the profit is _____



Oligopoly

Oligopolies are characterized by few sellers, limited entry, homogeneous or differentiated products, and firm's awareness of strategic interdependence between each other.

Cartels: formed when oligopolistic firms collude in setting prices or quantities to raise their profits

- Each member agrees to reduce its output from the level of output if it acted independently → market price rises and firms earn higher profits
- Cartels tend to produce the output analogous to monopolies → helps achieve the highest possible collective profit

Cournot Duopoly: two firms compete in choosing quantity (more realistic)

Bertrand Duopoly: two firms compete in choosing price.

Best Response Functions: shows the firm's best output as a function of the other firm's output and depends on the firm's marginal cost.

Nash-Cournot Equilibrium: the set of quantities chosen by firms where no firm can obtain higher profits by choosing a different quantity (holding the quantities of all other firms constant) → intersection of best-response curves



Solving Cournot Model and Deriving Best Response Functions:

Step 1: Find the residual demand function

Step 2: Use the residual demand function to find the MR equation of each firm

Step 3: Set $MR = MC$ for both firms

Step 4: Solve for Q_A and Q_B

Step 5: Use Q to find the price

Explanations of Steps:

Step 1: For *Cournot oligopolies*, where there are only two firms that are identical in marginal cost and their demand curves (this is also called a duopoly), we look for their residual demand curves so we can solve for the best-response functions.

- Because the two firms compete with one another, they consider each other's behavior when choosing profit-maximizing output.
 - The firms are concerned with the residual demand curve, which shows the market demand that is not met by other sellers at any given price.

Step 2: Once we know the residual demand function, we want to find the MR equation so we can set the profit maximizing condition that a firm should follow to maximize its profit given the behavior of the other firm

- The firm's best response - its profit maximizing output given the output of the other firm - is the output that equates its marginal revenue and its marginal cost
- Because the two firms have the same marginal cost and demand curves, their best-response functions will be identical

Step 4: To solve for Q_A and Q_B , we take the best response functions of one firm and plug it into another. This will give us the quantity a firm should produce in response of another.



Oligopoly

There are two firms in a Cournot duopoly. The market demand function is $Q = 339 - P$ and the cost function is $C = 147Q$. Find the equilibrium price, the quantity produced by each firm, and the profit of each firm.



Game Theory

Game Theory: tries to determine the optimal strategy for each player

A game consists of:

1. Players (i.e. firms)
2. Rules (simultaneous, sequential)
3. Strategies (price and quantity decisions, given the other's move)
4. Payoffs (what each player receives for the combination of strategies)

Static game: each player acts once and at the same time

Dynamic Game: arises when players move sequentially or repeatedly

Dominant Strategy: the strategy that is best no matter what one's rival does

Nash Equilibrium: the set of strategies such that each player is doing the best it can, GIVEN the strategy of the rival player(s)

Prisoner's Dilemma Game:

1. There is a dominant strategy solution
 2. An alternative outcome exists that provides higher payoffs for all players
- In a prisoner's dilemma game, the Nash Equilibrium can be worse than a possible outcome in the game
 - There can be another possible outcome that can give better payoffs than the Nash Equilibrium, but is not achieved

Player B			
Player A		Confess	Don't Confess
	Confess	-2, -2	0, -3
	Don't Confess	-3, 0	-1, -1



Game Theory

The following diagram below shows the payoff matrix for the decisions of you and your professor.

		Professor		
You		Test	Quiz	Cancel Class
	Eat	0,0	8,3	18,6
	Study	3,8	18,18	23,12
	Sleep	6,18	12,23	21,21

What is the Nash Equilibrium?

Is this a Prisoner's Dilemma Game?

