commerce undergraduate society

COMM 295

MIDTERM REVIEW SESSION

BY WENDY ZHANG

CMP

Table of Content

INTRODUCTION, SUPPLY AND DEMAND, ELASTICITY

Positive (Descriptive) Statement	Normative (Prescriptive) Statement
▪ A statement made based on facts ▪ Could be tested or proved ▪ Could be true or false—does not necessarily have to be a true fact!	▪ A statement made based on subjective opinion ▪ Debatable and persuasive

Market Equilibrium is the point where the demand curve intersects with the supply curve; this point is also called the market-clearing pricing.

The price elasticity of demand

Arc Elasticity

$$E_p = \frac{\frac{Q_2 - Q_1}{(Q_1 + Q_2)/2}}{\frac{P_2 - P_1}{(P_1 + P_2)/2}}.$$

Point Elasticity

$$E_p = \frac{\Delta Q / Q}{\Delta P / P} = \frac{\Delta Q}{\Delta P} \frac{P}{Q}$$

1. Identify the following statements as either positive or normative. Justify.

   a. Trump is going to be the best president for the Americans.

      Normative; this is an assertion of subjective opinion that cannot be tested by facts

   b. More people buy from Walmart because its merchandises are relative cheaper.

      Positive; this is a statement that could be proven or disproven by tests

   c. Samsung will go out of business by the time Apple releases iPhone 7.

      Positive; this can be tested—whether it be true or not, it could be proven or disproven by the outcome when the time comes

2. The demand function for the elementary band concert ticket is Q_d=4P-10, where Q_d is the number of tickets and P is the price per ticket. The supply is represented by Q_S=7P-40, where Q_s is the number of tickets supplied. What is the price and quantity of tickets sold at equilibrium?

i. Since equilibrium is where Q_d=Q_s, equate the two functions 4P-10 and 7P-40 and solve for P

   4P-10=7P-40

   30=3P

   P=$10

ii. Given P, plug the value in and solve for Q_d or Q_s
   Q_d=4($10)-10
   Q_d=30 tickets

3. Weekly demand for NuNunemon leggings is expressed as P=50-Q. Determine the price elasticity of demand at a price of $25 per pair of leggings.

i. Use point elasticity equation

$$E_P = \frac{\Delta Q / Q}{\Delta P / P} = \frac{\Delta Q}{\Delta P}\frac{P}{Q}$$

   Assume change of P to be from $25 to $0, then change of P is $25-$0=$25
   Plug in P=$25 and P=$0 into the demand function P=50-Q, so we get two Q's of 25 pairs of leggings with P=$25 and 50 pairs of leggings when P = $0; change of Q is therefore 25-50=-25 pairs of leggings

ii. Given change of P=$25, change of Q=-$25, P=$25 and Q=50-$25=$25, plug in using the equation
   E_P=(-25/$25) x ($25/25)= -1

ESTIMATION

Ordinary Least Squares draws a line across all data points such that the sum of squared residuals is as small as possible.

Goodness of Fit (R^2) suggests how well the relationship is explained by the function.

1. The regression for kale chips estimates a demand of Q_d=24-8P. The regression model has R^2 statistic of 0.83. You find out that one of the data points used to derive the demand function was incorrect. The actual price is $3.29 rather than $2.19 so the residual of that point should actually be smaller. What happens to R^2?

If residual is smaller, that means variation is smaller. Smaller variation means greater accuracy in the prediction of the relationship and since R^2 is the test of how well the relationship is explained by the regression function, R^2 becomes larger.

2. The demand function for diamond ring is Q_d=9000-8P where P is the price of the diamond ring. The standard error is 24.6. Given that P is $900, find the t-statistic for the price coefficient and interpret your t-statistic.

i. Use formula $\text{t} - \text{statistic} = \frac{\text{Price coefficient}}{\text{Standard error}}$

ii. Given price coefficient of $900 and standard error of 24.6, plug in the numbers

iii. t-statistic=$900/24.6=36.585

3. The number of thunderstorms in a week is positively correlated with midterm class average. It's tempting to conclude that higher midterm class average is caused by more thunderstorms in a week, but it's incorrect! What explains the relationship here?

   Third factor problem—more thunderstorms are correlated with higher midterm class average because students are more likely to stay home and study more for the midterm

PROFIT MAXIMIZATION

Profit is maximized at the point where **MR=MC**

MR is the derivative of the revenue function; MC is the derivative of the cost function

1. The short-run total cost function of Susie's furniture shop is $C=800+6Q-4Q^2+5Q^3+Q^4$. Rewrite the function to reflect average cost, average variable cost, average fixed cost and marginal cost.

   Average cost = $(800+6Q-4Q^2+5Q^3+Q^4)/Q$
   Average variable cost = $(6Q-4Q^2+5Q^3+Q^4)/Q$
   Average fixed cost = $800/Q$
   Marginal cost (derivative of the function) = $6-8Q+15Q^2+4Q^3$

2. Mike's donut shop has a price function of $P=702-7Q$ and a cost function of $C=35+2Q$. What is the profit maximizing quantity? Given that the average variable cost function is $AVC=Q/25$ and an average fixed cost of \$1600, should Mike shut down the shop in a short run? How about in a long run?

   Mike should shut down the shop in a short run if MR<AVC when profit is maximized
   i. To find point of profit maximization, **set MR=MC**
   Revenue (R)= $P \times Q = (702-7Q) \times Q = 702Q - 7Q^2$
   Marginal revenue (MR) = derivative of R function = $702 - 14Q$
   Marginal cost (MC) = derivative of C function = 2
   $702 - 14Q = 2$
   $14Q = 700$
   $Q = 50$
   $P = 702 - 7(50) = \$352$

   → Profit is maximized when P=\$354 and Q=50

   ii. Plug profit-maximizing quantity Q=50 into MR function
   $MR = 702 - 14(50) = \$2$
   iii. AVC = \$2 when Q=50
   iv. Since MR = AVC, Mike should not shut down in the short run

   Mike should shut down in a long run only if MR<AC when profit is maximized

   i. $AC = AVC + AFC = Q/25 + 1600$
   ii. AC = \$1602 when Q=50
   iii. Since MR is \$2, MR < AC, Mike should shut down in the long run

COMPETITION, CONSUMER AND PRODUCER SURPLUS

Perfect Competition

- Firms are price takers—price of good is determined by the market; cannot set price themselves
- There are many sellers and buyers
- Products are identical; no differentiation
- Buyers and sellers have full information of products
- Easy entry and exit in the long run
- Low transaction costs

Consumer surplus is the area under the demand curve but above the market price; it is the difference between what consumers are willing to pay for relative to the market price.

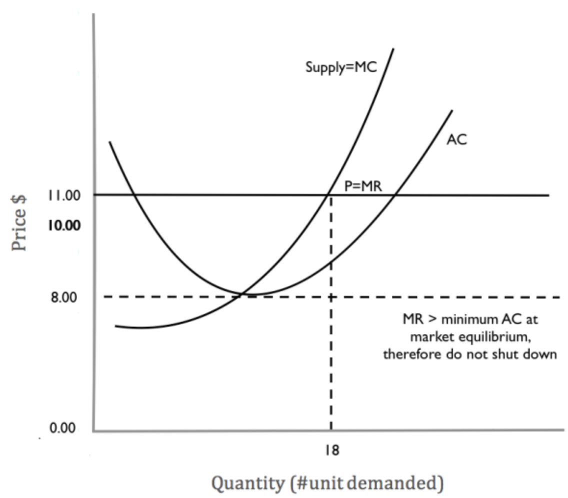
Producer surplus is the area under the market price and above the supply curve; it is the difference between the market price and the minimum amount that induces producers to produce.

1. The market demand for muffin tin is Q_d=84-6P. There are currently 20 firms in the market, each with a supply function of Q_s=2P-4.

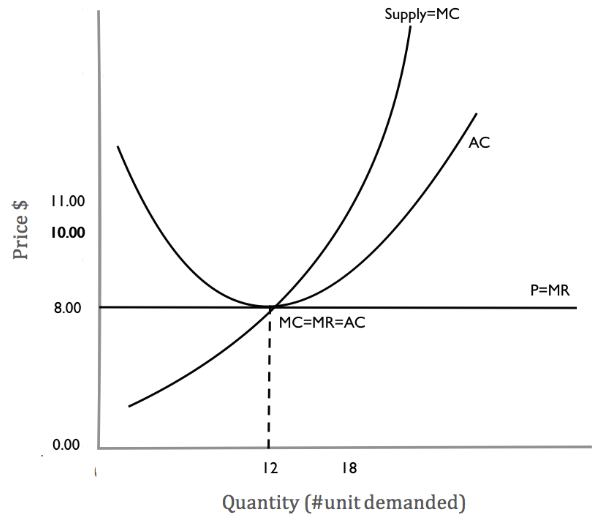
    a. If the minimum average cost is $8, explain using a graph whether the firms will enter or exit the market in a short run.

        i. Set Q_d=Q_s to get equilibrium quantity and price
        84 – 6P = 2P – 4
        88 = 8P
        P = $11; since MR = P in perfect competition, MR = $11
        Q = 18

        ii. Only shut down in the short run if MR < AVC and in the long run if MR < AC, but since MR>AC, the firms should not exit the market



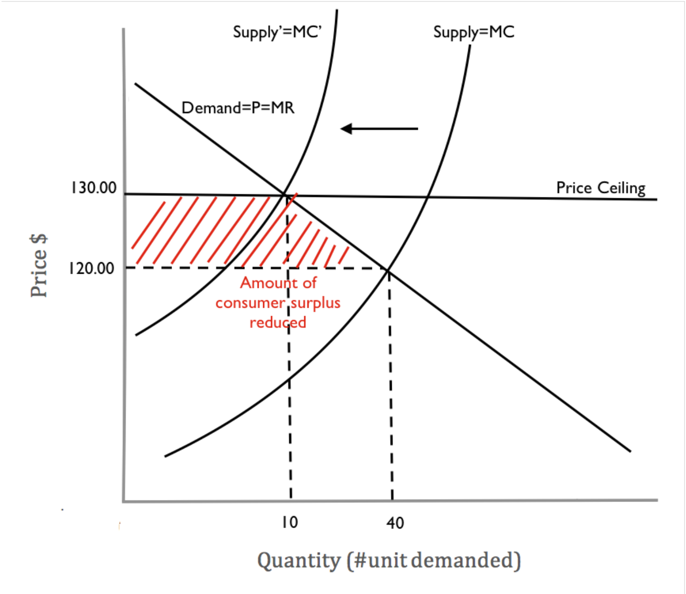
b. Derive a long run market supply curve.



2. A steel market has a demand of Q_d=110-3P. If price is $20 for each unit of steel, what is the consumer surplus?

   Consumer surplus is the area under demand curve and above MC (or P) curve
   Q_d = 110 – 3($20) = 50
   CS = [(110-20) x (50-0)]/2
   CS = 1125

3. The demand for the aluminum market is Q_d=400-3P. Market equilibrium is at Q=40. Suppose the government has placed a price ceiling at $150. What is the loss in consumer surplus? Show calculation and explain with a graph.
   i. Price ceiling raises price and reduces market demand for aluminum (a shift along the demand curve). The reduce in demand induces all producers to decrease supply (a shift of supply curve toward the left).
   ii. The new equilibrium shifts from Q = 40 and P = $120 to Q = 10 and P = $130
   iii. Old CS = [(400 – 120) x 40]/2 = 5600
   iv. New CS = [(400 – 130) x 10]/2 = 1350
   v. Change in CS = 5600 – 1350 = $4250 (loss in consumer surplus is $4250 as a result of price ceiling)


Supply'=MC'
Supply=MC
Demand=P=MR
130.00
Price Ceiling
120.00
Amount of consumer surplus reduced
Price $
10
40
Quantity (#unit demanded)

MONOPOLY

Monopoly

- Price setter—company sets the price at which to sell the product
- Only one firm in the market with no other substitutes

1. A monopolistic electricity provider faces a market demand curve of Q_d=40-2P. The cost of generating the electricity is expressed by C=890+8Q. At what price and quantity should the firm produce to maximize profit?

   Set MR = MC
   P = (40 – Q)/2 = 20 – Q/2
   Revenue (R)= P x Q = (20 – Q/2) x Q = 20 Q – Q^2/2
   Marginal revenue (MR) = derivative of R function = 20 – Q
   Marginal cost (MC) = derivative of C function = 8
   MR = MC = 20 – Q = 8
   Q = 12
   P = 20 – 12/2 = $14

2. Given that P=500-2Q and that C=40Q. At what quantity will a monopoly produce? What is the deadweight loss as a result?

   i. Set MR = MC
   Revenue (R)= P x Q = (500 – 2Q) x Q = 500Q – $2Q^2$
   Marginal revenue (MR) = derivative of R function = 500 – 4Q
   Marginal cost (MC) = derivative of C function = 40
   MR = MC → 500 – 4Q = 40
   4Q = 460
   Q = 115
   P = 500 – 2(115) = $270

   ii. Deadweight loss is the difference between the total surplus at perfect competition where no deadweight loss occurs and the total surplus of the monopoly where there is a deadweight loss
   In perfect competition, P = MC, so P = $40
   At P = $40, Q = 230
   TS at perfect competition = [(500 – 40) x 230]/2 = 52900
   TS at monopoly = [(500 – 270) x 115]/2 = 13225

TS (perfect competition) – TS (monopoly) = 52900 – 13225 = 39675
→ Deadweight loss is 39675

3. Ginger Ltd. used to be a perfectly competitive firm in a large market. It has a demand curve of Q_d=220-2P. The market cost function is C=2Q. One day, a thunderstorm destroyed all its competitors and all of a sudden, Ginger Ltd. becomes the monopoly. How much consumer surplus gets transferred to the producer?

i. Find profit-maximizing Q and P under perfect competition; P = MC
Q_d=220-2P
2P = 220 – Q_d
P = 110 – Q_d/2
MC = derivative of C function = 2
P = MC → 110 – Q_d/2 = 2
108 = Q_d/2
Q_d = 216; P = 110 – 216/2 = $2
CS (perfect competition) = [(110 – 2) x 216]/2 = 11664

ii. Find profit-maximizing Q and P under monopoly; MR = MC
Revenue (R)= P x Q = (110 – Q_d/2) x Q = 110Q – Q^2/2
Marginal revenue (MR) = derivative of R function = 110 – Q
Marginal cost (MC) = derivative of C function = 2
MR = MC → 110 – Q = 2
Q = 108; P = 110 – 108/2 = $56
CS (monopoly) = [(110 – 56) x 108]/2 = 2916

iii. Calculate change in consumer surplus = CS (perfect competition) – CS (monopoly)
11664 – 2916 = 8748 consumer surplus got transferred to Ginger Ltd. (producer)

Price Discrimination

1. A monopoly firm has a demand function of Q_d=900-6P and cost function of C=60+20Q. What is the profit under perfect price discrimination?

i. Find profit-maximizing Q and P
MR = MC
6P = 900 – Q
P = 150 – Q/6
Revenue (R)= P x Q = (900 – Q/6) x Q = 150Q – Q^2/6
Marginal revenue (MR) = derivative of R function = 150 – Q/3
Marginal cost (MC) = derivative of C function = 20
MR = MC → 150 – Q/3 = 20
Q = 390; P = 150 – 390/6 = $85

ii. Find producer surplus to determine profit
PS = [(150 – 85) x 390]/2 = 12675

2. Magical Produce Co. is a monopoly undergoing uniform pricing. It has a price function of P=140-2Q and cost function of C=68+6Q.

   a. If you are the manager trying to maximize profitability, will you practice perfect price discrimination? How profitable is perfect price discrimination? Explain and justify your answer.

      Under uniform monopoly pricing:

      MR = MC
      Revenue (R)= P x Q = (140 – 2Q) x Q = 140Q – $2Q^2$
      Marginal revenue (MR) = derivative of R function = 140 – 4Q
      Marginal cost (MC) = derivative of C function = 6
      MR = MC → 140 – 4Q = 6
      Q = 33.5; P = 140 – 2(33.5) = $73
      Profit = PS = [(140 – 73) x 33.5]/2 = 1122.25

      Under perfect price discrimination:

      P = MC
      140 – 2Q = 6
      2Q = 136
      Q = 68; P = 140 – 2(68) = $4
      Profit = PS = [(140 – 4) x 68]/2 = 4624

      4624 – 1122.25 = 3501.75 → Perfect price discrimination is $3501.75 more profitable than uniform pricing

   b. From the social standpoint, should Magical Produce Co. switch to perfect price discrimination? Explain and justify your answer.

      Yes, under perfect price discrimination, there is zero deadweight loss because the quantity being supplied by Magical Produce Co. is equal to a quantity that would be supplied by a perfectly competitive firm such that total surplus is maximized

   c. Assume that now Magical Produce Co. decides to go with perfect price discrimination. It has a new marginal cost function of MC=30+7Q. How much consumer surplus gets transferred to the producer?

      Under uniform monopoly pricing:

      MR = 140 – 4Q
      MR = MC → 140 – 4Q = 30 + 7Q
      Q = 10; P = 140 – 2(10) = $120
      CS = [(140 – 120) x10] = $200

Under perfect price discrimination:

All consumer surplus ($200) gets transferred to producer

3. Carcinogen Electricity Co. is a monopoly that decides to target two segments of consumer: Gen X and Gen Y. Gen X has a demand given by P=150-2Q while Gen Y has a demand given by P=60-Q/2. Cost function is 4Q. How should the company charge its customers to maximize profit?

   This is a group price discrimination problem; Carcinogen Electricity Co. should charge the two groups of consumer different prices
   For Gen X:
   MR = MC → 150 – 4Q = 4
   4Q = 146
   Q = 36.5; P = 150 – 2(36.5) = $77 → should charge group Gen X $77

   For Gen Y:
   MR = MC → 60 – Q = 4
   Q = 56; P = 60 – 56/2 = $32 → should charge group Gen Y $32

4. Wow Ltd. has a monopolistic demand of P=100-3Q and cost of AC=MC=10. The CEO of Wow Ltd. cannot decide on which pricing proposal to adopt for conference room rental (see table below).

Proposal A	Proposal B
$70/hr for the first 10 hours $55/hr for the first 15 hours $40/hr for the first 20 hours	$55/hr

   a. If you are the manager, demonstrate to your CEO which pricing strategy is superior.
      Compare profits of the two proposals (area of producer surplus)
      Proposal A:
      PS = (70 – 10) x 10 + (55 – 10) x (15 – 10) + (40 – 10) x (20 – 15) = 975
      Proposal B:
      Q = (100 – 55)/3 = 15
      PS = (55 – 10) x 15 = 675

      975 > 675 → proposal A generates a greater profit, hence is better

b. Explain from the consumer's perspective, which pricing is better overall?
Compare consumer surpluses of the two proposals (area of consumer surplus)
Proposal A:
CS = [(100 – 70) x 10]/2 + [(70 – 55) x (15 – 10)]/2 + [(55 – 40) x (20 – 15)]/2 = 225
Proposal B:
CS = [(100 – 55) x 15]/2 = 337.5

337.5 > 225 → proposal B generates greater consumer benefits, hence is better

c. Explain from the social standpoint, which pricing is better overall?

Compare deadweight loss generated by the two proposals (area of deadweight loss)
Proposal A:
DL = [(40 – 10) x (30 – 20)]/2 = 150
Proposal B:
DL = [(55 – 10) x (30 – 15)]/2 = 337.5

150 < 337.5 → proposal A generates smaller deadweight loss, hence is better

STATIC GAME

Dominant strategy is a strategy that is the best response to all possible strategic choices of the rival; there can only be one dominant strategy in a game.

Nash equilibrium is a set of strategies where each player is making its best response to the other player's strategy; there can be multiple Nash equilibria in a single game.

Prisoners' Dilemma game always has a dominant strategy and will never arrive at the best outcome (highest joint profits) for both firms.

1. The software market is dominated by Company X and Company Y. Both companies are deciding whether to launch their software updates. If rival company launches, it will harm the host company by capturing the entire market. If both companies do not launch, firms do not incur the launching costs and things remain the same as they have always been.

Company X

		Launch	Not launch
Company Y	Launch	1 / 1	0 / 3
	Not launch	3 / 0	2 / 2

a. What is the dominant strategy?

Dominant strategy is for both Company X and Company Y to launch

b. What is the Nash equilibrium?

Nash equilibrium is where both companies launch and each company gains 1

2. Both companies are deciding whether or not to pay for the improvement in supply chain. If one of them pays for the improvement, the improvement will benefit both companies but the company that pays will incur a cost while the rival company free rides.

		Company X	
		Pay	Not pay
Company Y	Pay	2 / 2	3 / 5
	Not pay	3 / 5	0 / 0

a. What is the Nash equilibrium in this game?

There is no Nash equilibrium in this game

b. What is the best response of each firm?

The best response for Company X is to pay when Company Y does not pay, and not pay if Company Y pays

The best response for Company Y is to pay when Company X does not pay, and not pay if Company X pays

3. Alice and Alex are deciding where to go for dinner. Both of them like pizza and sushi, but both prefer pizza over sushi.

		Alex: Pizza	Alex: Sushi
Alice	Sushi	-1 -1	3 3
Alice	Pizza	5 5	-1 -1

a. What is the Nash equilibrium in this game?

The Nash equilibria are where Alex and Alice both have sushi together, and where Alex and Alice both have pizza together

b. What should Alice and Alex do?

There is a Pareto criterion in this coordination game. Alice and Alex should do a pre-communication before picking their decisions to ensure they both arrive at the 5/5 outcome that maximizes collective benefits