Econ 301: Microeconomic Analysis

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Monopoly Behavior

Monopoly vs Competitive Equilibrium

- Compare FOC for optimal monopoly supply y_M^* and optimal competitive supply y_C^*:

$$\underbrace{p'(y_M^*)y_M^* + p(y_M^*)}_{MR_M(y_M^*)} = MC(y_M^*)$$

$$\underbrace{p(y_C^*)}_{MR_C(y_C^*)} = MC(y_C^*)$$

- What is relationship between y_M^* and y_C^*?
  - Since $p'(y) < 0$, MR_M is below the demand curve
  - So $y_M^* < y_C^*$ from intersections with MC curve
  - Also have $p_M^* > p_C^*$

Deadweight Loss of Monopoly

- Since $p_M^* > p_C^*$, we can calculate change in consumer surplus ΔCS
- We can also calculate competitive firm's profit and monopoly profit, giving $\Delta PS = \Delta\pi$
  - Note that profits go up, so $\Delta PS > 0$
  - Can also calculate $\overline{\text{PS}}$ from area above supply curve
- Calculate deadweight loss $DWL = |\Delta TS| = |\Delta CS + \Delta PS|$
  - No tax revenue to worry about

Deadweight Loss of Monopoly

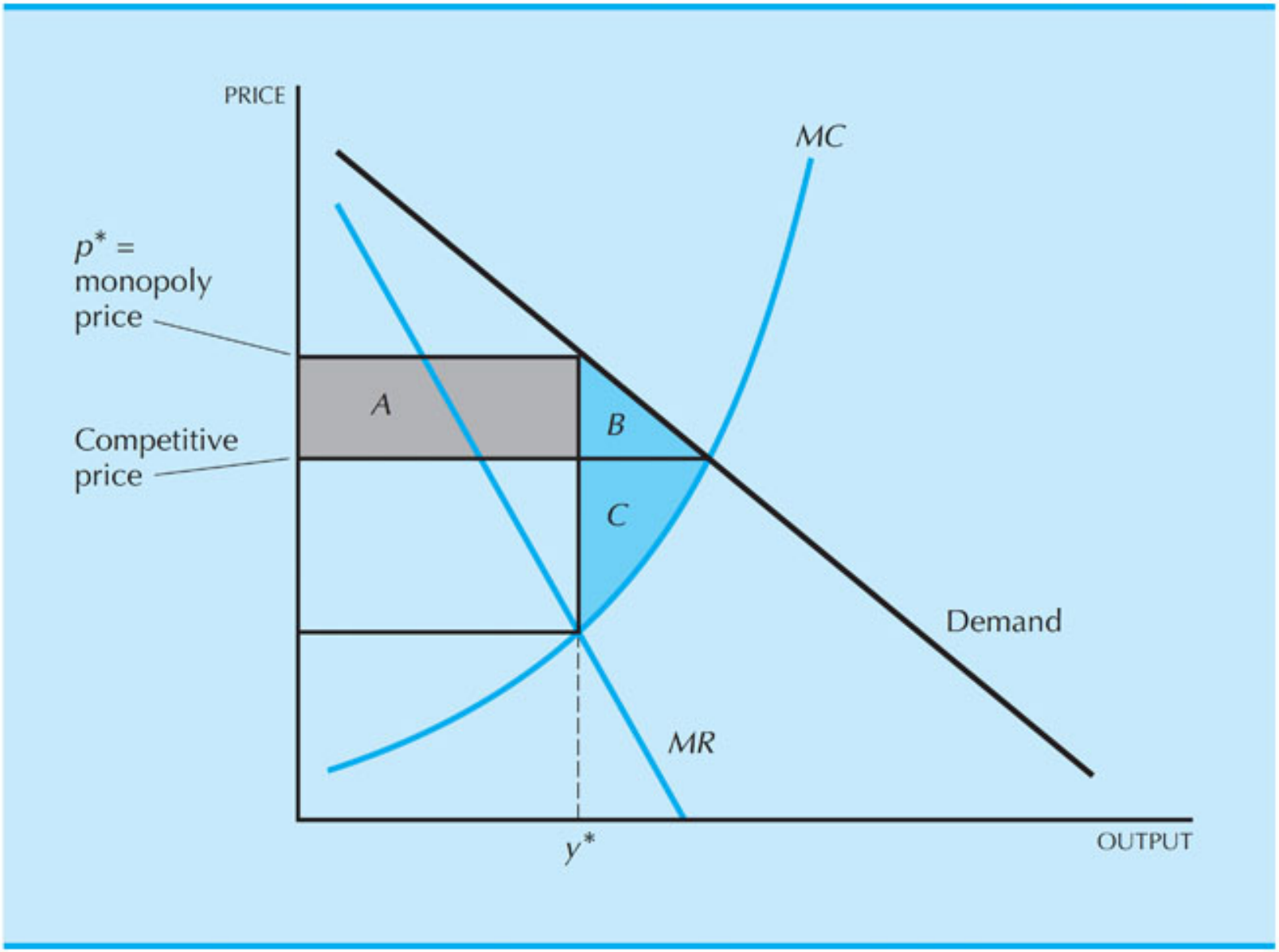

Figure 25.5

Expanding the Monopolist's Toolkit

- So far we have made several assumptions about the monopoly setting
  - Can only set one price regardless of who purchases, or how much
  - Only selling one kind of good
  - No competitive pressure at all
- Now we break these assumptions and see what happens

Price Discrimination

Price Discrimination

- We have *price discrimination* when monopolist can set different prices based on who is buying good and/or how much they are buying
- Three types of price discrimination:
  1. *First degree price discrimination*: sell every single unit for exactly its marginal utility
  2. *Second degree price discrimination*: Price depends on number of units sold but every consumer faces same discount
  3. *Third degree price discrimination*: Same price per unit for a given consumer, but different types of consumers pay different prices

First Degree Price Discrimination

- Also called *perfect price discrimination*
- Each marginal unit is sold to the person who values it most
- Thus price paid is equal to willingness to pay for that unit
- Sell up until price equals MC
- True first degree discrimination is very rare, since it is hard to know exact WTP of consumers
- What is consumer surplus in this case?
  - Consumer surplus is zero, since all buyers pay their full WTPs
- Is outcome Pareto efficient? Yes
  - Cannot make buyers better off without lowering monopolist profits
  - No other consumers willing to buy at profitable price

Second Degree Price Discrimination

- Price depends on number of units sold to consumer (but not on the consumer's WTP)
- Also called *non-linear* pricing
- Example? Bulk discounts
- Another version of second degree discrimination:
  - Rather than price depending on quantity, price can depend on quality
  - If prices are set correctly, consumers with high willingness to pay will sort into buying high-quality good
  - This is called *self selection*
  - Example? First class vs economy class, at different prices

Third Degree Price Discrimination

- Price depends on what type of consumer is buying good (but not how many units they buy)
- Example? Student or senior citizen discounts
- Note that we are assuming monopolist can tell types of consumers apart (but still not measure their individual WTP exactly)

Third Degree Price Discrimination: Monopolist's Problem

- Suppose there are two types of consumers with inverse demands $p_1(y_1)$ and $p_2(y_2)$
- Monopolist solves

$$max_{y_1,y_2} p_1(y_1)y_1 + p_2(y_2)y_2 - c(y_1 + y_2)$$

- What are FOC?

$$MR_1(y_1) = MC(y_1 + y_2)$$
$$MR_2(y_2) = MC(y_1 + y_2)$$

- Note marginal revenues from two types must be equal: $MR_1(y_1) = MR_2(y_2)$

Third Degree Price Discrimination: Monopolist's Problem

- Which consumer type will get the better price?
  - Can re-write MR equality condition as

$$p_1(y_1)\left[1-\frac{1}{|\epsilon_1(y_1)|}\right]=p_2(y_2)\left[1-\frac{1}{|\epsilon_2(y_2)|}\right]$$

  - Note $p_1 > p_2 \iff |\epsilon_2(y_2)| > |\epsilon_1(y_1)|$
  - So, type with more elastic demand gets lower monopoly price
  - Example? Senior citizens get discounts because they are more preice-sensitive

Third Degree Price Discrimination: Linear Demand

- Suppose the demands for two types of consumers are given by $x_1 = a - bp_1$ and $x_2 = c - dp_2$
- Assume marginal cost is zero
- What are monopolist's optimal prices and quantities?
  - Revenue is $\frac{a-x_1}{b}x_1 + \frac{c-x_2}{d}x_2$
  - Taking FOC with respect to x_1 and x_2 we find

$$x_1^* = \frac{a}{2} \qquad x_2^* = \frac{c}{2}$$

  - Solving for prices we find

$$p_1^* = \frac{a}{2b} \qquad p_2^* = \frac{c}{2d}$$

Third Degree Price Discrimination: Linear Demand

- What is price and quantity if monopolist can't discriminate? (ie must charge same price to both types of consumer)
  - Total demand is $x = x_1 + x_2 = a + c - (b + d)p$
  - Inverse demand is then $p = \frac{a+c-x}{b+d}$
  - Monopolist solves $\max_x \frac{a+c-x}{b+d} x$
  - Can solve to find $x^* = \frac{a+c}{2}$ and $p^* = \frac{a+c}{2(b+d)}$
- Note that total quantity supplied is the same as in discrimination case
  - True for linear demand but not in general
- In general, need to check that at optimal price, demand is positive for both types

Bundling

Bundling

- So far have assumed monopolist sells only one good
- If they sell multiple goods, they have another option that is distinct from price discrimination: bundling
- Suppose there are two types of consumers buying two software products from Microsoft:
  - Type A consumers: willing to pay \$120 for Word and \$100 for Excel
  - Type B consumers: willing to pay \$100 for Word and \$120 for Excel
- Assume equal proportions of types A and B, and $MC = 0$

Bundling Strategies

- If producer treats these software products as two different goods, what is optimal pricing strategy?
  - Set price to $100 in both markets, making $200 in revenue per person
- If producer *bundles*, ie treats the two programs together as one product, what is optimal price to set?
  - WTP for entire bundle is $220 for both types
  - Thus producer can charge $220 in revenue per person

Monopolistic Competition

Location Model

- Suppose two ice cream vendors are choosing location on the boardwalk at the beach
- Boardwalk of length L, price is fixed by government
- Consumers prefer to walk to closest ice cream stand
- What is socially optimal location of two vendors?
  - One at $\frac{1}{4}L$ and $\frac{3}{4}L$
- Will stands want to deviate from these locations?
  - Note that either firm can do better if they move towards middle of boardwalk
  - Only case where both firms happy: both located exactly at middle, ie $\frac{1}{2}L$
- Same logic applies along any dimension: can differentiate based on quality, marketing, packaging etc

Location Model: Multiple Vendors

- What happens if we have three vendors?
  - Note that if one vendor is stuck in middle, other vendors can "squeeze" her
  - If all vendors are at same location, any one of them will want to deviate left or right to capture more consumers as they walk by
  - Thus there is no equilibrium for three vendors
- We will discuss this idea more generally in the next section, on *game theory*