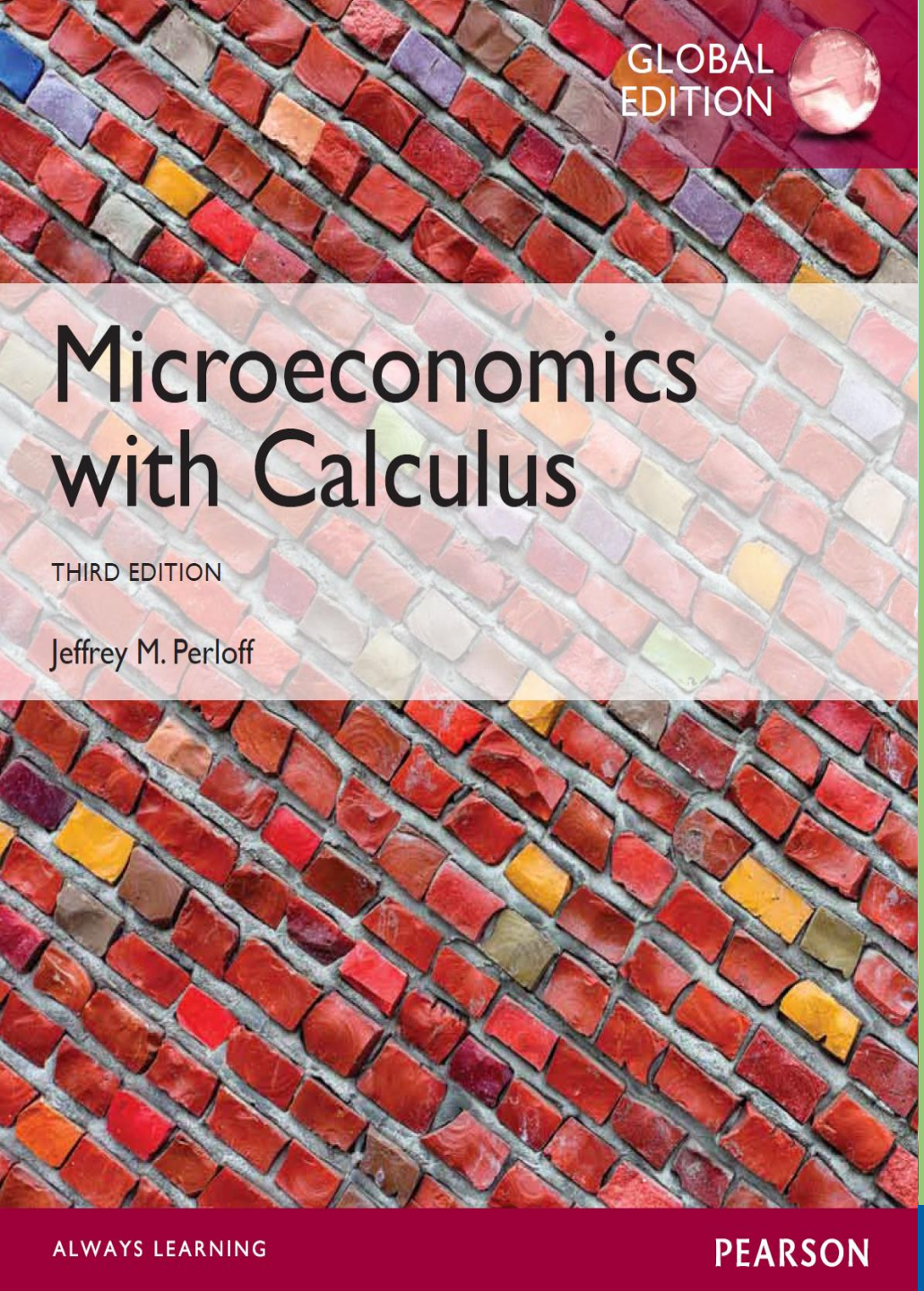


Lecture 6

Firm Pricing

PEARSON

Outline

0 Review on Monopoly
1 Conditions for Price Discrimination
2 Perfect Price Discrimination
3 Group Price Discrimination
4 Nonlinear Pricing
5 Two-Part Pricing
6 Tie-In Sales

Readings: Perloff 11.1, 12.1-12.6

0 Monopoly Profit Maximization

- Profit function to be maximized by choosing output, Q:
  - $\pi(Q) = R(Q) - C(Q)$, where
  - $R(Q)$ is the revenue function
  - $C(Q)$ is the cost function
- The necessary condition for profit maximization:

$$\frac{d\pi(Q^*)}{dQ} = \frac{dR(Q^*)}{dQ} - \frac{dC(Q^*)}{dQ} = 0$$

0 Monopoly Profit Maximization

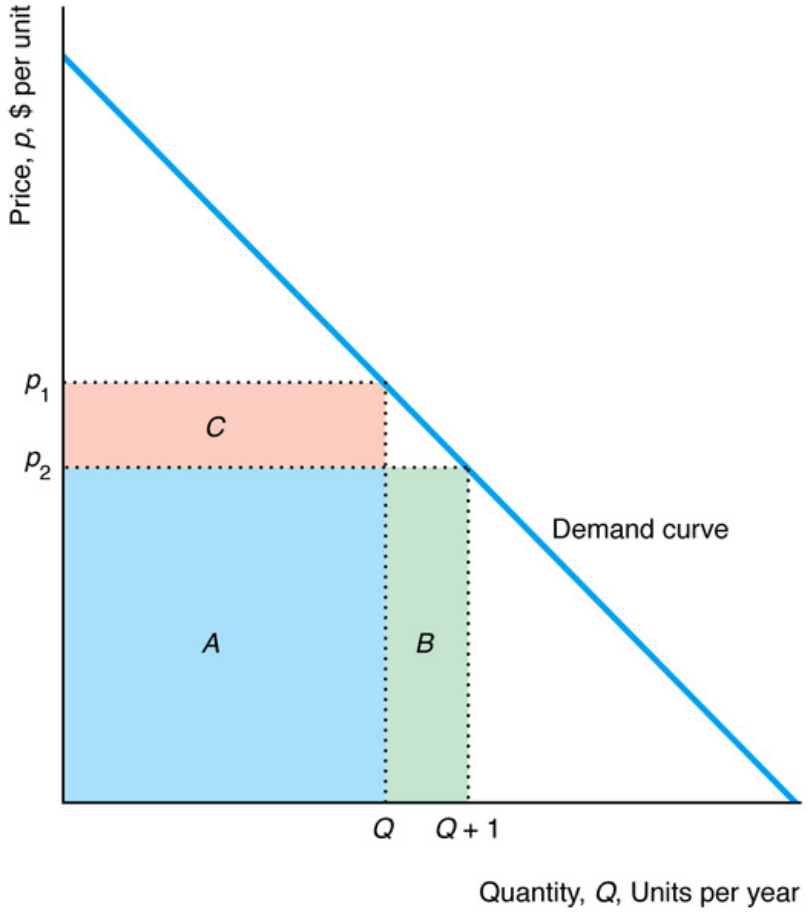
- A firm's MR curve depends on its demand curve.
  - MR is also downward sloping and lies below D
- If $p(Q)$ is the inverse demand function, which shows the price received for selling Q, then the marginal revenue function is:

$$MR(Q) = \frac{dR(Q)}{dQ} = \frac{dp(Q)Q}{dQ} = p(Q)\frac{dQ}{dQ} + \frac{dp(Q)}{dQ}Q = p(Q) + \frac{dp(Q)}{dQ}Q$$

  - Given a positive value of Q, MR lies below inverse demand.
- Selling one more unit requires the monopolist to lower the price
  - Price is lowered on the marginal unit **and** all other units sold

0 Monopoly Profit Maximization

- Moving from Q to Q+1, the monopoly's marginal revenue is less than the price it charges by an amount equal to area C



0 MR Curve and the Price Elasticity of Demand

- We can rewrite MR function so that it is stated in terms of elasticity:

$$MR = p + \frac{dp}{dQ}Q = p + p\frac{dp}{dQ}\frac{Q}{p} = p\left[1 + \frac{1}{(dQ/dp)(p/Q)}\right] = p\left(1 + \frac{1}{\varepsilon}\right)$$

- This makes the relationship between MR, D, and elasticity quite clear.
  - Everywhere that MR > 0, demand is elastic (ε<-1).
  - The quantity at which MR = 0 corresponds to the unitary elastic portion of the demand curve (ε=-1).
  - Everywhere that MR < 0, demand is inelastic (-1< ε<0).

0 Monopoly Example

- Inverse demand function: $p(Q) = 24 - Q$
  - Can be used to find the marginal revenue function:

$$MR(Q) = 24 - 2Q$$

- Quadratic cost function: $C(Q) = VC(Q) + F = Q^2 + 12$
  - Can be used to find the marginal cost function:

$$MC(Q) = \frac{dC(Q)}{dQ} = 2Q$$

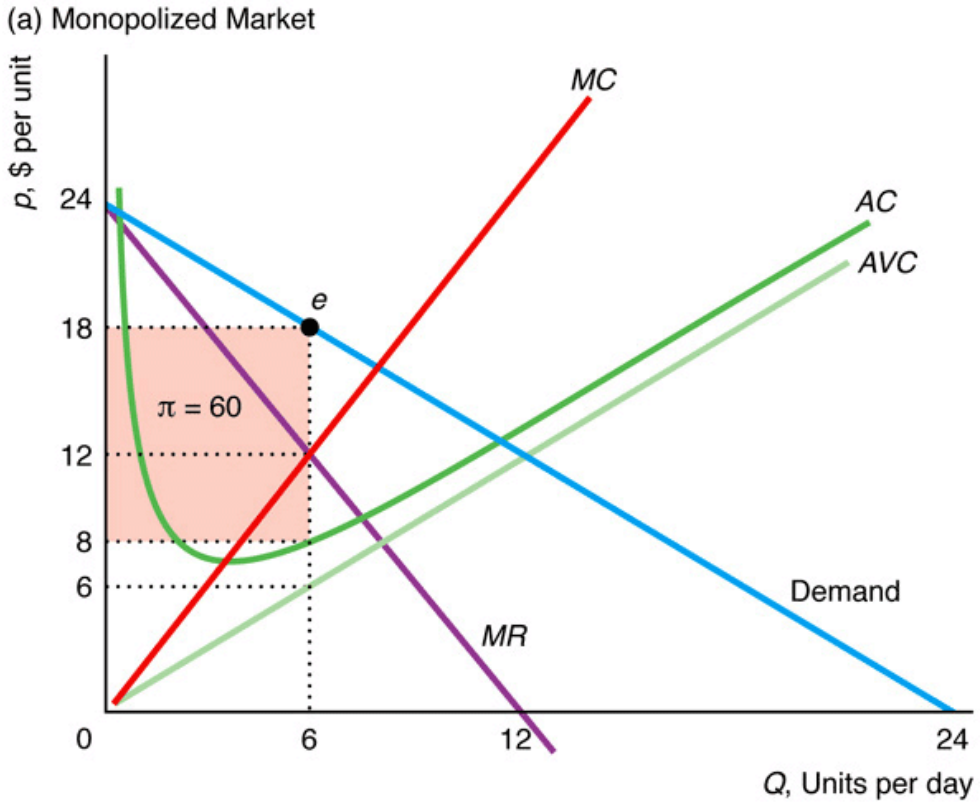
- Profit-maximizing output is obtained by producing Q^*:

$$MR(Q^*) = 24 - 2Q^* = 2Q^* = MC(Q^*)$$

  - Solving this expression reveals $Q^*=6$
- The inverse demand function indicates that people are willing to pay p = \$18 for 6 units of output.

0 Monopoly Example

- The monopolist's profit maximizing choice of output is found where *MR=MC.*
- At the profit-maximizing output, set *p* according to inverse demand.



1 Price Discrimination

- Uniform pricing so far
- Firms sometimes use ***nonuniform pricing***, where prices vary across customers or quantities, to earn a higher profit.
  - Quantity discrimination (buy-one-get-one-free)
  - Multimarket price discrimination (senior citizens, children pay less)
  - Two-part tariffs (Cell phone service providers charge a monthly service fee and a fee per text message or call)
  - Bundling (airtickets bundled with hotels; computers bundled with softwares)

1 Conditions for Price Discrimination

- A firm engages in ***price discrimination*** by charging consumers different prices for the same good based on
  - *individual* characteristics
  - belonging to *an identifiable* sub-group of consumers
  - the *quantity* purchased
- Two reasons why a firm earns a higher profit from price discrimination than uniform pricing:
  1. Price-discriminating firms charge higher prices to customers who are willing to pay more than the uniform price.
  2. Price-discriminating firms sell to some people who are not willing to pay as much as the uniform price.

1 Conditions for Price Discrimination

- Conditions for *successful* price discrimination:
  1. A firm *must have market power* (otherwise it cannot charge a price above the competitive price).
     - ***Market power*** is the ability of a firm to charge a price above marginal cost and earn a positive profit.
     - Examples: monopolist, oligopolist, …
  2. There is some variation in consumers' willingness to pay, and the firm must be able to identify which consumers are willing to pay relatively more.
  3. A firm must be able *to prevent or limit resale* from customers who are charged a relatively low price to those who are charged a relatively high price.

1 Conditions for Price Discrimination

- A firm's inability to prevent resale is often the biggest obstacle to successful price discrimination.
- Resale is difficult or impossible for services and when transaction costs are high.
  - Examples: haircuts, plumbing services, admission that requires showing an ID
- Not all differential pricing is price discrimination.
- It is not price discrimination if the different prices simply reflect differences in costs.
  - Example: selling magazines at a newsstand for a higher price than via direct mailing

1 Types of Price Discrimination

1. **First-degree**
   - Also known as ***perfect price discrimination***
   - Each unit sold for each customer's reservation price (willingness to pay)
2. **Second-degree**
   - Also known as ***nonlinear discrimination***
   - Firm charges a different price for large quantities than for small quantities
3. **Third-degree**
   - Also known as ***group price discrimination***
   - Firm charges different groups of customers different prices, but charges any one customer the same price for all units sold

2 Perfect Price Discrimination

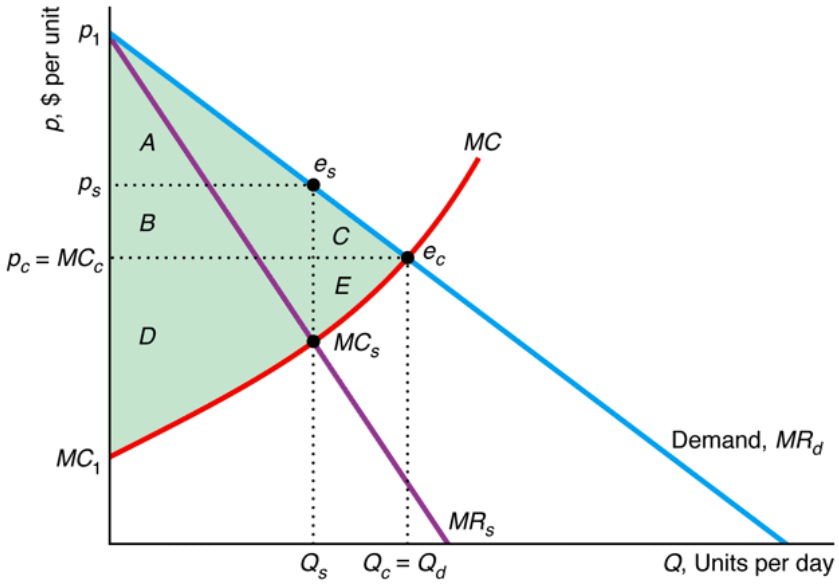
- Under perfect price discrimination, the firm charges each consumer a price that is exactly equal to the maximum he/she is willing to pay.

- Thus, each consumer gets zero consumer surplus.

- Firm profit is increased by the amount of consumer surplus that would exist in a competitive market; all CS is transferred to the firm.

2 Perfect Price Discrimination

- Producing where Demand = MC, all consumer surplus (A+B+C) is transformed into firm profit.



		Monopoly	
	Competition	Single Price	Perfect Price Discrimination
Consumer Surplus, *CS*	$A + B + C$	A	0
Producer Surplus, *PS*	$D + E$	$B + D$	$A + B + C + D + E$
Welfare, $W = CS + PS$	$A + B + C + D + E$	$A + B + D$	$A + B + C + D + E$
Deadweight Loss, *DWL*	0	$C + E$	0

2 Perfect Price Discrimination

- The perfect price discrimination result of producing where demand equals MC means that the competitive quantity of output gets produced.
- This outcome is efficient:
  - it maximizes total welfare
  - no deadweight loss is generated
- But the outcome is harmful to consumers because all surplus is producer surplus.
- Perfect price discrimination is hard because it requires that the firm knows exactly how much each consumer is willing to pay for each unit of good, and is able to prevent resale.

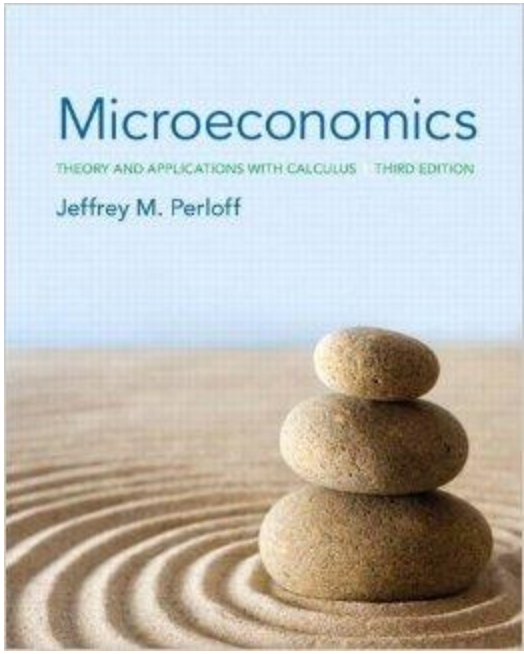
3 Group Price Discrimination

- Firms divide potential customers into two or more groups (based on some easily observable characteristic) and set a different price for each group.
- Example: senior or student discounts
- Example: "Microeconomics with Calculus" (global edition) and "Microeconomics: theory and applications with calculus" (US edition)
  - Only differences: Chapter and section titles and page numbers (from my observation) to prevent resale
  - Prices: US$257.6 for US edition and £53.99=US$81.4 for global edition (from Pearson website).

3 Group Price Discrimination

"Microeconomics: theory and applications with calculus" Table of Contents:

3. A Consumer's Constrained Choice
9. Properties and Applications of the Competitive Model
11. Monopoly
13. Game Theory
14. Oligopoly and Monopolistic Competition
17. Externalities, Open Access, and Public Goods
18. Asymmetric Information
19. Contracts and Moral Hazards



Compare it with your book.

3 Group Price Discrimination

- The firm chooses quantities sold to each group, Q_1 and Q_2, such that
  - FOCs:

$$\max_{Q_1,Q_2} \pi = R_1(Q_1) + R_2(Q_2) - C(Q_1 + Q_2)$$

  - Marginal revenue from each group should be the same and equal to marginal cost:

$$\frac{\partial \pi}{\partial Q_1} = \frac{dR_1(Q_1)}{dQ_1} - \frac{dC(Q)}{dQ}\frac{\partial Q}{\partial Q_1} = 0 \qquad \frac{\partial \pi}{\partial Q_2} = \frac{dR_2(Q_2)}{dQ_2} - \frac{dC(Q)}{dQ}\frac{\partial Q}{\partial Q_2} = 0$$

$$MR^1 = MC = MR^2$$

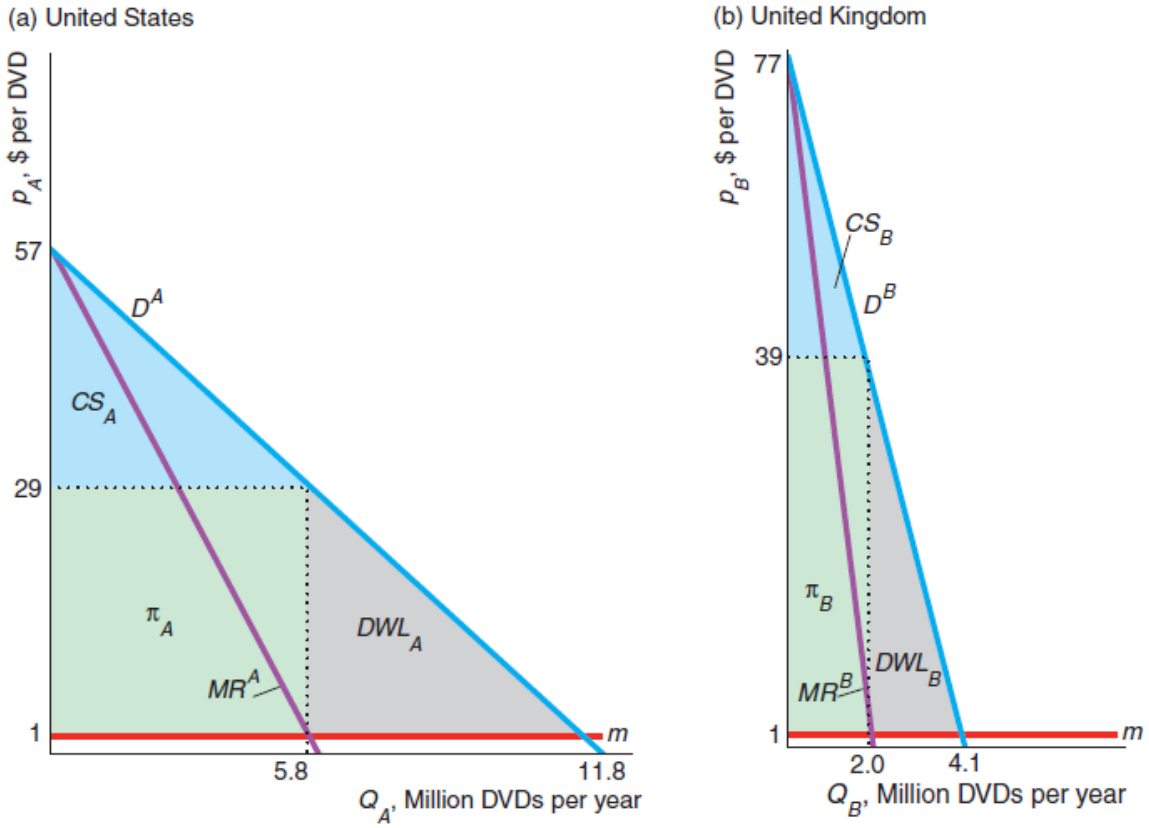
3 Group Price Discrimination

- The first-order conditions imply that marginal revenue from each group should be the same and equal to marginal cost: $MR^1 = MC = MR^2$
- Because marginal revenue is a function of elasticity, we can write:
  - $$MR^A = p_A\left(1+\frac{1}{\varepsilon_A}\right) = m = p_B\left(1+\frac{1}{\varepsilon_B}\right) = MR^B$$

    $$\frac{p_B}{p_A} = \frac{1+1/\varepsilon_A}{1+1/\varepsilon_B}$$
- Thus, *the higher price will be charged in the less elastic market segment*.

3 Group Price Discrimination

- A higher price will be charged in the market with the more price-inelastic demand.



3 Group Price Discrimination

- Welfare under multimarket price discrimination is lower than it is under either competition or perfect price discrimination.
  - Under competition, more output is produced and CS is greater

3 Group Price Discrimination

Exercise:

A monopoly sells its good in the U.S. and Japanese markets. The American inverse demand function is $p_A = 100 - Q_A$, and the Japanese inverse demand function is $p_J = 80 - 2Q_J$, where both prices, p_A and p_J, are measured in dollars. The firm's marginal cost of production is m = 20 in both countries. If the firm can prevent resale, what price will it charge in both markets?

Solve:

$MR_A = MC = MR_J$

Determines : Q_A, Q_J

Calculates: p_A, p_J

$p_A = 60$

$p_J = 50$

4 Nonlinear Price Discrimination

- Price varies only with the quantity purchased, but each customer faces the same nonlinear pricing schedule.
- Not all quantity discounts are price discrimination; some reflect reductions in firm costs associated with large-quantity sales.

- Many utilities use ***block-pricing*** schedules, by which they charge one price for the first few units of usage (block) and then a different price for subsequent blocks.

4 Nonlinear Price Discrimination

- Consider a monopolist with constant marginal cost $m=30$ and inverse demand curve $p=90-Q$.
- Suppose the firm can have block-pricing.
- How does the firm decide on the quantity for the first-block rate (Q_1) and total quantity (Q_2)?

4 Nonlinear Price Discrimination

- Profit:

$$\pi = p(Q_1)Q_1 + p(Q_2)(Q_2 - Q_1) - mQ_2$$

$$\pi = (90 - Q_1)Q_1 + (90 - Q_2)(Q_2 - Q_1) - 30Q_2$$

- FOC

$$\frac{d\pi}{dQ_1} = Q_2 - 2Q_1 = 0$$

$$\frac{d\pi}{dQ_2} = Q_1 - 2Q_2 + 60 = 0$$

- $Q_1=20$, $Q_2=40$, $p_1=70$, $p_2=50$.

4 Nonlinear Price Discrimination

- Consider Single-price monopoly:

$$\pi = p(Q)Q - mQ = (90 - Q)Q - 30Q$$

- FOC

$$\frac{d\pi}{dQ} = 60 - 2Q = 0$$

- Q=30

4 Nonlinear Price Discrimination

Exercise

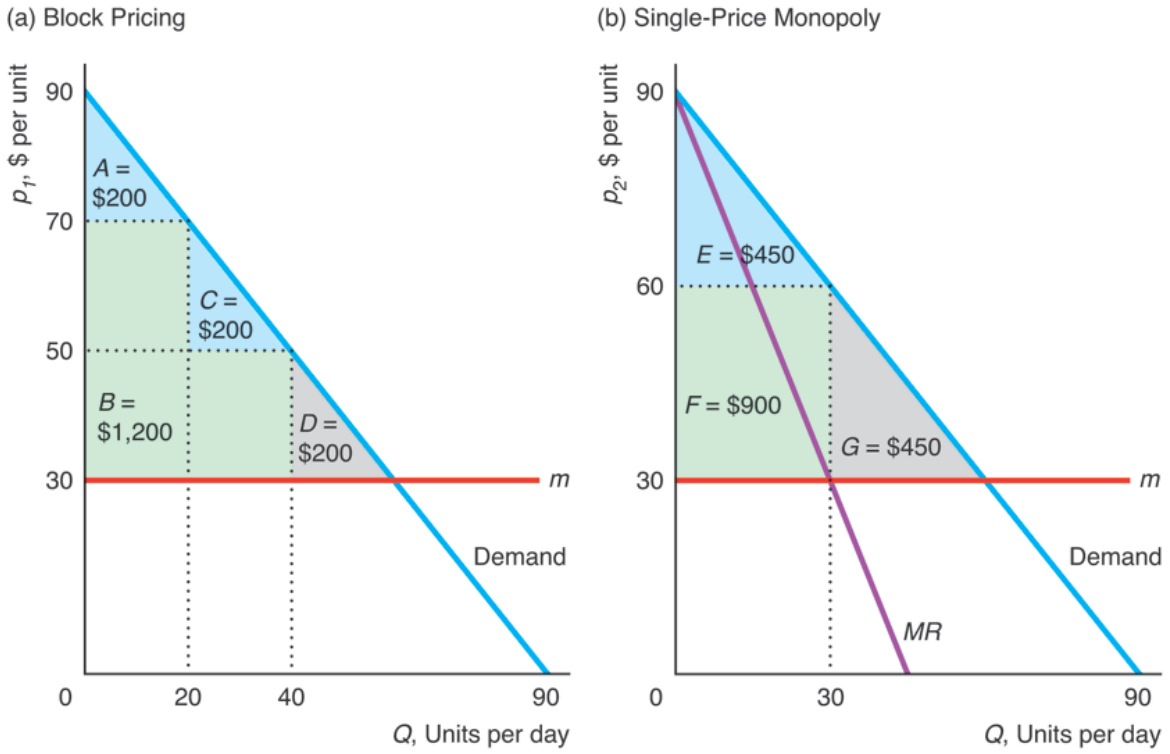
- Inverse demand curve $p=140-Q$
- $MC = 20$
- How does the firm decide on the quantity for the first-block rate (Q_1) and total quantity (Q_2)?
- Single-price monopoly Q?

4 Nonlinear Price Discrimination

Aswer:

- $Q_1=40$, $Q_2=80$, $p_1=100$, $p_2=60$.
- $Q=60$, $p=80$

4 Nonlinear Price Discrimination



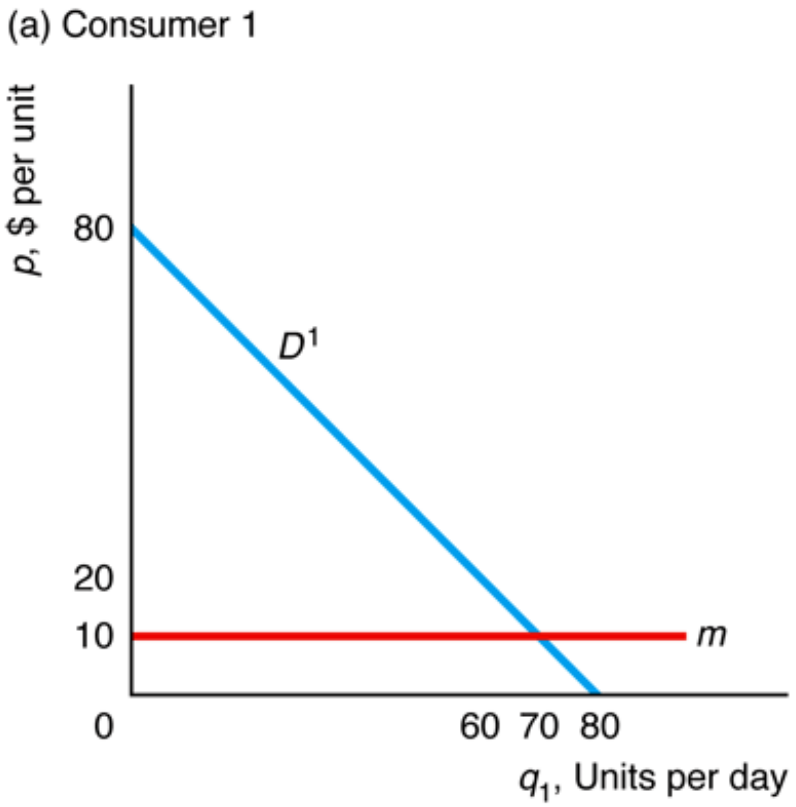
	Block Pricing	Single Price
Consumer Surplus, *CS*	$A + C = \$400$	$E = \$450$
Producer Surplus or Profit, $PS = \pi$	$B = \$1{,}200$	$F = \$900$
Welfare, $W = CS + PS$	$A + B + C = \$1{,}600$	$E + F = \$1{,}350$
Deadweight Loss, *DWL*	$D = \$200$	$G = \$450$

5 Two-Part Pricing

- Another form of nonlinear pricing, a ***two-part tariff***, is when the firm charges a consumer a lump-sum fee for the right to purchase (first tariff) and a per unit fee for each unit actually purchased (second tariff).
  - Think of the first tariff as an "access fee" and the second as a "usage fee".
  - Examples:
    - A country club charges a membership fee and greens fees to play a round of golf
    - Cell phone service providers charge a monthly service fee and a fee per text message

5 Two-Part Tariffs

- If all consumers are identical, the firm can capture all CS by charging a lump-sum "access fee" equal to CS ($2450 in the figure) and a "usage fee" equal to marginal cost (*m*).



6 Tie-In Sales

- Another type of nonuniform pricing is a ***tie-in sale***, in which customers can buy one product only if they agree to purchase another product as well.
  - **Requirement tie-in sale**: customers who buy one product from a firm are required to make all purchases of related products from that firm
    - Example: photocopying machine buyers must buy services and supplies from same company
  - **Bundling**: two goods are combined so that customers cannot buy either good separately
    - Example: Refrigerators are sold ***with*** shelves

6 Tie-In Sales

- Example of Bundling: Elsevier
  - The cost of knowledge http://thecostofknowledge.com/
  - They charge exorbitantly high prices for subscriptions to individual journals.
  - In the light of these high prices, the only realistic option for many libraries is to agree to buy very large "bundles", which will include many journals that those libraries do not actually want. Elsevier thus makes huge profits by exploiting the fact that some of their journals are essential.

6 Tie-In Sales

- Why does bundling increase the firm's profit?
- Table below shows the maximum rental price two theatres are willing to pay for two Disney movies, A and *B*.

Theater	*Max Price per Film*		*Bundled Price*
	A	*B*	
1	*800*	*250*	*1050*
2	*700*	*300*	*1000*

- If Disney must charge the same rental fee for each film to each theatre, it can either: (a) charge 700 for *A* and 250 for *B*; or (b) bundle the films together and charge 1000 for the bundle to each theatre.
- Under (a), Revenue=2(700)+2(250)=1900
- Under (b), Revenue=2(1000)=2000, which is better.

6 Tie-In Sales

- Bundling works because the theatres' demands are *negatively correlated* i.e. though both theatres are willing to pay more for *A than for B, their relative evaluations are different.*
- *Bundling does not help in the following case.*

Theater	*Max Price per Film*		*Bundled Price*
	A	*B*	
1	*800*	*300*	*1150*
2	*700*	*250*	*950*

Reference:

- Chapters 11, 12:
- Microeconomics: Theory and Applications with Calculus, 3rd Edition. By Jeffrey M. Perloff. 2014 Pearson Education.