Price Discrimination (Chapter 12)

Uniform Price vs Price Discrimination

Definition: A monopolist charges a **uniform price** if it sets the same price for every unit of output sold.

While the monopolist captures profits due to an optimal uniform pricing policy, **it can still extract greater profits and greater producer surplus with price discrimination.**

Definition: A monopolist **price discriminates** if it charges more than one price for the same good or service, e.g. different prices in movie theatres, airlines, etc.

Forms of Price Discrimination

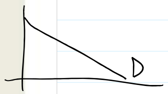
Definition: A policy of **first degree (or perfect) price discrimination** prices each unit sold at the consumer's maximum willingness to pay. This willingness to pay is directly observable by the monopolist.

Definition: A policy of **second degree price discrimination** allows the monopolist to offer consumers a quantity discount.

Definition: A policy of **third degree price discrimination** offers a different price for each segment of the market (or each consumer group) when membership in a segment can be observed.

Conditions for Price Discrimination

$\frac{P - MC}{P} = \frac{1}{|\varepsilon|}$ (lerner index)



To be able to adopt Price Discrimination,

- The firm must have some market power to price discriminate.
- The firm must have some information about buyers.
  - Willingness to pay for each individual (for 1st Degree)
  - Willingness to pay [redacted] (for 2nd Degree) for each amount of good.
  - PED for each segment of the market (for 3rd Degree)
- The firm must be able to prevent "arbitrage", i.e. resale.

1st Degree Price Discrimination

Definition: A policy of **first degree price discrimination** prices each unit sold at the consumer's maximum willingness to pay.

Definition: The consumer's maximum willingness to pay is called the consumer's **reservation price**.

We can think of the demand curve as a "willingness to pay" curve. If the monopolist can observe the willingness to pay of each customer, then the monopolist can "perfectly" price discriminate. **In other words, it can charge each consumer the highest price he/she is willing to pay for the product.**

1st Degree PD gives an efficient allocation of resource, i.e. there is no deadweight loss.

P = WTP

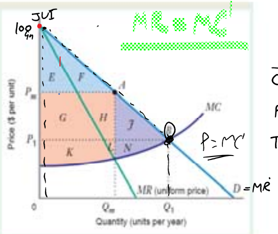


FIGURE 12.1 Monopoly with Uniform Pricing
A profit-maximizing monopolist charging a uniform price would choose the price P_m and sell Q_m. Its producer surplus would be the area G + H + K + L. However, some consumer surplus (area E + F) escapes the producer. In addition, the deadweight loss (area J + N) represents potential surplus that neither the producer nor consumers capture.

	$Q = Q_m$ (Charges P_m to all) Uniform Pricing	$Q = Q_1$ 1st degree PD
CS	E + F	0
PS	G + H + K + L	E + F + G + H + J + K + L + N
TS	E + F + G + H + K + L	E + F + G + H + J + K + L + N
	J + N	0

1st Degree Price Discrimination

LEARNING-BY-DOING EXERCISE 12.1

Capturing Surplus: Uniform Pricing versus First-Degree Price Discrimination

In this exercise we will see how a monopolist can capture more surplus with first-degree price discrimination than with a uniform price. Suppose a monopolist has a constant marginal cost $MC = 2$ and faces the demand curve $P = 20 - Q$, as shown in Figure 12.3. There are no fixed costs.

Problem

(a) Suppose price discrimination is not allowed (or is not possible). How large will the producer surplus be?

(b) Suppose the firm can engage in perfect first-degree price discrimination. How large will the producer surplus be?

Solution

(a) The marginal revenue curve is $MR = P + (\Delta P/\Delta Q)Q = (20 - Q) + (-1)Q = 20 - 2Q$. To find the optimal quantity, we set marginal revenue equal to marginal cost. Thus, $20 - 2Q = 2$, or $Q = 9$. Substituting this into the demand curve, we find that $P = 20 - 9 = 11$.

1st Degree Price Discrimination

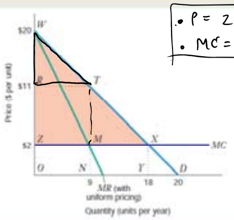


FIGURE 12.3 Capturing Surplus: Uniform Pricing versus First-Degree Price Discrimination
With uniform pricing, the firm produces 9 units (corresponding to the intersection of the marginal cost curve MC and the marginal revenue curve MR). It sells these units at a price of $11 per unit, capturing a producer surplus of $81 (area $RTMZ$). With perfect first-degree price discrimination, the firm produces 18 units (corresponding to the intersection of MC and the demand curve D), capturing a producer surplus of $162 (area WXZ).

$$\boxed{\begin{array}{l} \bullet\ P = 20 - Q \\ \bullet\ MC = 2 \end{array}}$$

	UNIFORM PRICING	1st DEGREE
CS	= △ W R T	0
PS =	□ R T M Z	△ W Z X
DWL =	△ T M X	0

2nd Degree Price Discrimination

Definition: A policy of **second degree price discrimination** allows the monopolist to charge a different price to different consumers. **While different consumers pay different prices, the reservation price of any one consumer cannot be directly observed.**

2nd Degree Price Discrimination often involves **Multipart Tariff,** which is a tariff/price that consist of two or more prices, e.g.

- Block Pricing or Block Tariff (Quantity Discount)
- Subscription and Usage Charges (Club / Membership)

Two-Part Tariff

Usage Charge

Subscription Charge

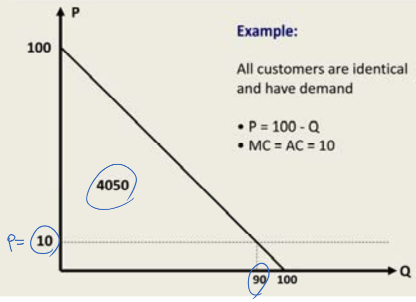
Definition: A monopolist charges a two-part tariff if it charges **a per unit price plus a lump-sum price** (paid whether or not a positive number of units is consumed).

Unit Price is also called "**Usage Charge**".
Lump-Sum Price is also called "**Subscription Charge**".

This, effectively, charges demanders of a low quantity a different average price than demanders of a high quantity.

Example: hook-up charge plus usage fee for a telephone, club membership, or the like.

Two-Part Tariff



Example:

All customers are identical and have demand

- P = 100 - Q
- MC = AC = 10

Two-part Tariff: usage charge = his CS = 4050; unit charge = 10 baht/unit

Two-Part Tariff

What is the optimal two-part tariff?

Two steps:

(1) maximize the benefits to the consumers by charging UNIT PRICE = MC = 10.

(2) capture this benefit by setting LUMP-SUM PRICE = consumer benefits = 4050.

Two-Part Tariff

Any higher usage charge would result in a dead-weight loss

Ex: consider a pub owner who wants to implement two-part tariff:

- $TC = 1000 + 0.5Q \rightarrow MC = 0.5$ €/drink
  Q = # of drinks
- $Q = 10 - 2P$ for all drinkers
- N = number of drinkers = 500 drinkers.

W/O Two-part tariff:

From $Q = 10 - 2P$,

$$P = \frac{10-Q}{2} = 5 - \frac{1}{2}Q.$$

$$TR = P \cdot Q = \left(5 - \tfrac{1}{2}Q\right) \cdot Q = 5Q - \tfrac{1}{2}Q^2$$

$$MR = \frac{dTR}{dQ} = 5 - Q$$

The owner maximizes his profit by setting Q where

$MR = MC$: $5 - Q = 0.5$

$Q = 4.5$ drinks/customer/night

Two-Part Tariff

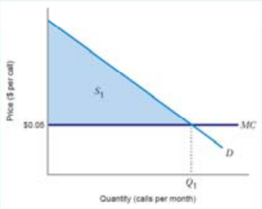
Any higher usage charge would result in a dead-weight loss that could not be captured by the monopolist. Any lower usage charge would result in selling at less than marginal cost.

In essence, the monopolist maximizes the size of the "pie", then sets the lump-sum fee so as to capture the entire "pie" for itself.

The total surplus captured is the same as in the case of perfect price discrimination.

Two-Part Tariff

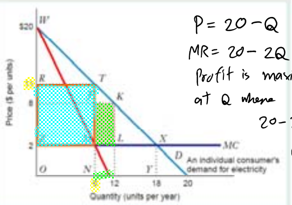
FIGURE 12.8 Subscriber and Usage Charges. Each consumer has the demand curve D for telephone service, and the telephone company incurs a marginal cost of \$0.05 for each call. If the company sets a usage charge of \$0.05 for each call, the consumer would make Q_1 calls each month and realize a consumer surplus of S_1. The telephone company could capture virtually all the consumer surplus by implementing a monthly subscription charge of slightly less than S_1 dollars.



Block Tariff

Definition: If a consumer pays one price for one block of output and another price for another block of output, the consumer faces a **block tariff.**

FIGURE 12.4 Uniform Pricing versus Second-Degree Price Discrimination. With uniform pricing, the firm captures a producer surplus of \$81 (equal to area RTMZ). With a block tariff, the firm charges a price of \$11 for the first 9 units a consumer purchases and a price of \$8 for the three additional units. This example of second-degree price discrimination lets the firm capture a producer surplus of \$99 (areas RTMZ + JKLM).



$P = 20 - Q$

$MR = 20 - 2Q$

Profit is maximized at Q where MR=MC; $20 - 2Q = 2$

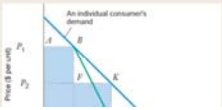
$Q = 9$ (uniform pricing)

$P = 11$

$\pi = TR - TC$
$= P \cdot Q - AC \cdot Q$
$= 11 \cdot 9 - 2 \cdot 9$
$= (11-2) \cdot 9$
$= 9 \cdot 9 = 81$ \$

Block Tariff

For 2-Block Tariff, we need to find Q1, Q2, P1, P2 such that producer surplus is maximized.



$MR = MC$: $5 - Q = 0.5$

$Q = 4.5$ drinks / customer / night

$P = 5 - \frac{1}{2}Q = 5 - \frac{1}{2}(4.5) = 2.75$ € / drink.

Find Total Profits:

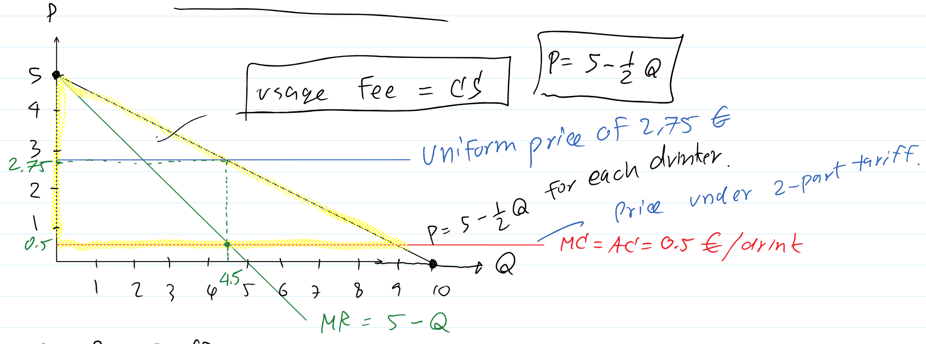
$\pi = TR - TC$

$= P \cdot Q_{TOTAL} - (1000 + 0.5 Q_{TOTAL})$

$= (2.75 \cdot 4.5 \cdot 500) - [1000 + 0.5(4.5 \cdot 500)]$

$= 6187.50 - 2125.00$

$= \underline{4062.50 \text{ € / night.}}$



W/ Two-Part Tariff:

1. usage fee must be charged equal to consumer surplus of each drinker
2. price per drink must be charged equal to MC.

Given 1 & 2, $P = MC = 0.5$ € / drink

with $P = 0.5$, Q will be equal to 9 drinks / customer.

So Total $Q = N \cdot Q = 500 \cdot 9 = 4{,}500$ drinks sold / night.

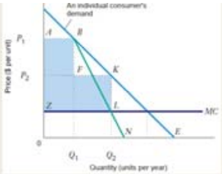
usage fee = CS of each customer

$= \frac{1}{2} \times \text{base} \times \text{height}$

$= \frac{1}{2} \times 9 \times (5 - 0.5)$

For 2-Block Tariff, we need to find Q1, Q2, P1, P2 such that producer surplus is maximized.

That is, we try to maximize the shaded area.



If the monopolist could set a different block price for each customer, it would capture the same amount of surplus as a perfectly price-discriminating monopolist.

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Block Tariff

Example 1

Let
Inverse Demand: P = 20 – Q
Marginal Cost: MC = 2 = AC

Assume that the monopolist wants to charge two different prices. What the two prices should it charge in order to maximize the producer surplus?

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Block Tariff

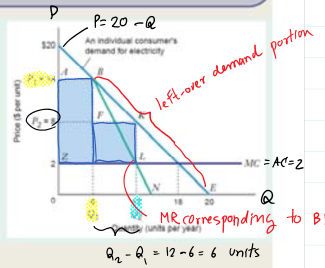

FIGURE 12.5 Optimizing Producer Surplus with Second-Degree Price Discrimination
With the optimal block tariff (assuming only two blocks), the firm sells 6 units at a price of $14 per unit and 6 additional units at a price of $8 per unit. This maximizes producer surplus at $108 (the shaded area ABFKLZ).

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Block Tariff

Example 2

Let
Inverse Demand: P = 100 – Q
Marginal Cost: MC = 10 = AC

Assume that the monopolist wants to charge two different prices. What the two prices should it charge in order to

$= \frac{1}{2} \times \text{base} \times \text{height}$

$= \frac{1}{2} \times 9 \times (5 - 0.5)$

$= \frac{1}{2} \times 9 \times 4.5$

$= 20.25$ € / customer → optimal Entrance fee.

Find Total Profits when using 2-Part Tariff:

$\pi = TR - TC$

$= [(500 \cdot 20.25) + \cancel{(\underbrace{500}_{N} \cdot \underbrace{9}_{Q} \cdot \underbrace{0.5}_{P})}^{4500}] - [\underbrace{1000}_{\text{Fixed costs}} + \cancel{(\underbrace{0.5}_{AC} \cdot \underbrace{500}_{N} \cdot \underbrace{9}_{Q})}]$

$= (500 \cdot 20.25) - 1000$

$= 9{,}125$ € / night !!!

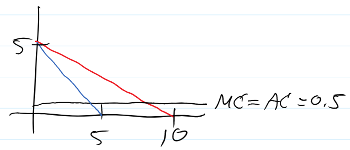
Notice that $\pi_{\text{2-part tariff}} > \pi_{\text{uniform pricing}}$,

Next, What if the pub owner faces w/ 2 kinds of customers?

500 Drinkers: $Q_{\text{drinker}} = 10 - 2P$. ⟹ $P = 5 - \frac{1}{2}Q$

500 Dancers: $Q_{\text{dancer}} = 5 - P$. ⟹ $P = 5 - Q$

• Drinker
• Dancer



3 STEPS

① WRITE Q_2 in terms of Q_1

$Q_2 = \frac{Q_1 + 18}{2}$

② WRITE PRODUCER SURPLUS IN TERMS OF Q_1: $=5-P$

Recall that PS = TR – variable cost

TR from 1st block = $P_1 \cdot Q_1$.

TR from 2nd block = $P_2 \cdot (Q_2 - Q_1)$

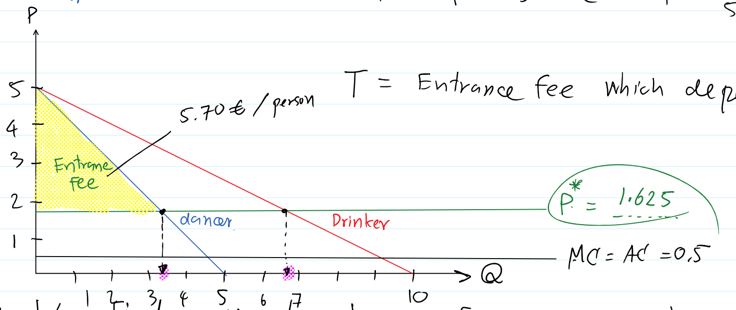
Total variable cost = $2 \cdot Q_2$

$PS = P_1 \cdot Q_1 + P_2 \cdot (Q_2 - Q_1) - 2Q_2$

$= (20 - Q_1) \cdot Q_1 + (20 - Q_2) \cdot (Q_2 - Q_1) - 2Q_2$

$= 20Q_1 - Q_1^2 + 20Q_2 - 20Q_1 - Q_2^2 + Q_1Q_2 - 2Q_2$

$\boxed{PS = -3(Q_1 - 6)^2 + 108}$



T = Entrance fee which depends on Price

Let's Find optimal entrance fee and optimal price:

Entrance Fee $[T^*(P)] = \frac{1}{2} \times \text{base} \times \text{height}$

$= \frac{1}{2} \times (5 - P) \times (5 - P)$

Let
Inverse Demand: P = 100 – Q
Marginal Cost: MC = 10 = AC

Assume that the monopolist wants to charge two different prices. What the two prices should it charge in order to maximize the producer surplus?

Answer: It should sell the first 30 units at P = 70 and another 30 units at P = 40. Total Q = 60.

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Block Tariff

LEARNING-BY-DOING EXERCISE 12.3

Increasing Profits with a Block Tariff

Softco is a software company that sells a patented computer program to businesses. Each business it serves has the demand for Softco's product: P = 70 − 0.5Q. The marginal cost for each program is $10. Assume there are no fixed costs.

Problem

(a) If Softco sells its program at a uniform price, what price would maximize profit? How many units would it sell to each business customer? How much profit would it earn from each business customer?

(b) Softco would like to know if it is possible to improve its profit by implementing block pricing. Suppose that Softco were to sell the first block at the price you determined in (a), and that the quantity for that block is the quantity you determined in (a). Find the profit-maximizing quantity and price per unit for the second block. How much extra profit would Softco earn from each of its business customers?

(c) Do you think Softco could earn even more profits with a set of prices and quantities for the two blocks different from those in part (b)? Explain.

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3rd Degree Price Discrimination

Definition: A policy of **third degree price discrimination** offers a different price for each segment of the market (or each consumer group) when membership in a segment can be observed.

Example: Movie ticket sales to older people or students at discount

Given that the whole market is segmented into sub-markets, the monopolist can set different P* and Q* for each sub-market in order to maximize its total profit, e.g. sub-market for students and sub-market for seniors.

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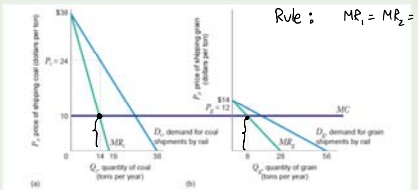
3rd Degree Price Discrimination



Rule : $MR_1 = MR_2 = MC$

$$\boxed{PS = -\frac{3}{4}(Q_1 - 6)^2 + 108}$$

③ FIND Q_1 THAT MAXIMIZES PS :

- $Q_1 = 6$
- $Q_2 = \frac{(Q_1 + 18)}{2} = \frac{6+18}{2} = \frac{24}{2} = 12$
- $P_1 = 20 - Q_1 = 20 - 6 = 14$
- $P_2 = 20 - Q_2 = 20 - 12 = 8$
- PS = 108 vs. PS = 81 under uniform pricing

PS increases by 108 − 81 = 27 \$.

Entrance fee [T(P)] = $\frac{1}{2}$ × base × height

$= \frac{1}{2} \times (5-P) \times (5-P)$

$\pi^* = ?$

$\pi = TR - TC = 1000 \times T(P) + 500\,(P \times Q_{DRINKER}) + 500\,(P \times Q_{DANCER})$

$- \left(1000 + 500 \times 0.5 \times Q_{DRINKER} + 500 \times 0.5 \cdot Q_{DANCER}\right)$

$= 1000 \times T(P) + 500 \times P \times (10 - 2P) + 500 \times P \times (5 - P)$

$- \left(1000 + 500 \times 0.5 \times (10 - 2P) + 500 \times 0.5 \times (5 - P)\right)$

$$\boxed{\pi = -1000 \cdot P^2 + 3250P + 7750}$$

Find the profit-maximizing price by setting $\frac{d\pi(P)}{dP} = 0$:

$\frac{d\pi(P)}{dP} = -2000P + 3250 = 0$

$$\boxed{P^* = \frac{3250}{2000} = 1.625 \text{ € / drink}}$$

So

$$\boxed{\text{Optimal entrance fee } [T(P^*)] = \frac{1}{2}(5-P^*)(5-P^*) = \frac{1}{2}(5 - 1.625)^2 = 5.70 \text{ € per custom}}$$

- $Q_{drinker} = 10 - 2P = 10 - 2(1.625) = 6.75$ drinks / pe
- $Q_{dancer} = 5 - P = 5 - 1.625 = 3.375$ drinks
- $\pi^* = -1000P^2 + 3250P + 7750$

er

rson/night

/person/night 。

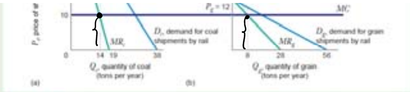


FIGURE 12.9 **Pricing Coal and Grain Transport by Rail: Third-Degree Price Discrimination** The demand for rail transport of coal is much less price sensitive than the demand for rail transport of grain. Railroads can exploit this fact, using third-degree price discrimination to set a much higher profit-maximizing price for coal than for grain, even though the marginal costs of transporting the two goods are the same.

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Example

Suppose the monopolist operates in two market segments, at the same constant marginal cost.

MC = AC = 20 in both segments

Mkt Segment 1: $P_1 = 100 - Q_1$ → FIND TR_1 AND THEN MR_1

Mkt Segment 2: $P_2 = 80 - 2Q_2$ → FIND TR_2 AND THEN MR_2

→ $MR_1 = MR_2 = MC$

get $P_1^*, P_2^*, Q_1^*, Q_2^*$

What P* and Q* should be in each market?

LEARNING-BY-DOING EXERCISE 12.4

Third-Degree Price Discrimination in Railroad Transport

Suppose a railroad faces the demand curves for transporting coal and grain shown in Figure 12.9. For coal, $P_c = 38 - Q_c$, where Q_c is the amount of coal moved when the transport price for coal is P_c. For grain, $P_g = 14 - 0.25Q_g$, where Q_g is the amount of grain shipped when the transport price for grain is P_g. The marginal cost for moving either commodity is $10.

Problem Equate marginal revenue and marginal cost to find the profit-maximizing rates for coal and grain transport.

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3rd Degree Price Discrimination

LEARNING-BY-DOING EXERCISE 12.5

Third-Degree Price Discrimination for Airline Tickets

According to Table 2.2, the estimated price elasticity of demand for coach class airline tickets for business travelers is $\epsilon_{Q_B, P_B} = -1.15$, while for vacation (leisure) travelers it is $\epsilon_{Q_V, P_V} = -1.52$.[13] Suppose an airline facing these demand elasticities wants to use third-degree price discrimination to maximize profit, by setting the price of a business travel ticket to P_B and the price of a vacation travel ticket to P_V. Also suppose that the airline faces the same marginal cost MC for both types of travelers.

Problem Use the inverse elasticity pricing rule [IEPR; see equation (11.4)] to determine the ratio P_B/P_V.

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$$\frac{P - MC}{P} = \frac{1}{|\varepsilon|}$$

Business Class (B): $\frac{P_B - MC}{P_B} = \frac{1}{1.15}$ → $MC = 0.13 P_B$

Economy Class (E): $\frac{P_E - MC}{P_E} = \frac{1}{1.52}$ → $MC = 0.342 P_E$

$$0.13 P_B = 0.342 P_E$$

$$\frac{P_B}{P_E} = \frac{0.342}{0.13} = 2.63$$

$$\boxed{P_B = 2.63 P_E}$$ ***

- $$\pi^* = -1000p^2 + 3250p + 7750$$
$$= -1000(1.625)^2 + 3250(1.625) + 7$$
$$= 10{,}391 \text{ €} / \text{night !!!}$$

Summary	Entrance fee	Price / Drink
• w/o Two-Part Tariff	0	2.75
• One type of customers	20.25	0.5 (= MC)
• Two types of customers	5.70	1.625

Here, the best strategy is to lower the ent
get the dancer

In some cases, depending on demand chara
two groups, it may be more profitable
only the drinkers!

HW
- $Q = 10 - p$ for Drinker
- $Q = 5 - p$ for Dancer
- $TC = 1000 + 0.5Q$
- $MC = 0.5$ € / drink

Compute P, $Q_{drinker}$, Q_{dancer}, Entrance
two cases:

Case I when capturing only

750

Q/person	π (€)
4.5	4,063
9	9,125
6.75 for Drinker 3.375 for Dancer	10,391

ance fee and
rs at the pub too.
acteristics of the
e to just capture

($N_1 = 500$)
($N_2 = 500$)

e fee, and π in

drinkers

Case 1 when capturing only

case 2 when capturing b

Due date : Wed. 30 October 2019

drinkers

oth groups.

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Friday, 25 October, 2019 10:36 AM

Price Discrimination (Chapter 12)

-Continued-

1

Price Discrimination Summary

1st Degree

The monopolist charges each consumer the maximum price he/she is willing to pay.

2nd Degree

Price varies according to quantity demanded, i.e. quantity discount.

3rd Degree

The monopolist charges different prices for different consumer groups.

3rd Degree Price Discrimination

For the monopolist to implement the **3rd Degree PD**, it has to be able to "**screen**" consumers.

Screening is a process for sorting consumers based on their characteristics.

These characteristics can be

- Observable, e.g. sex and age.
- Unobservable but inferable, e.g. PED and willingness to pay.

3rd Degree Price Discrimination

Two Interesting Screening Mechanisms

Time
- Some consumers want to be the first who own the product.
- Sellers price goods higher when they are first introduced.

Intertemporal Price discrimination   Ex: Harry Potter

Coupons and Rebates (a partial refund)
- For example, you buy a printer ink cartridge for $20, when it is empty, you can send it to the seller and get a rebate of $2.
- Consumer who take time to process rebates shows that they are price-sensitive.
- Sellers will offer lower prices for these consumers.

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3^{rd} Degree Price Discrimination

3^{rd} Degree Price Discrimination with Capacity Constraints

Capacity Constraints: Production or supply of goods is limited, e.g. seats of airlines, cars of car rentals, etc.

Suppose that the monopolist can produce up to Q' units.

It is to supply Q' units of output in two market segments. ① ②

How should it allocate Q' between these two segments?

$Q_1 = ?$

$Q_2 = ?$

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3^{rd} Degree Price Discrimination

3^{rd} Degree Price Discrimination with Capacity Constraints

Let Q_1 be quantity supplied to Segment 1
Q_2 be quantity supplied to Segment 2

It should allocate $Q' = Q_1 + Q_2$
such that $MR(Q_1) = MR(Q_2)$.

If $MR(Q_1) > MR(Q_2)$, it can increase revenue and hence profit by supplying more quantity in Segment 1.

6

segment 1 segment 2

$MR_1 > MR_2$

$\uparrow Q_1$ $\downarrow Q_2$

$P_1 \downarrow$ $P_2 \uparrow$

3rd Degree Price Discrimination

LEARNING-BY-DOING EXERCISE 12.6

Price Discrimination Subject to Capacity Constraints

$\boxed{\text{RULE: } MR_1 = MR_2}$

This exercise shows you how to determine the profit-maximizing prices and quantities for a firm that wants to engage in third-degree price discrimination but operates with a capacity constraint.

Suppose that the demand curve in market segment 1 is $Q_1 = 200 - 2P_1$ and the demand curve in market segment 2 is $Q_2 = 250 - P_2$. The marginal cost of selling in each market segment is \$10 per unit. The firm's overall capacity is 150 units.

$\boxed{Q_1 + Q_2 = 150}$ — (1)

Problem What are the profit-maximizing quantities and prices in each market segment?

$P_1^*, P_2^*, Q_1^*, Q_2^*$

$Q_1 = 200 - 2P_1 \rightarrow P_1 = 100 - \frac{1}{2}Q_1 \rightarrow TR_1 = P_1 \cdot Q_1 = (100 - \frac{1}{2}Q_1)Q_1 = 100Q_1 - \frac{1}{2}Q_1^2$

$Q_2 = 250 - P_2 \rightarrow P_2 = 250 - Q_2 \rightarrow TR_2 = P_2 \cdot Q_2 = (250 - Q_2)Q_2 = 250Q_2 - Q_2^2$

$MR_1 = 100 - Q_1.$

$MR_2 = 250 - 2Q_2.$

Equating $MR_1 = MR_2$ gives $100 - Q_1 = 250 - 2Q_2$

$\boxed{2Q_2 - Q_1 = 150}$ — (2)

Third Degree Price Discrimination

Implementing the 3rd Degree Price Discrimination

Suppose the monopolist cannot "screen" consumers.

How can it ensure that the consumers targeted to pay the high price ACTUALLY pay the high price?

Versioning refers to a strategy of selling two or more versions of a product with different quality levels at different prices.

Versioning takes advantage of the trait that the least price-sensitive buyers tend to be the most quality-sensitive.

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Third Degree Price Discrimination

Implementing the 3rd Degree Price Discrimination

Damaged Goods Strategy refers to a versioning strategy in which the firm creates a low-end version of its full-price good by deliberately damaging the product.

For example, one version of a 1990 IBM laser printer was "added" chips to slow down printing speed.

Other examples include goods in shopping outlets.

Tie-in Sales

Apart from Price Discrimination, ANY FIRMS with market power have another technique that can be used to "capture" surplus from consumers.

Definition: A **tie-in sale** occurs if customer can buy one product ONLY IF they agree to purchase another product as well. Examples include printers and ink cartridges, photocopiers and papers, computers and monitors, etc.

The firm can extend its market power from one product to the other.

Tie-in Sales – Bundling

Package tie-in sales *(or **bundling**)* occur when goods are combined so that customers cannot buy either good separately.

For example, one Disney Land ticket includes "admission fee" and "roller coaster fee".

Bundling may be used in place of price discrimination to increase producer surplus when consumers have different willingness to pay for the goods sold in the bundle.

Bundling MAY NOT increase profit.

Pure Bundling : as a package only

Mixed Bundling : consumers can choose to buy

① Good 1 only

② Good 2 only

③ Package of Good 1 & 2

11.5 BUNDLING

- **bundling** Practice of selling two or more products as a package.

To see how a film company can use customer heterogeneity to its advantage, suppose that there are two movie theaters and that their reservation prices for these two films are as follows:

	MOVIE 1 Gone with the Wind	MOVIE 2 Getting Gertie's Garter	
Theater *A*	$12,000	$3000	15,000
Theater *B*	$10,000	$4000	14,000

If the films are rented separately, the maximum price that could be charged for *Wind* is $10,000 because charging more would exclude Theater *B*. Similarly, the maximum price that could be charged for *Gertie* is $3000.

But suppose the films are *bundled*. Theater *A* values the pair of films at $15,000 ($12,000 + $3000), and Theater *B* values the pair at $14,000 ($10,000 + $4000). Therefore, we can charge each theater $14,000 for the pair of films and earn a total revenue of $28,000.

case 1 Pure Bundling

IF $\boxed{P_B^* = 14{,}000}$, then $TR = 2 \cdot 14{,}000 = 28{,}000$

IF $P_B = 15{,}000$, then $TR = 1 \cdot 15{,}000 = 15{,}000$

case 2 sell the two products separately

$P_1 = 10{,}000 \rightarrow TR_1 = 2 \cdot 10{,}000 = 20{,}000$

$P_2 = 3000 \rightarrow TR_2 = 2 \cdot 3000 = 6{,}000$

$\boxed{TR_{TOTAL} = 26{,}000}$

Conclusion: Bundling gives high TR than selling separately. (Why?)

11.5 BUNDLING

Relative Valuations

Why is bundling more profitable than selling the films separately? Because the *relative valuations* of the two films are reversed.

The demands are *negatively correlated*—the customer willing to pay the most for *Wind* is willing to pay the least for *Gertie*.

To see why this is critical, suppose demands were *positively correlated*—that is, Theater *A* would pay more for *both* films:

	r_1 Gone with the Wind	r_2 Getting Gertie's Garter	
Theater *A*	$12,000	$4000	$r_1^A + r_2^A = 12{,}000 + 4000 = 16{,}000$

case 1 Pure Bundling

$P^B = 13{,}000 \rightarrow TR = 2 \cdot 13{,}000$

$= 26{,}000$

correlated—that is, Theater *A* would pay more for *both* films:

	r_1 Gone with the Wind	r_2 Getting Gertie's Garter
Theater *A*	$12,000	$4000
Theater *B*	$10,000	$3000

If we bundled the films, the maximum price that could be charged for the package is $13,000, yielding a total revenue of $26,000, the same as by renting the films separately.

$r_1^A + r_2^A = 12{,}000 + 4000 = 16{,}000$

$r_1^B + r_2^B = 10{,}000 + 3000 = 13{,}000$

$P^B = 13{,}000 \to TR = 2 \cdot 13{,}000$
$= 26{,}000$

case 2 Selling separately

$P_1 = 10000 \to TR_1 = 2 \cdot 10000$
$= 20{,}000$

$P_2 = 3000 \to TR_2 = 2 \cdot 3000$
$= 6000$

$TR_{total} = 26{,}000$

Here, bundling gives the same TR as selling separately. (Why?)

11.5 BUNDLING

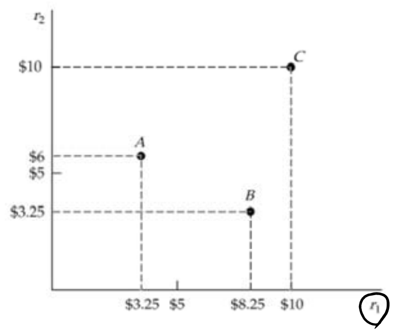
Relative Valuations

Figure 11.12

Reservation Prices

Reservation prices r_1 and r_2 for two goods are shown for three consumers, labeled *A*, *B*, and *C*.

Consumer *A* is willing to pay up to $3.25 for good 1 and up to $6 for good 2.



11.5 BUNDLING

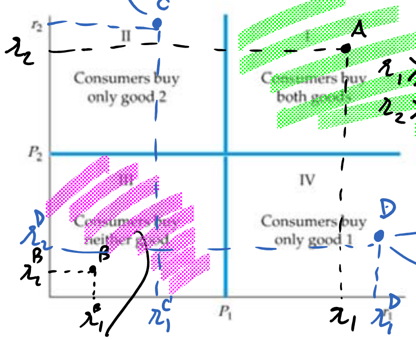
Relative Valuations

since $r_1 < P_1$, then no purchase of good 1
since $r_2 > P_2$, then purchase good 2

Figure 11.13

Consumption Decisions When Products Are Sold Separately

The reservation prices of consumers in region I exceed the prices P_1 and P_2 for the two goods, so these consumers buy both goods.
Consumers in regions II and IV buy only one of the goods, and consumers in region III buy neither good.



$r_1 \geq P_1$ → buy good 1
$r_2 \geq P_2$ → buy good 2

since $r_1 > P_1$, then buy good 1
since $r_2 < P_2$ ⇒ do not buy good 2

$r_1 < P_1$ → No purchase of good 1
$r_2 < P_2$ → ⟵⟶ 2

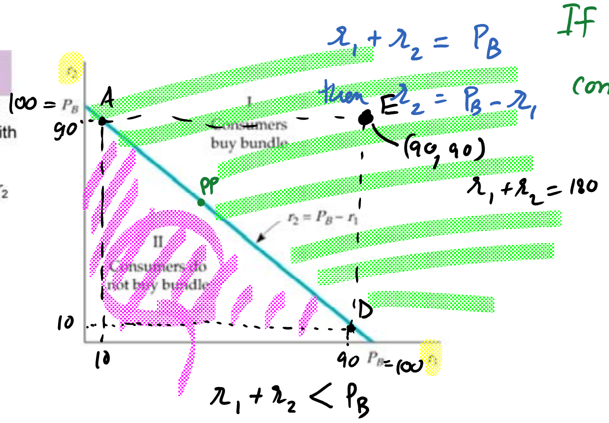
Relative Valuations

Figure 11.14

Consumption Decisions When Products Are Bundled

Consumers compare the sum of their reservation prices $r_1 + r_2$, with the price of the bundle P_B.

They buy the bundle only if $r_1 + r_2$ is at least as large as P_B.



If $r_1 + r_2 \geq P_B$, consumers will purchase the bundle.

11.5 BUNDLING

Relative Valuations

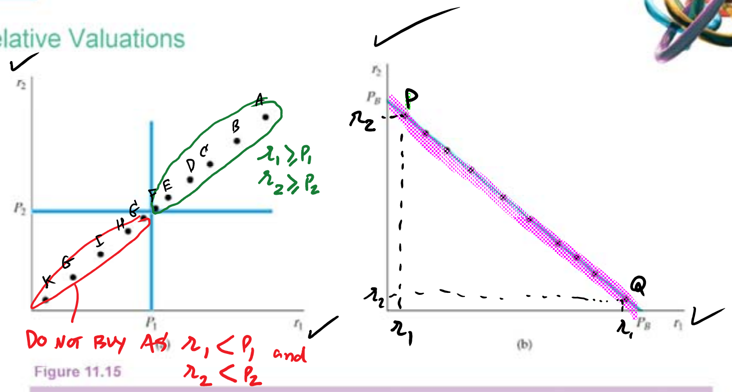


Figure 11.15

Reservation Prices

In **(a)**, because demands are perfectly positively correlated, the firm does not gain by bundling: It would earn the same profit by selling the goods separately.

In **(b)**, demands are perfectly negatively correlated. Bundling is the ideal strategy—all the consumer surplus can be extracted.

Relative Valuations

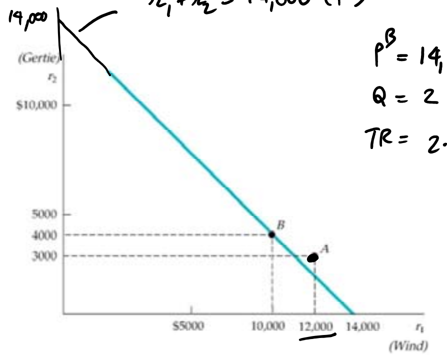
Figure 11.16

Movie Example

Consumers *A* and *B* are two movie theaters. The diagram shows their reservation prices for the films *Gone with the Wind* and *Getting Gertie's Garter.*

Because the demands are negatively correlated, bundling pays.

$r_1 + r_2 = 14{,}000 \; (P^B)$



$P^B = 14{,}000$

$Q = 2$

$TR = 2 \cdot 14000 = 28{,}000$

11.5 BUNDLING

Mixed Bundling

- **mixed bundling** Selling two or more goods both as a package and individually.
- **pure bundling** Selling products only as a package.

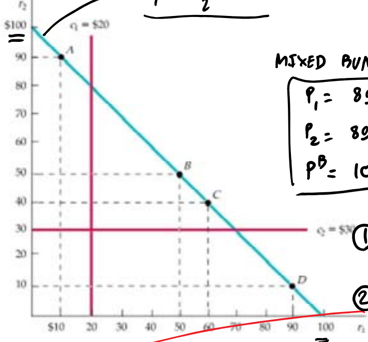
Figure 11.17

Mixed versus Pure Bundling

With positive marginal costs, mixed bundling may be more profitable than pure bundling.

Consumer *A* has a reservation price for good 1 that is below marginal cost c_1, and consumer *D* has a reservation price for good 2 that is below marginal cost c_2.

With mixed bundling, consumer *A* is induced to buy only good 2, and consumer *D* is induced to buy only good 1, thus reducing the firm's cost.



$Y = a - bx$ (100, −1)

$r_1 + r_2 = 100$ or $r_2 = 100 - r_1$

MIXED BUNDLING

$P_1 = 89.95$
$P_2 = 89.95$
$P^B = 100$

① A will buy only good 2 !

② D will buy ~~only~~ only good 1 !!

③ B and C will buy the package.

Chapter 11: Pricing with Market Power

$\pi_1 = (P_1 - AC_1')\cdot Q_1 = (89.95 - 20)\cdot 1 = 69.95\$$

$\pi_2 = (P_2 - AC_2')\cdot Q_2 = (89.95 - 30)\cdot 1 = 59.95\$$

$\pi^B = (P^B - AC'^B)\cdot Q^B = (100 - 50)\cdot 2 = 100\$$

$\boxed{\pi_{TOTAL} = 229.90}$!!!

OPTION 1 Selling separately

$P_1^* = ?$ $P_2^* = ?$

Consider good 1:

IF $P_1 = 50$, B, C, D will buy. So $Q_1 = 3$

$\pi_1 = P_1 \cdot Q_1 - AC_1' \cdot Q_1 = (P_1 - AC_1')Q_1 = (50-20)\cdot 3 = 90\$$

IF $P_1 = 60$, C, D will buy. So $Q_1 = 2$

$\pi_1 = (P_1 - AC_1')Q_1 = (60 - 20)\cdot 2 = 80\$$

IF $P_1 = 90$, D buys. So $Q_1 = 1$

$\pi_1 = (P_1 - AC_1')Q_1 = (90 - 20)\cdot 1 = 70\$$

So $\boxed{P_1^* = 50}$

Consider good 2:

IF $P_2 = 40$, A, B, C will buy. So $Q_2 = 3$

$\pi_2 = (P_2 - AC_2')Q_2 = (40 - 30)\cdot 3 = 30\$$

IF $P_2 = 50$, A and B will buy. $Q_2 = 2$

$\pi_2 = (P_2 - AC_2')Q_2 = (50 - 30)\cdot 2 = 40\$$

IF $P_2 = 90$, only A buys. So $Q_2 = 1$

$\pi_2 = (P_2 - AC_2')Q_2 = (90 - 30)\cdot 1 = 60\$$

So $\boxed{P_2^* = 90}$

$\pi_{TOTAL} = \pi_1^* + \pi_2^* = 90 + 60 = 150\$$

11.5 BUNDLING

Mixed Bundling

Let's compare three strategies:

1. Selling the goods separately at prices P_1 = \$50 and P_2 = \$90.
2. Selling the goods only as a bundle at a price of \$100.
3. Mixed bundling, whereby the goods are offered separately at prices $P_1 = P_2$ = \$89.95, or as a bundle at a price of \$100.

TABLE 11.4 Bundling Example

Chapter 11: Pricing with Market Power

TABLE 11.4 Bundling Example				
	P_1	P_2	P_B	Profit
Sold separately	$50	$90	—	$150
Pure bundling	—	—	$100	$200
Mixed bundling	$89.95	$89.95	$100	$229.90

11.5 BUNDLING

Mixed Bundling

Figure 11.18

Mixed Bundling with Zero Marginal Costs

If marginal costs are zero, and if consumers' demands are not perfectly negatively correlated, mixed bundling is still more profitable than pure bundling.

In this example, consumers *B* and *C* are willing to pay $20 more for the bundle than are consumers *A* and *D*.

With pure bundling, the price of the bundle is $100. With mixed bundling, the price of the bundle can be increased to $120 and consumers *A* and *D* can still be charged $90 for a single good.

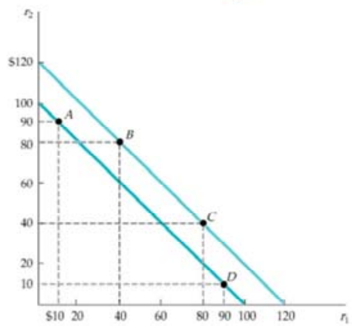


TABLE 11.5 Mixed Bundling with Zero Marginal Costs				
	P_1	P_2	P_B	Profit
Sell separately	$80	$80	—	$320
Pure bundling	—	—	$100	$400
Mixed bundling	$90	$90	$120	$420

→ VERIFY THIS RESULT.

$$\pi_{TOTAL} = \pi_1^* + \pi_2^* = 90 + 60 = 150\,\$$$

OPTION 2 PURE BUNDLING

w/ $P^B = 100$, A, B, C, D will buy. So $Q^B = 4$

$$\pi^B = (P^B - AC) \cdot Q^B$$
$$= (100 - (20+30)) \cdot 4$$
$$= (100 - 50) \cdot 4$$
$$= 50 \cdot 4$$

$$\boxed{\text{So } \pi^B = 200\,\$}$$

So far, π^B (200) > $\pi^{\text{sold separately}}$ (150).

OPTION 3 MIXED BUNDLING

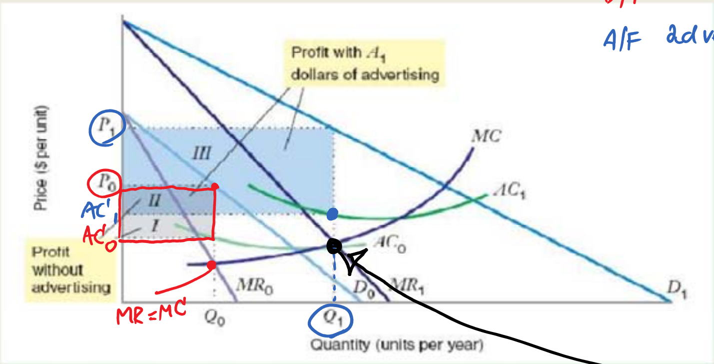
$P_1 = ?$

$P_2 = ?$

$P^B = ?$

Advertising

The firm can capture surplus using ***non-price strategies*** such as advertising.



B/F advertising, $\pi = I + II$

A/F advertising, $P = P_1$

$Q = Q_1$ (where $MR_1 = MC$)

$\pi_{NEW} = II + III$ which is higher than $I + II$

Advertising expenditure must fulfill two conditions

① $MR = MC$ for production of good.

② $MR_A = MC_A$ for determing optimal adv expenditure.

if $MR_A > MC_A$, advertising more

If $MR_A < MC_A$, " " less

Advertising

Advertising comes with costs; therefore, for a firm to maximize profit, two conditions must hold:

1) Quantity is optimally chosen:
$$MR(Q) = MC(Q)$$

2) Expenditure on Advertising is optimally chosen:

MR(Q) = MC(Q)

2) Expenditure on Advertising is optimally chosen:
MR(A) = MC(A)

Advertising

Recall the Inverse Elasticity Pricing Rule (IEPR):

$$\frac{P - MC}{P} = -\frac{1}{\varepsilon}$$

The IEPR tells us the profit-maximizing price.

We can derive a similar expression for a profit-maximizing firm to choose the optimal level of advertising:

$$\boxed{\frac{A}{PQ} = -\frac{\theta}{\varepsilon}}$$

where θ is the advertising elasticity of demand.

LHS = ratio of advertising expenditure to TR
RDH = ratio of the two elasticities

$A \rightarrow$ advertising expenditure

$P \cdot Q$ — Total revenue from sale

segment 1   segment 2

$\theta_1 > \theta_2$

$$\left[\frac{A}{P \cdot Q}\right]_{\text{segment 1}} > \left[\frac{A}{P \cdot Q}\right]_{\text{segment 2}}$$

$$\left[\frac{A}{P\cdot Q}\right]_{segment\ 1} > \left[\frac{A}{P\cdot Q}\right]_{segment\ 2}$$

Advertising

LEARNING-BY-DOING EXERCISE 12.7

Markup and Advertising-to-Sales Ratio

Suppose you own a restaurant specializing in fine steak dinners, and you want to maximize your profits. Your marketing studies have revealed that your own price elasticity of demand is −1.5 and that your advertising elasticity of demand is 0.1. Assume that these elasticities are constant, even if you change your price and your level of advertising.

Problem

(a) Interpret the advertising elasticity of demand.

(b) How much should you mark up your price over marginal cost of your dinners? What should your advertising-to-sales ratio be?