MANAGERIAL ECONOMICS

LECTURE 5: PRICE DISCRIMINATION

Rudolf Winter-Ebmer
Winter 2023

JOHANNES KEPLER
UNIVERSITY LINZ

Aims of this lecture

- How price discrimination may be used to increase profits
- How to identify submarkets
- Strategic segmentation of the market
- Setting different prices to different consumers

Motivation for price discrimination

Consider a (non-discriminating) monopoly, i.e., one price for all customers:

- Single-price monopoly equilibrium cannot capture all consumer surplus
- Some potential surplus is lost, “dead-weight loss”
- If the monopoly could charge individual prices to each customers, it could capture total surplus.

Price discrimination

Price discrimination

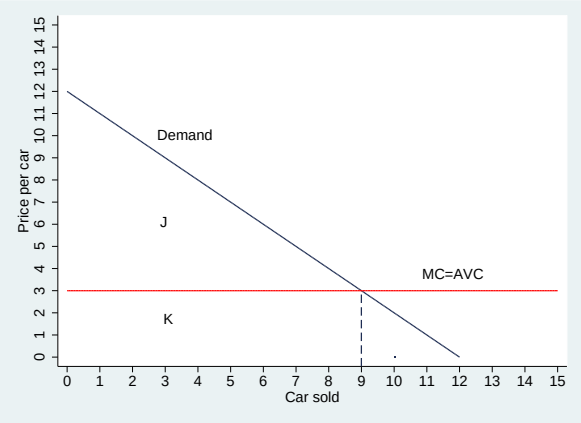
When the same product is sold at more than one price

NB: Different prices of similar products are *not* necessarily evidence of price discrimination as costs could also differ

First-degree price discrimination

- All customers are charged a price equal to their individual reservation price.
- The firm captures 100 percent of the consumer surplus.
- Equilibrium output and marginal cost are the same as under perfect competition.
- There is no dead-weight loss.
- Requires that firms have a relatively small number of buyers and that they know (estimate) the reservations prices
  - May be operationalized by means of a two-part tariff
  - Haggling
  - Car dealers with person-specific discounts plus extras

First-degree price discrimination



Notes: Consumer surplus is given by the area between the marginal cost curve and the demand curve. It is area J in this diagram. A firm that manages to extract (some of) the consumer surplus obtains *rents*, i.e., super-normal profits. See Allen et al., *Managerial Economics* (8th ed.), p308f.

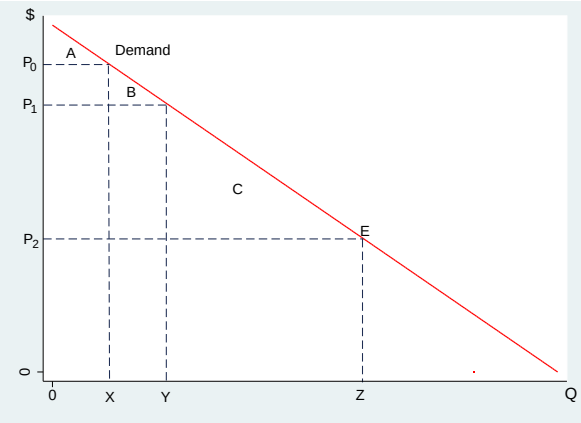
Second-degree price discrimination

Different prices are charged for different quantities, either

1. different consumers pay different pricess if they buy different quantities, or
2. each consumer pays a different price for consecutive purchases.

- Often used by utilities (gas, electricity, water, etc.)
- What condition must be fulfilled to make this price discrimination possible?

Second-degree price discrimination



Notes: A firm that manages to charge different prices, e.g., P_0, P_1, P_2, for different amounts of sold units (bulk discounts) extracts (some of) the consumer surplus. The areas A, B, and C indicate the consumer surplus obtained from trade. See Allen et al., *Managerial Economics* (8th ed.), Figure 9.2, p311.

Third-degree price discrimination

Customers differ in their observable characteristics and in their price elasticities. Each group pays a different price.

- Demand must be heterogeneous; that is, different customer segments must have different price elasticities of demand.
- Managers must be able to identify and segregate the different customer segments.
- Markets must be successfully sealed so that customers in one segment cannot transfer the goods to another segment, “no-arbitrage-condition”.

Examples for different segments

1. Students:
   - Low income makes students more responsive to price differences
   - Students' demand is thus likely to be more elastic than that of other segments
   - Students can be readily identified by their student IDs, aiding in segmentation
2. Senior citizens for travel
3. Tickets for business trips and vacations
4. Seasonal prices

The pink tax

- Why do women pay more at the hairdresser?
- Why do they pay more for a shaver?
- ...

www.youtube.com/watch?v=J7X2FEMzvXU

The pink tax


Tough on Plaque,
Gentle on Gums
Colgate
POWERED BY
OMRON
PROCLINICAL®
250+
RECHARGEABLE TOOTHBRUSH
Tough on Plaque,
Gentle on Gums
Colgate
POWERED BY
OMRON
PROCLINICAL®
250+
RECHARGEABLE TOOTHBRUSH
Proclinical C250 Black Electric Each
£39
Colgate Toothbrush
Colgate Proclinical C250 Pink
£50

The pink tax


5.49
BIC
COMFORT 3
Advance
low price
6.39
BIC
Soleil
Twilight


THE PINK TAX
WHAT COSTS MORE FOR WOMEN?
13% more for personal care products
8% more for adult clothing
7% more for toys and accessories
4% more for children's clothing
Source: New York City Department of Consumer Affairs

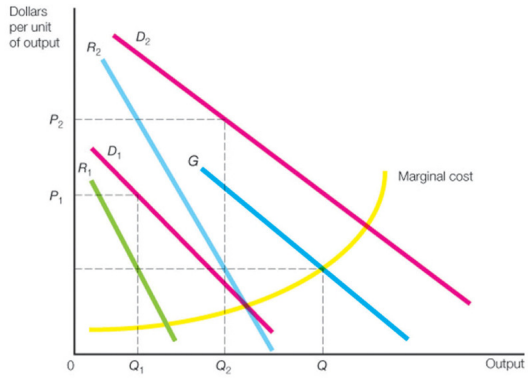
Optimal price discrimination

- The monopolist wants to allocate total output so that the marginal revenue in all customer segments is equal to the firm's marginal cost.
- This results in optimal price ratios of two segments, P_1 and P_2:

$$\frac{P_1}{P_2} = \frac{1 - \left(\frac{1}{|\eta_2|}\right)}{1 - \left(\frac{1}{|\eta_1|}\right)} \quad .$$

- Customers who have a relatively elastic demand are charged a lower price, and vice versa.

Third-degree price discrimination



Notes: A firm that manages to charge different prices to different types of consumers, e.g., P_1, P_2, for different *elasiticities* of demand extracts (some of) the consumer surplus. The different demand curves are given by D_1 and D_2, the corresponding marginal revenue curves by R_1 and R_2, and G is the (horizontal) sum of R_1 and R_2. The optimal quantity is Q, given by the intersection of MC and G. The output Q is split into Q_1 adn Q_2 (see the dashed horizontal line) with prices obtained from the corresponding demand curves, P_1 and P_2. See Allen et al., *Managerial Economics* (8th ed.), Figure 9.3, p315.

Examples

Women pay more:

- Dry cleaners: shirts vs. blouses
- Hair salons: difference could double

Yield management and pricing:

- Yield management models are complex pricing mechanisms, e.g., airlines
- Prices respond to customer behavior
- At any one time, several classes of seats priced differently
- Airlines forcast demand for third-price discrimination

Examples for price discrimination

1. One day in Disneyland Anaheim, near LA
   - ☐ Family A from Point Place, Wisconsin pays $312
   - ☐ Family B from Los Angeles, California pays $292
   - ☐ Why? On which characteristics has been price discriminated?
2. Prices at amusement parks in Disneyland
   - ☐ Gate prices are most expensive compared to advance purchase online or on special days
   - ☐ Five parks card: substantial discount
3. Skiing
   - ☐ Daily vs. weekly tickets

What is the PIZZAMANN doing?

- If you buy a pizza, you get a red tomato
  - The tomato is a voucher for a discount for your next purchase
  - Other examples?
- Why don't they cut prices for everybody?

Coupons allow to charge different prices

- Firms distribute coupons which offer a discount on a product
- Coupon users are more price-sensitive, i.e., more price elastic
- Only a small proportion of coupon recipients actually use them
- Coupons and rebates lead people to self-select their market segment
- Coupon reminds the customer each time of the lower price (loyalty)

Optimal coupon value

Pricing strategy

- $P(1-1/|\eta_R|) = (P-X)(1-1/|\eta_S|) = MC$
  P market price
  X discount from coupon
  η_R price elasticity of demand by those who don't use the coupons
  η_S price elasticity of demand by those who do use coupons

Assume $MC = 2$, $\eta_R = -2$, and $\eta_S = -5$:
$MR = MC \Rightarrow P = 4$
$MR = (4-X)[1-1/|-5|] = 2 = MC \Rightarrow X = 1.5$

Demand fluctuations

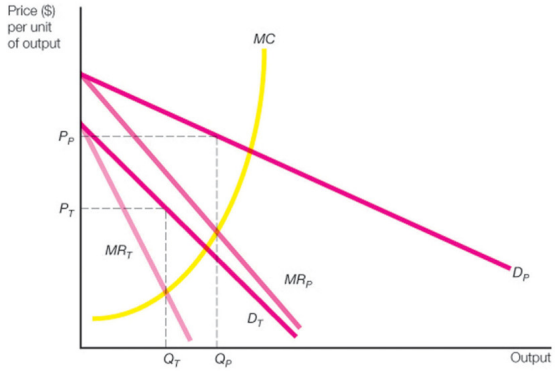
Often, the demand for some goods is time sensitive or seasonal, but the capacity is constant:

- Electricity generation
- Roads, Highways
- Hotel rooms
- Books: Early hard cover versions are more expensive than later paperback issues

Peak load pricing

- During peak time periods, when demand is high, managers should charge a higher price (P_P)
- During trough time periods, when demand is low, managers should charge a lower price (P_T)
- Marginal costs often follow a cyclical pattern in which MC are high during peaks and low during troughs
- Firms should price such that $MC = MR$ separately in each period to determine the appropriate prices.

Peak and trough prices



Notes: The optimal peak price, P_P, is given by $MR_P = MC$. The optimal trough price, P_T, is given by $MR_T = MC$. See Allen et al., *Managerial Economics* (8th ed.), Figure 9.4, p322.

Price discrimination vs. Peak-load pricing

1. Price discrimination:
   - ☐ Everything produced at the same time
   - ☐ $MC = F(Q_1 + Q_2)$
   - ☐ Pricing solution: $MR_1(Q_1) = MR_2(Q_2) = MC(Q_1 + Q_2)$
2. Peak-load pricing:
   - ☐ Same capacity, but different demand at different times
   - ☐ Pricing: $MR_1(Q_1) = MC_1(Q_1)$ and $MR_2(Q_2) = MC_2(Q_2)$

Why do your laundry at 3 a.m.?

- electric utilities may be allowed to practice time-of-day pricing to residential customers who opt to be charged in this way
- Austria: “Nachtstrom”
- Public utilities save quite a lot of money
  - In the case of peak demand, do not have to buy on the (more expensive) spot market or bring its least efficient (most expensive) capacity on line

Two-part tariffs

Two-part tariff

Prices consist of a fixed part (“entry fee”) and a variable per unit part (“use fee”).

- Entry fee should be low to maximize participation (demand) in the market
- Entry fee extracts consumer surplus
  - *Clubs* (golf, health, etc.) that charge a membership fee and a per use fee
  - *Phone plans* that charge a fixed fee and then additional fees per minute
  - *Personal seat licenses* (PSL) for sport events consist of a fixed cost that gives the buyer the right to buy a ticket for a game

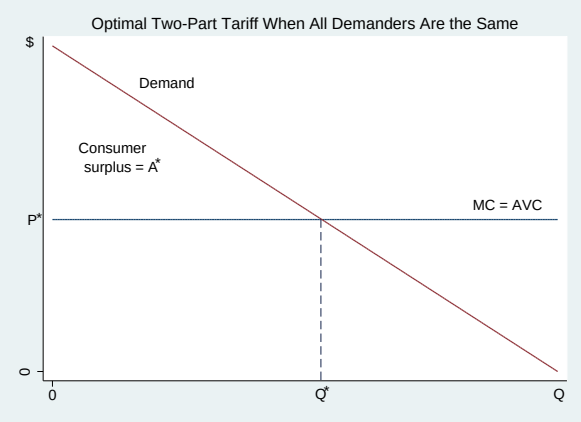
Two-part tariffs with identical customers

Assume that all consumers have the same preferences, defined by the demand curve $P = a - bQ$; and the firm's marginal cost is constant.

Optimal two-part tariff:

- Entry fee is equal to consumer surplus.
- Use fee is equal to marginal cost.
- Total revenue is the same as under first-degree price discrimination.

Two-part tariff with identical consumers



Notes: The optimal two-part tariff when all customers are identical consists of (i) a variable fee, $P^* = MC$, which is linked to the amount purchased, and (ii) a fixed fee, $P^F = A^*$, where A^* is equal to the consumer surplus. See Allen et al., *Managerial Economics* (8th ed.), Figure 9.5, p330.

Example: Mobile Phone Calling Plans

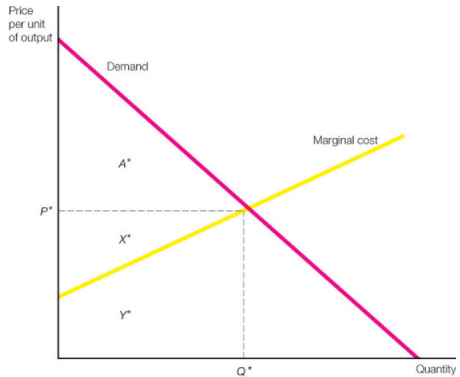
Telephone service is a typical example of a two-part tariff:

- A customer pays the phone company a monthly fee for the privilege of receiving a dial tone
- For each call, the customer pays a price per call, dependent on length or distance

Sophisticated pricing strategies

- Managers do not know consumers' demand exactly and offer a menu of pricing plans
- Most plans are two part tariffs, but there are also other strategic pricing elements such as *bundling* or *price discrimination*

Two-part tariff with increasing MC



Notes: The optimal two-part tariff consists of a (i) use fee which is P^* that is equal to MC, and (ii) a entry fee equal to *total consumer suplus*, area A^* in the diagram. See Allen et al., *Managerial Economics* (8th ed.), Figure 9.6, p333.

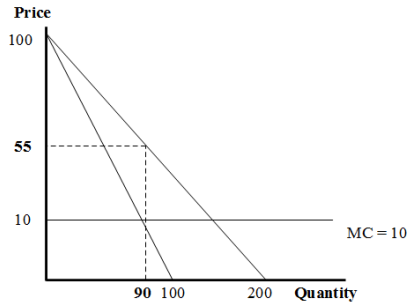
Example: Telephone pricing

Assume:

- Telephone company is monopolist
- Demand: $P = 100 - 0.5Q$
- Marginal cost: $MC = 10$ (cents/minute)

- Find the monopolist's optimal price and calculate the profit!
- Show this graphically!
- Consider the optimal two-part tariff and calculate the profit!

Solution: Telephone Pricing



Notes: Graphical solution of the problem. You should see that extracting *consumer surplus* is better than mere monopoly pricing!

- Monopoly pricing:
  $P = 100 - 0.5Q$
  $TR = 100Q - 0.5Q^2$
  $MR = 100 - Q$
  $MR = MC$:
  $100 - Q = 10 \Rightarrow$ **Q=90**
  $P = 100 - 0.5Q \Rightarrow$ **P = 55**
  Profit $= 90 \cdot (55 - 10) = 4050$
- Two part tariff:
  $Q = 180$
  Price/Minute $= 10$
  Fee $= 90 \cdot 180/2 = 8100$
  Profit = 8100.

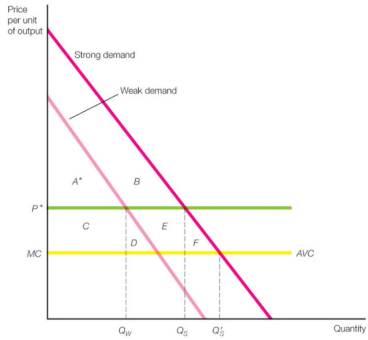
Two-part tariffs with different demand

Assume that there are two types of customers, “strong” and “weak” demanders, with equal size

Pricing strategy:

1. When strong demand is much stronger than weak demand
   - 1.1 Set the use fee equal to marginal cost and entry fee equal to the strong demanders’ consumer surplus. Weak demanders will be excluded from the market.
   - 1.2 Set high entry fee for strong demanders and low entry fee for weak demanders and the user fee at marginal costs. Strong demanders will “hide” themselves by pretending they are weak.
     - Additional bonus or prestige to strong demanders, e.g., Gold and Silver Credit Card, Frequent Flyer Card, . . .

Optimal two-part tariff with two types of customers



Notes: In this case, the optimal tariff when the firms wants to exclude customers who have a weak demand implies a use fee of $P = MC$ and an entry fee of $A^* + B + C + D + E + F$, i.e., the consumer surplus of customers who have a strong demand. When the firm wants to serve both types of customers, the need to set a use fee of either $P^* > MC$ or $P^* = MC$. P^* is chosen to maximize the consumer surplus that can be extracted by the entry fee, this is either A^* or $A^* + C + D$. You should understand the trade-off between pricing above MC and extracting consumer surplus. See Allen et al., *Managerial Economics* (8th ed.), Figure 9.7, p338.

Two-part tariffs with different demand

2. When strong demand is not much stronger than weak demand:
   - Set use fee equal to marginal cost and entry fee equal to the weak demanders' consumer surplus. Both types will buy.
   - Alternatively, set use fee above marginal cost at a price that maximizes variable cost profit and entry fee equal to the weak demanders' consumer surplus. Both types will buy.
   - Optimal strategy when strong demand is not much stronger than weak demand is found by comparing total average cost profit from the two strategies. Note that there is a trade-off between pricing above MC and extracting consumer surplus. The firm needs to compare the profits from $P^* > MC$ or $P^* = MC$.