Switching Costs and lock-in

⇒ Users incur costs when changing from ~~one~~ using one technology to the other. This is implemented by the service provider
⇒ The presence of lock-in ~~system~~ is very slow.
⇔ The degree of lock-in is calculated by how much switching costs are incurred.

* Types of Switching Costs

1. Long term Contracts
   Termination of contract enforces payment for breach of contract.
2. Training and Learning
   Expenses on users as they have to learn systems
3. Search.
   Cost of searching for new systems.
4. Portability of information
   → Transfer of information to new systems.
   →
5. Loyalty Programs.
   ⇒ losing of benefits.
   ⇒

Switching Costs and lock-in : Implications

* Opposite effect on price competition

Supply-Side economies of scale.

⇒ firms incur high fixed sunk costs and negligible marginal costs.
⇒ Average costs decline as output rises.

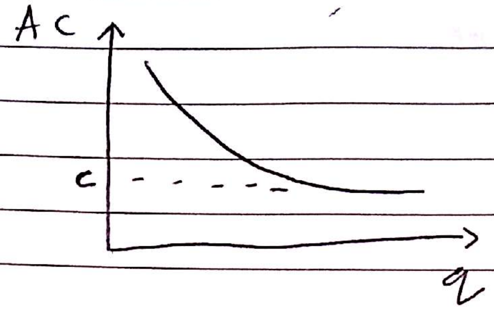
$$TC(q) = \underbrace{f}_{\text{fixed}} + \underbrace{cq}_{\text{variable}}$$

Average costs

$$AC(q) = \frac{TC(q)}{q} = \frac{f}{q} + c$$

$$q \uparrow \Rightarrow AC \downarrow$$

Max = 3 hours



$dTd(q)$

$$MC(q) = \frac{dTC(q)}{dq} = c$$

marginal cost of production

Two cases

1. Traditional network industries
2. Information goods

a) Traditional

Multi Product firm

$$TC(q_1, q_2) = F + c_1 q_1 + c_2 q_2$$

$$TC(q_1, q_2) < TC(q_1, 0) + TC(0, q_2)$$

The condition holds for economies of scale.

b) Information goods

→ first costs are huge fixed costs that cannot be recovered.

→ Additional copies can be produced at low costs.

Market structure in Network Industries

⇒ Equilibrium
Paretal Optimum
* Ideal case which rel

① → Many small firms /NA in NI
② → These small firms are PRICE TAKERS /NA in NI
→ These firms have Homogeneous products ⇒ Same technology
③ FREE ENTRY / EXIT /NA in NI
→ COMPLETE INFORMATION

Public Policy in Network Industries

(Efficiency)

STATIC

↓ ALLOCATIVE

↓ PRODUCTIVE

DYNAMIC

⇒ Firms invest in new technology
⇒ Firms incur high fixed costs

$P > MC$

ALLOCATIVE → MAXIMUM output.

↓

$P = MC$

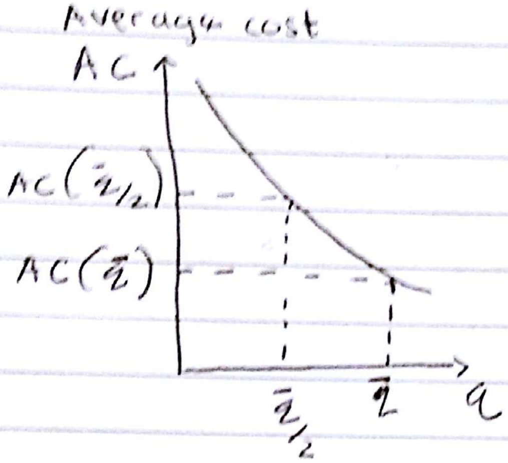
MC → supply

↓

P → valuation that consumers have for buying

SCALE ECONOMIES

NATURAL MONOPOLY (costs less to produce by single firm)



NATURAL MONOPOLY	POTENTIALLY COMPETITIVE
TLC = Local loop	VOICE / DATA SERVICES
E.g: Energy = Transmission	Generation
Transport	Extraction
Distribution	Billing
Railways ⇒ Tracks/Stations	Passenger / Freight Transport

PRICING STRATEGIES

Monopoly → A firm which controls the entire market for a particular product
→ No close substitutes for products that the firm provides

CROSS PRICE ELASTICITY OF DEMAND

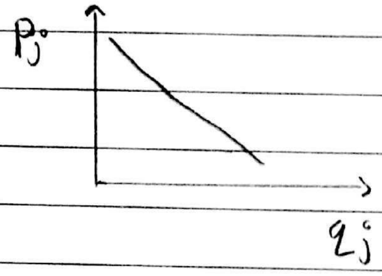
consider $M_{ij} = \frac{\delta q_i}{\delta P_j} \cdot \frac{P_j}{q_i}$ → >0, → <0

Products i, j

Assumption: $P_j \uparrow \Rightarrow q_j \downarrow \Rightarrow q_i$?

$\uparrow$ increases ⟨q sold⟩

$\downarrow$ Decrease ⟨q sold⟩



Cross price elasticity of demand measures the responsiveness of a quantity demanded for a good to change in the price of another good

→ a negative elasticity explains complementary products
→ A positive elasticity explains substitutes

(1) Substitutes products
(2) Complementary ⟨Complements⟩

$M_{ij} > 0$ but Small

In general this means a given increase in price for the monopoly has an increase in profits because the elasticity of the two products is small.

Profits of a firm (Monopoly)

$$\pi(q) = TR(q) - TC(q)$$

$\pi(q)$ ↓ profits; $TR(q)$ ↓ Total Revenue; $TC(q)$ ↓ Total cost

$$\frac{d\pi(q)}{d(q)} = 0 \Rightarrow \frac{d\pi(q)}{dq} = \frac{dTR}{dq} - \frac{dTC(q)}{dq}$$

$\frac{dTR}{dq}$ → Marginal Revenue $MR(q)$

$\frac{dTC(q)}{dq}$ → Marginal Cost $MC(q)$

$$\Rightarrow MR(q^m) = MC(q^m)$$

$\uparrow$

OPTIMAL QUANTITY

If

$$MR(q^m) > MC(q)$$

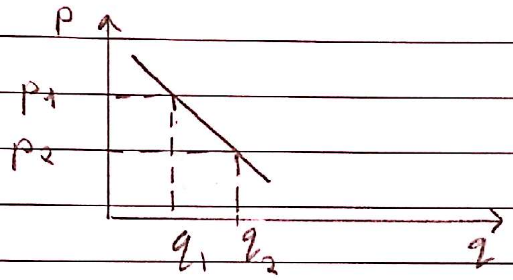
The firm will decide to have an increase in production

However

If $MR(q) < MC(q)$

The opposite happens.

$$TR(q) = P \cdot q$$



$$TR(q) = P \cdot q$$
$$= P(q) \cdot q$$

derivative of price wrt q

$$MR(q) = \frac{d\,TR(q)}{dq}$$

$$MR(q) = \frac{dP}{dq} \cdot q$$

OPTIMALITY

$\Downarrow$

$$\frac{dP}{dq} \cdot q + P = MC$$

$$\frac{P - MC}{P} = \left| -\frac{dP}{dq} \cdot \frac{q}{P} \right|$$

OWN PRICE ELASTICITY OF DEMAND

$$\eta = \underbrace{-\frac{dq}{dP}\cdot\frac{P}{q}}_{>0}$$

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

Ass: $\eta \uparrow \Rightarrow P \rightarrow MC$

THE CASE OF PERFECT COMPETITION

- Many small firms
- Same technology
- Same Goods

Price takers.

$$\frac{d\Pi(q)}{dq} = MR(q) - MC(q) = 0$$

$$TR(q) = P \cdot q$$

$$MR(q) = \frac{dTR(q)}{dq} = P = MC$$

MONOPOLY VS PERFECT COMPETITION

$\boxed{P > MC}$ $\boxed{P = MC}$

Market power

Firm better off

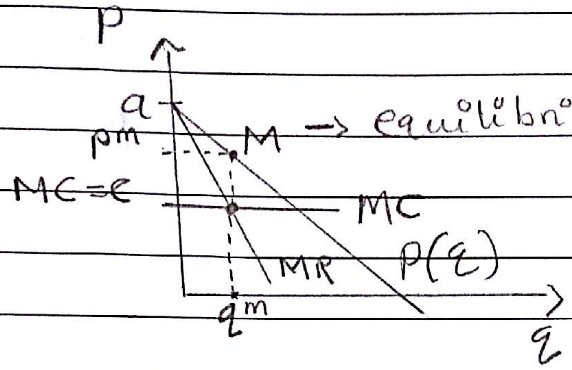
consumers worse off

Assume

Price $P(q) = \underset{>0}{(a)} - \underset{>0}{(b)}\, q$

$$TR(q) = P(q)\cdot q = (a - bq)q =$$
$$= aq - bq^2$$

$$MR(q) = \frac{dTR(q)}{dq} = a - 2bq = MR(q)$$



→ equilibrium point of the monopoly.

Conditions for paretal - optimality.

① Efficiency of exchange
- The marginal rate of substitution between any two products must be the same for any individual who consumes both (MRS) must be equal to the ratio of their prices

② Efficiency in production

$$TC(q) = F + Cq$$
$$\downarrow$$
$$MC$$

$$MR(q^m) = MC(q^m)$$

ADDITIONAL UNIT

$$p^M = P(q^m) > \underbrace{P > MC(q^m)}$$

← Additional Unit

↓ willingness to pay → consumer Evaluation → Consumers are better off

↓ firm better off

⇒ Moving from the optimality point of the monopoly to add and additional unit its is possible to find evaluation of the consumers to be higher than the MC.

⇒ This shows that the point of equilibrium M for the monopoly is not Pareto Optimal

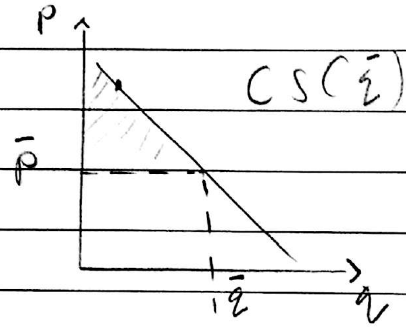
MEASURE OF INEFFICENCY

SOCIAL WELFARE

$W = CS + \pi$

↓

Consumer Surplus

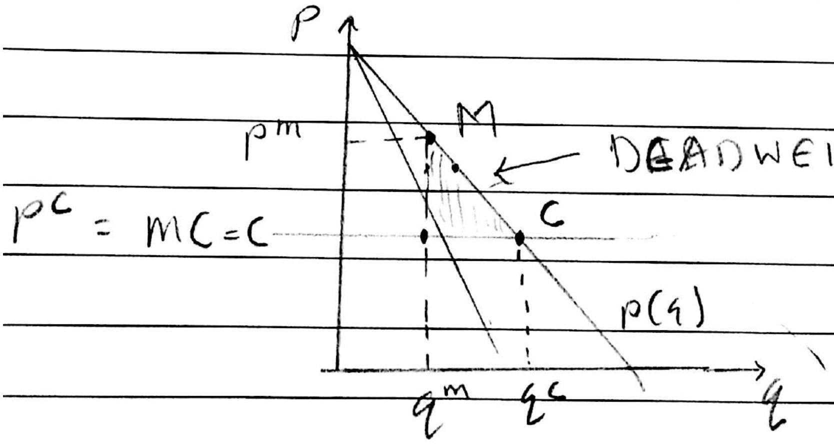


$$\underbrace{CS(q)}_{\text{Net CoS}} = \underbrace{\int_0^q p(x)\,dx}_{\text{GROSS BENEFIT}} - \underbrace{pq}_{\text{consumer expenditure}}$$

$$W = CS + \pi = \underbrace{\int_0^q p(x)\,dx}_{\text{Gross Surplus}} - \underbrace{pq}_{\text{Expenditure}} + \underbrace{pq}_{\text{firm's revenue}} - \underbrace{TC(q)}_{\text{cost of production}}$$

$W(q)$

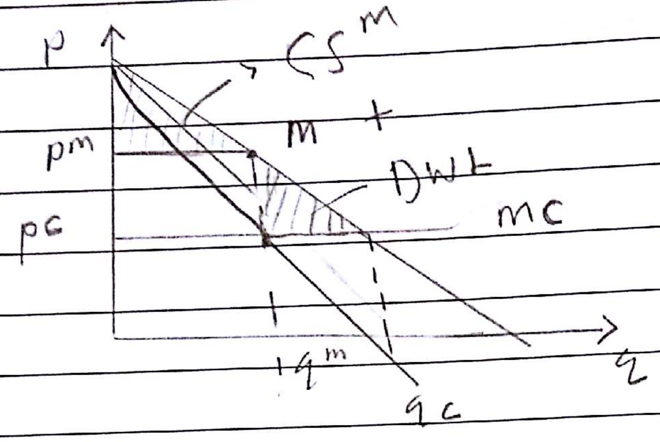
$$\frac{dW(q)}{dq} = 0 \quad p(q) - MC(q) = 0$$



DEADWEIGHT LOSS OF MONOPOLY

↓

$\Delta W = W^c - W^M$



PRICE DISCRIMINATION

- Information (This is the infor. that the firm has considering the spending behaviours of consumers)
- Instruments (Price, Quantity, Quality etc

TYPES OF PRICE DESCRIMINATION

UNIFORM PRICE

UNEXPLOITED SURPLUS

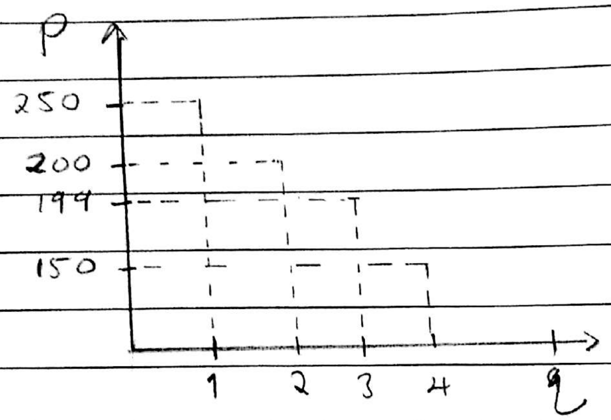
PRICE DISCRIMINATION — FIRST - DEGREE / SECOND-DEGREE / THIRD - DEGREE

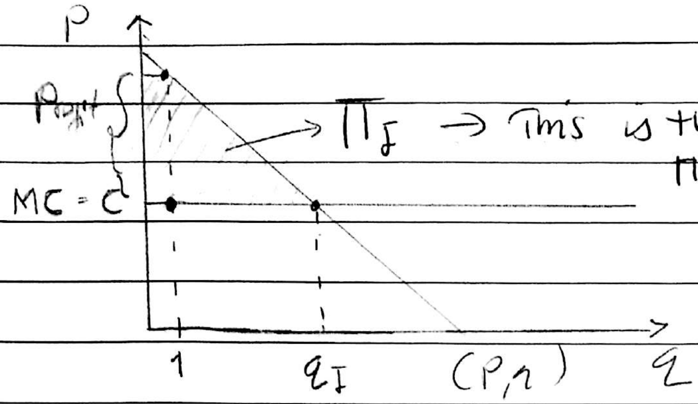
Perfect PD = Personalised Pricing = First Degree

Menu Pricing : PRICE + Quantity / Quality = Second Degree

GROUP PRICING : Third Degree

PERSONALISED PRICING





Π_I → This is the measure of the monopolist's profit.
$\Pi_I \equiv W_I \equiv W_{AX}$

There is no DEADWEIGHT LOSS.

The point where the demand curve intercept the marginal costs is called : profit margine is zero :

$P = MC(q_I)$ ⇒ This the price of the last unit.

q_I : AMOUNT THAT THE MONOPOLIST IS SELLING OF QUANTITY

PARETO OPTIMALITY (WELFARE IS MAX)

$W_I = SC_I + \Pi_I = W_{MAX}$

n perfect Competition $W_C = SC_C + \Pi_C = W_{MAX}$

GROUP PRICING

$P_1(q_1)$ $P_2(q_2)$

Workers STUDENTS

Market Demand Curves

$$\text{MAX } \Pi = \underbrace{P_1(q_1)\cdot q_1}_{TR_1} + \underbrace{P_2(q_2)\cdot q_2}_{TR_2} - \underbrace{C(q_1+q_2)}_{\text{production costs}}$$

Independent Demand + Non-Separable Costs

$$\text{MAX } \Pi = \underbrace{P_1(q_1)\cdot q_1}_{TR_1} + \underbrace{P_2(q_2)\cdot q_2}_{TR_2} - C(q_1+q_2)$$

derivative

* Considering.

$$MR_1(q_1^{**}) = MC(q_1^* + q_2^*) \quad \text{Group 1}$$

$$MR_2(q_2^*) = MC(q_1^* + q_2^*) \quad \text{Group 2.}$$

Optimality condition

$$MR_1(q_1) = MR_2(q_2)$$

$$MR = P\left(1 - \frac{1}{\eta}\right)$$

∴ if we use the above elasticity we have;

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

If we make an Assumption

if $P_1 > P_2$ then $\left(1 - \frac{1}{\eta_1}\right) < \left(1 - \frac{1}{\eta_2}\right)$

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GROUP PRICING

$P_1 > P_2 \iff \eta_1 < \eta_2$

Conditions

1) Market Power

$P_1 > MC$

$P_2 > MC$

2) No ARBITRAGE

- If arbitrage is possible then Price Discrimination can not work because the firm can not sel different prices for different groups.

Conditions that avoid Arbitrage.

i) High transport costs between countries

ii) Services do not allow arbitrage.

iii) Contractual / Legal Restrictions

GROUP PRICING AND WELFARE

Relative to Uniform Pricing

$\Rightarrow$ Here the Firm is better off.

$\Rightarrow$ Consumers? for;

$GP \longrightarrow P_1 < P_2$

$UP \longrightarrow P^m$

Group 1 - Consumers are better off if monopolists sets different price.

for Group 2 - Will have to pay high price as articulated above

NECESSARY CONDITION FOR GP TO IMPROVE WELFARE

$$W_{\underset{GP}{III}} > W^{M}$$

$$\Rightarrow q_{III} > q^{u}$$

Country A (Group) Country B (Group) B

$q = a - p$ $a > b > 0$ $q = b + p$

Demand Curve $P = 0 \rightarrow q = a$ Means Market a is greater than Market b

Market Size

If We consider inverse proportionality, we have

INVERSE DEM-CURVE $P = a - q$

$q = 0 \rightarrow \boxed{P = a}$ → Reservation Price that the monopoly can sell in country A

Considering the Case of GP

Assumption; There are no production costs

for country A

$$\underset{P}{\text{MAX}}\ \Pi = \underbrace{P \cdot (a - P)}_{TR}$$

↓ derivative

country B

$$\frac{d\Pi}{dP} = 0 \longrightarrow P_A = \frac{a}{2} > P_B = \frac{b}{2}$$

Consider the case of Uniform Pricing (Same Price for All)

AGGREGATE DEMAND CURVE

~~This means Suming up the quanlities as a fun~~

$$Q = \begin{cases} a - p + b - p = a + b - 2p & \text{such that } p \leq b \\ a - p & \text{such that } p > b \end{cases}$$

$$\underset{p}{\text{MAX}}\ \Pi(p) = p \cdot (a + b - 2p)$$

Optimal Price ⇒ $\frac{d\Pi(p)}{dp} = 0$

$$\Rightarrow p^{*} = \frac{a+b}{4} \leq b \Rightarrow \boxed{a \leq 3b}$$

MARKET / GROUP A

⇒ Should be too much "greater" or "Richer" than Market/Group B.

⇒ Suppose markets are very different

$a > 3b$ ⇒

"Large" Assymmetry between Markets

$a > 3b$ ⇒ Market B is closed

⇒ This means there is reduction in welfare as there is lower

SECOND - DEGREE PRICE DISCRIMINATION

MENU PRICING

PRICE

Quantity

Quality

Time (Delay)

① Quantity

Quantity - dependent prices

→ These involve non-linear Pricing

Two Part Tariff

$$\underbrace{T(q)}_{\text{Total Expenditure}} = \underbrace{A}_{\text{Fixed Subscription Fee}} + \underbrace{Pq}_{\text{Variable (Usage) Price}}$$

Unit Expenditure

diving the total expenditure by the total amount of units

$$\text{UNIT EXPENDITURE} = \frac{T(q)}{q} = \frac{A}{q} + P$$

Higher Quantity consumers means lower unit price.

Assuming the buying of complimentary goods

$$T(q) = A + Pq$$

Price
Base product

complimentary
product price

② QUALITY

In this case the firm is selling differents versions with different levels of quality attached with varying prices

e.g High quality → High price
Low quality → Low price

This kind of Strategy is called <u>Versioning</u>

③ TIME (DELAY)

- Services or goods offered early tend to fetch high prices than the delayed purchases

Airlines

Discounts Based of Restrictions

Quality
(Business/Economy)

TIME (Delay)

NON-LINEAR PRICING

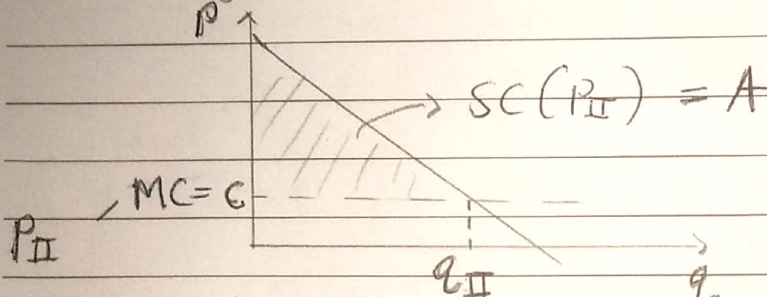
TWO-PART TARIFF

$T(q) = A + Pq$

A: Fixed Subscription fee.

Pq: Variable (usage) price

Assuming: Identical consumers



Demand curve of an individual

Q What is the best way for the monopoly to choose both components

Uniform Pricing

p^m " Too high

$\boxed{q^m \quad \text{Too low}}$

Set Variable Price to P_{II} which as the same as the firm's MC of production for the unit sold.

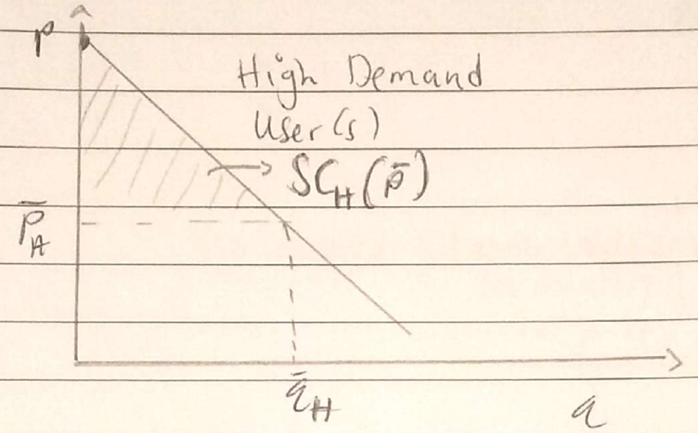
Therefore, the consumer has no Consumer Surplus as the Consumer pays the Subscription fee which is exactly equal to intended Consumer Surplus

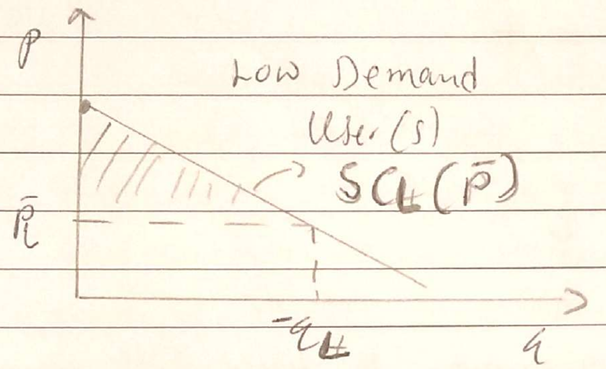
$$SC(P_{II}) = A = \Pi_{II} = W_{II} = W_{MAX}$$

EFFICIENT OUTCOME

↙ OUTPUT ↘ WELFARE

ASSUMPTION: DIFFERENT GROUPS





Assum: The firm can use single price all types of users

$$T(q) = A + pq$$

$$p = \bar{p} \ (\neq MC)$$

$$SC_L(\bar{P}) < SC_H(\bar{P})$$

Options for the firm to make Profits.

① Selling to both groups means;

a) $A \leq SC_L(\bar{P})$

b) $SC_H(\bar{P}) > 0$

② Extracting all Surplus from High demand Users

a) $A = SC_H(\bar{P})$

b) LD - Users Do not Buy at all

Criteria for choosing options

1) Size of each group
2) The difference in terms of willingness to p (WTP) / Reservation prices

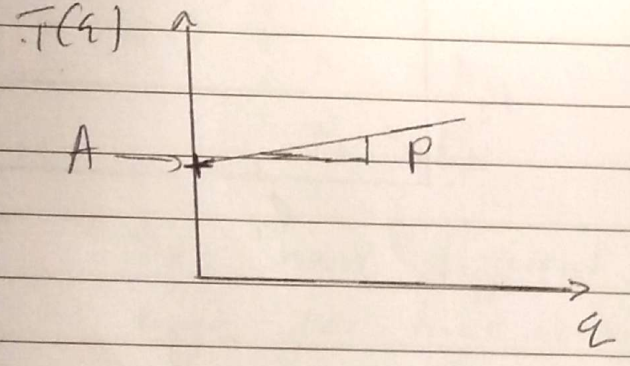
NON LINEAR PRICING / MENU PRICING

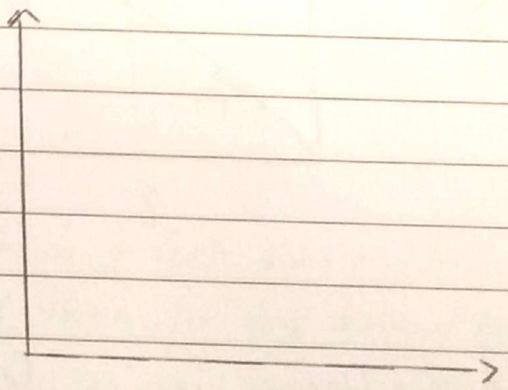
TWO - PART TARIFF

$$\underbrace{T(q)}_{\text{Total expenditure}} = \underbrace{A}_{\text{Fixed Subscription}} + \underbrace{P}_{\text{Variable usage price}} q \longrightarrow \text{Average expenditure}$$

Variable usage price = MARGINAL EXPENDITURE

$$\frac{T(q)}{q} = \frac{A}{q} + P$$

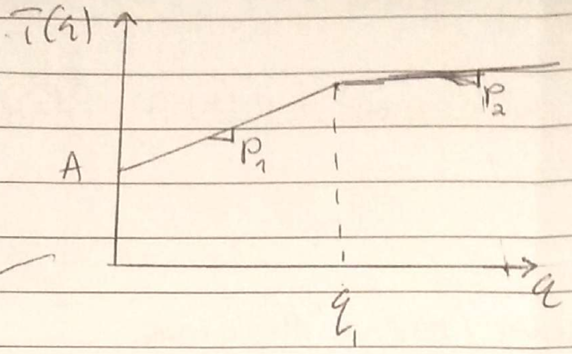


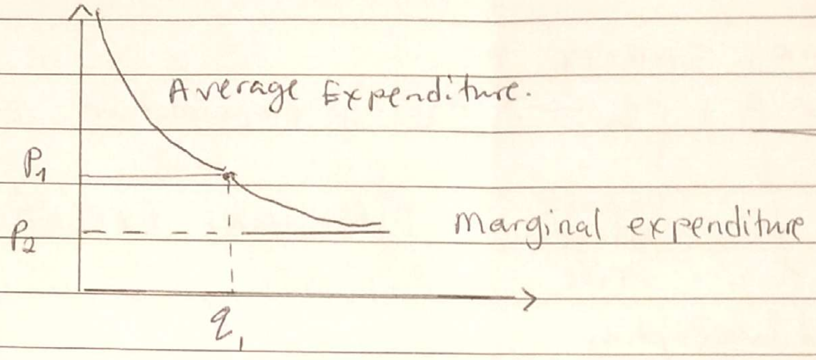


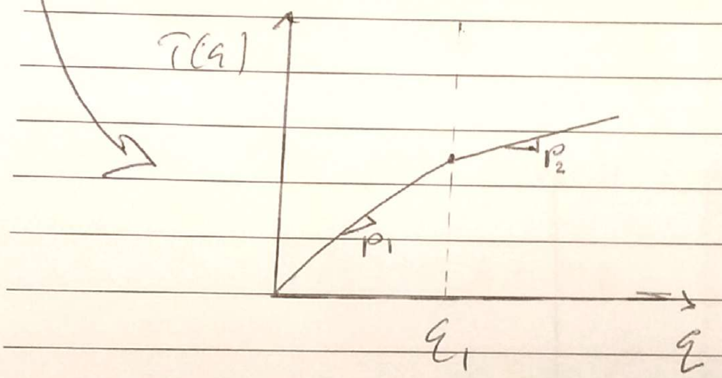
THREE - PART TARIFF

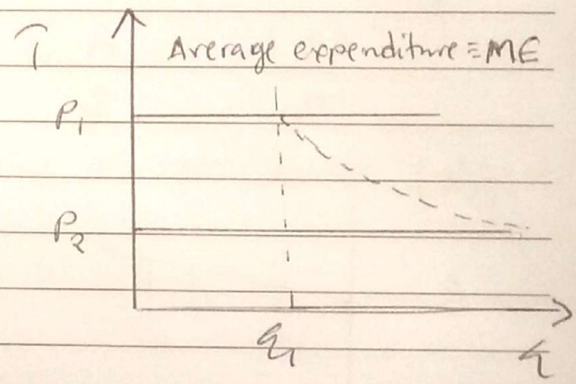
$$T(q) = \begin{cases} A + P_1 q & q < q_1 \\ A + P_1 q_1 + P_2 (q - q_1) & q > q_1 \end{cases}$$

we assume: $P_2 < P_1$





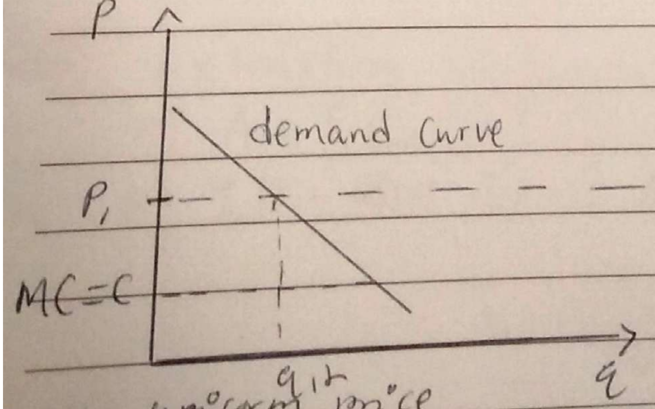




Non - linear Tariff Scheme
Pareto - Dominates
Uniform Price

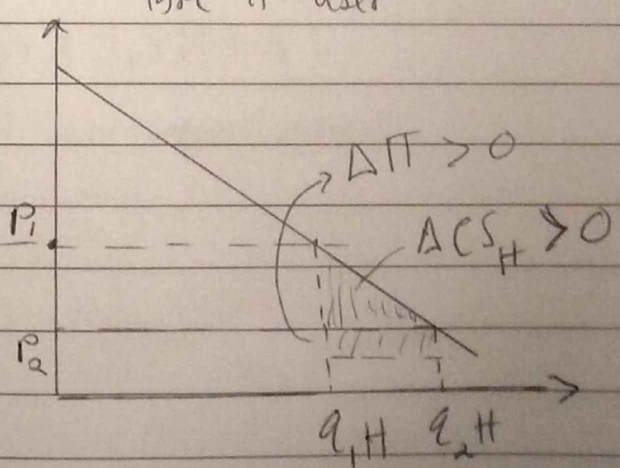
consumers
firm are betteroff

Type L - User



per uniform price
P_2

Type H - User



$$T(q) = \begin{cases} P_1 q & q \leq q_{1H} \\ P_1 q_{1H} + P_2(q - q_{1H}) & q > q_{1H} \end{cases}$$

Assup: $C < P_2 < P_1$

Low consumer user is not affected by the above pricing scheme but a high consumer user benefits more.

PRICING UNDER ASYMETRIC INFORMATION

Menu Pricing = means the firm offers price to the high demand user or the lower demand user

Ex.

LOW-DEMAND USERS

$T_L(q) = A_L + P_L q$

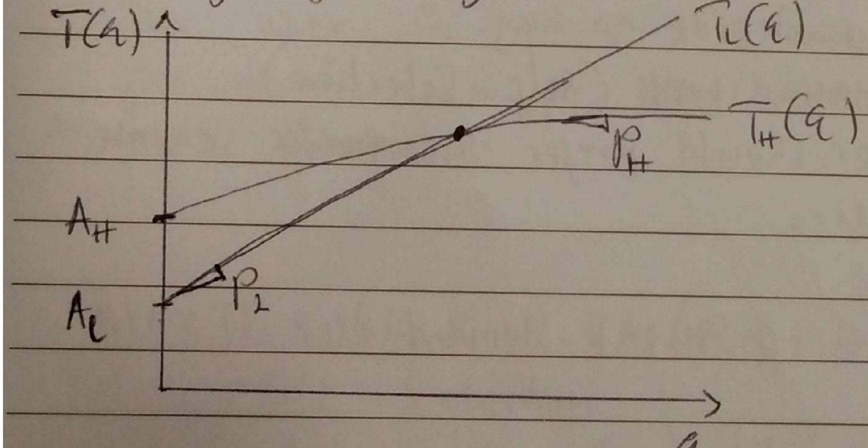
HIGH-DEMAND USERS

$T_H(q) = A_H + P_H q$

$A_H > A_L$

$P_L > P_H$

They have different subscription prices where it is high for high demand users than for low demand user



Tariff Plan low demand user

Tariff Plan High demand user

$$T_L(\bar{q}) = A_L + P_L q = T_H(\bar{q}) = A_H + P_H \bar{q}$$

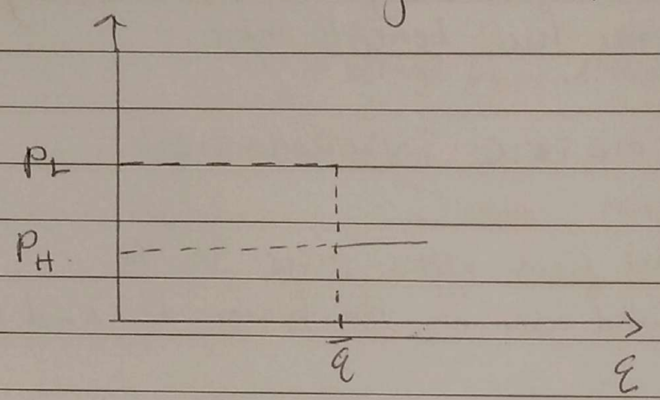
$$\bar{q} = \frac{A_H - A_L}{P_L - P_H}$$

$\forall\, q < \bar{q} \Rightarrow T_L(q) < T_H(q)$

$\forall\, q > \bar{q} \Rightarrow T_H(q) < T_L(q)$

$\Rightarrow$ low demand user would want to buy at the lowest minimum price available.

Marginal Exp



If we use the menu of two two part tariff we will achieve similar results.

Menu of two Part Tariff

Firm faces challenges as:

i) Participation
- Both types of users decide to buy.

ii) INCENTIVE - COMPATIBILITY (Self - Selection)
- Each type of user should prefer the tariff scheme targeted to the user.

Considering Participation for the L - demand user

$$\underbrace{\hat{S}_L(q_L)}_{GS} - \overbrace{T_L(q_L)}^{TE} > 0$$

Type H - user

$S_H(q_H) - T_H(q_H) >$

$> S_H(q_L) - T_L(q_L)$ net benefit here means that high demand user is buying according to Scheme for type L

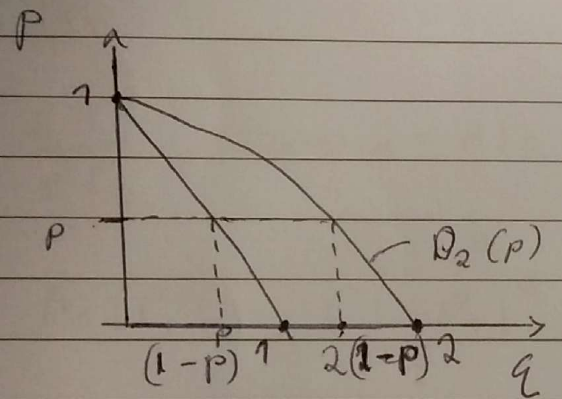
OPTIMAL MENU OF TWO-PART TARIFF

$q_1 = D_1(p) = 1-p$

$q_2 = D_2(p) = 2(1-p)$

- Groups of equal size
- $MC = C = 0$

Demand curves for type 1 or type 2 consumer



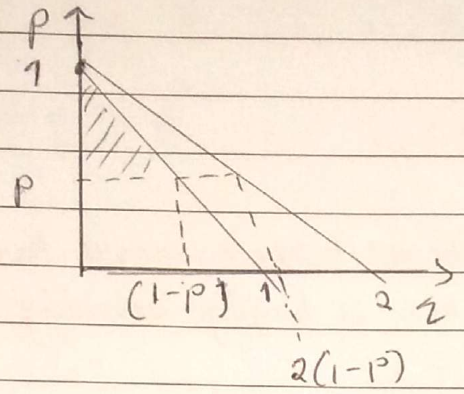
The user in group 1 is lower demand user and for group 2 is for High demand user.

Assump: ~~Finding~~

$$MAX\,\Pi = (1-P_1)P_1 + A_1(P_1) + 2(1-P_2)P_2 + A_2(P_2)$$

(Self-Selection / Incent-Compat) Type 2

participation constraint Type 1



$CS_1(P_1) \geq A_1(P_1)$

$\downarrow$

$\frac{(1-P_1)^2}{2}$

$A_1(P_1) \leq \frac{(1-P_1)^2}{2}$

Self - Selection

$T_1 = A_1 + P_1 q$

$T_2 = A_2 + P_2 q$

$CS_2(P_2) - A_2(P_2) \geq$

$\geq CS_1(P_1) - A_1(P_1)$

Chose to buy according to the second option because the neat benefit is huge.

$\frac{(1-P_2) \cdot 2(1-P_2)}{2}$

$= (1-P_2)^2$

$CS_2(P_1) = (1-P_1)^2$

$A_2(P_2) \leq (1-P_2)^2 - \cancel{\frac{(1-P_1)^2}{2}}\ A_1(P_1)$

$A_2(P_2) \leq CS_2(P_2) - CS_2(P_1) + A_1(P_1)$

$CS_2(P_2) \Rightarrow (1-P_2)^2$

$CS_2(P_1) \Rightarrow (1-P_1)^2$

maximising the max function:

$$A_2(P_2) = CS_2(P_2) - CS_2(P_1) + A_1(P_1)$$

$\uparrow$ optimal $\quad (1-P_2)^2 \quad (1-P_1)^2$

Since the monopoly will to ~~to~~ extract as much surplus from high demand users.

$$\underset{P_1, P_2}{MAX}\ \Pi = (1-P_1) \cdot P_1 + 2(1-P_2)P_2 + (1-P_2)^2$$

$$\frac{\delta \Pi}{\delta P_1} = 0 \rightarrow 1 - 2P_1 \Rightarrow 0 \rightarrow P_1 = \tfrac{1}{2} > 0 \ (= MC)$$

$$\frac{\delta \Pi}{\delta P_2} = 0 \rightarrow 2 - 4P_2 + 2P_2 - 2 = 0 \rightarrow P_2 = 0 \ (= mc)$$

$$A_1(P_1) = \frac{(1-\overset{1/2}{P_1})^2}{2} = 1/8$$

$$A_2(P_2) = (1-0)^2 - \frac{\left(1-\frac{1}{2}\right)^2}{2} = 7/8$$

$$\Rightarrow \Pi^* = \left(1-\tfrac{1}{2}\right)\tfrac{1}{2} + 1 = 5/4$$

$$P_1^* = \tfrac{1}{2} > 0 \ (= MC)$$

$$P_2^* = 0$$

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$$CS_1(P_1) - A_1(P_1) = 0$$

$$(1-P_2)^2 \leftarrow CS_2(P_2) - A_2(P_2) = \frac{1}{8} > 0$$

$$\cancel{P}_1^* = \frac{1}{2} > 0$$

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26/10/2016

Problem

- Monopoly
- $C(q) = \frac{4}{3} q$

2 Groups of Consumers

$P = 40 - 2q_A \Rightarrow$ first curve

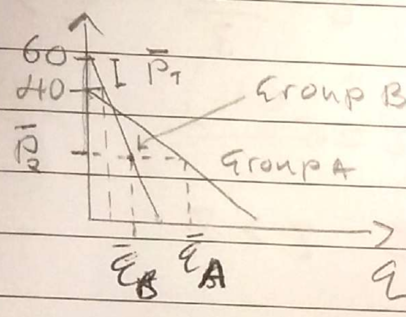
$P = 60 - 4q_B \Rightarrow$ Second curve

a) First solve the case of uniform price for the monopoly

* First we have to find the AGGREGATE Demand Curve

$\Rightarrow$ Sum up the ~~dem~~

First curve:



consider

$\forall P: 40 < P \leq 60 \quad \bar{P}_1$

means consumers in q_A will not buy.

consider

$\forall P: P \leq 40$

$\bar{P} \rightarrow q(\bar{P}) = \bar{q}_A + \bar{q}_B$

$P = 40 - 2q_A$: inverse Demand Curve

$P = 60 - 4q_B$

$$q_A = 20 - \frac{P}{2}$$

$$+ \; q_B = 15 - \frac{P}{4}$$

$$q = 35 - \frac{3}{4} P$$

$$P = 35 \cdot \frac{4}{3} - \frac{4}{3} q$$

$$P = \frac{140}{3} - \frac{4}{3} q$$

INVERSE MARKET DEMAND

$$P(q) = \begin{cases} 60 - 4q & q \leq 5 \; (q_B) \\ \frac{140}{3} - \frac{4}{3}q \end{cases}$$

Monopoly has to find the profit maximising price.

$P = 60 - 4q_B$

$$\max_{q} \pi(q) = TR(q) - TC(q)$$

$$\rightarrow MR(q^m) = MC(q^m)$$

$$TR(q) = Pq = \begin{cases} 60q - 4q^2 & q \leq 5 \\ \frac{140}{3}q - \frac{4q^2}{3} & q > 5 \end{cases}$$

$$\therefore MR(q) = \begin{cases} 60 - 8q & q \leq 5 \\ \frac{140}{3} - \frac{8}{3}q & q > 5 \end{cases}$$

$$MR(q^m) = MC(q^m)$$

(1) $60 - 8q = 4/3 \quad q \leq 5$

$\rightarrow q = 7.3 > 5$ → NOT FEASIBLE

(2) $\frac{140}{3} - \frac{8}{3}q = 4/3$

$\rightarrow q^m = 17 > 5$ — OK

$$p^m = \frac{140}{3} - \frac{4}{3} \cdot 17 = 24$$

$$\pi^m = \left(24 - \frac{4}{3}\right) \cdot 17 \approx 385$$

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b) Perfect Price Discrimination (Personalized Pricing)

→ Quantity

→ Profit

$P(q_I) = MC \Rightarrow \frac{140}{3} - \frac{4}{3}q = \frac{4}{3} \rightarrow q_I = 34$

$\Pi_I = AREA_1 + AREA_2$

$Area_1 = \frac{\left[\left(60 - \frac{4}{3}\right) + \left(40 - \frac{4}{3}\right)\right] \cdot 5}{2}$

$=$

$Area_2 = \frac{\left(40 - \frac{4}{3}\right)(34 - 5)}{2}$

$\Pi_I = 804$

c) GROUP PRICING

$P = 40 - 2q_A \longrightarrow MR = 40 - 4q_A = \frac{4}{3}$

$P = 60 - 4q_B$

$\rightarrow q_A^* = \frac{29}{3}$

$\rightarrow P_A^* = 40 - 2 \times \frac{29}{3} = \frac{62}{3}$

Revise Nonsense

Group B

$MR = 60 - 8q_B = 4/3$

$\Rightarrow q_B^* = \frac{22}{3} \rightarrow P_B^* = 60 - 4 \times \frac{22}{3} = \frac{92}{3}$

OPTIMALITY CONDITION

(i) $\frac{P - MC}{P} = \frac{1}{\eta}$

$\frac{P_A^* - MC}{P_A^*} = \frac{1}{\eta}$ $\quad P_A^* = 62/3, \; MC = 4/3$

$\eta_A = \frac{31}{29} = 1.07$

(ii) $\frac{P_B^* - MC}{p^*} = \frac{1}{\eta_B}$ $\quad P_B^* = 92/3, \; MC = 4/3$

$\eta_B = 1.05$

$\therefore \eta_A > \eta_B$

$\Pi_{III} = \left(\frac{62}{3} - \frac{4}{3}\right) \cdot \frac{29}{3} + \left(\frac{92}{3} - 4/3\right) \cdot \frac{22}{3} = 402$

$\Pi_I = 804 > \Pi_{III} = 402.$

$> \Pi^m = 385$

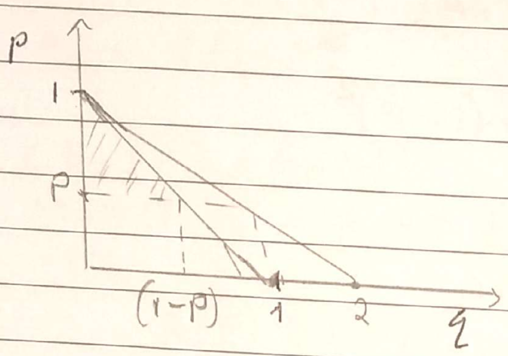
Examples:

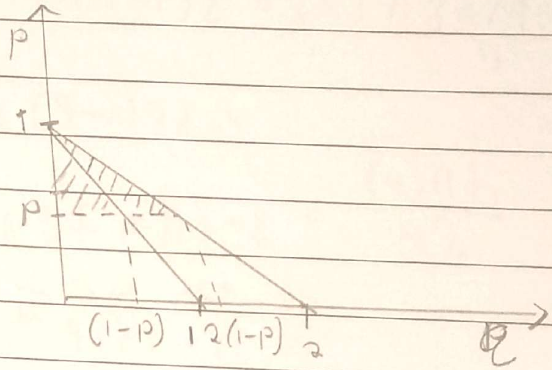
$MC = 0$ — Group Size

$q_1 = 1 - p$ — 1

$q_2 = 2(1-p)$ — 1

- TWO PART TARIFF
- DEMAND CURVE — $A \Rightarrow$ Subscription fee, $p =$ Price
- OPTIMAL TARIFF A^*, p^*





$q_1 = 1 - p \rightarrow p = 1 - q_1$

$\frac{q_2}{2} = (1-p) \Rightarrow p = 1 - \frac{q_2}{2}$

$T(q) = A + pq$

→ we have to find also consumer surplus as a function of price p

$CS_1(p) = \frac{(1-p)^2}{2}$

$CS_2(p) = \frac{(1-p) \cdot 2(1-p)}{2} = (1-p)^2$

Market Demand Curve

$$q = D(p) = \begin{cases} 0 & A(p) > (1-p)^2 = CS_2(p) \\ \cancel{2(1-p) \quad A(p) \leq (1-p^2)} & \\ \underbrace{2(1-p) + (1-p) = 3(1-p)}_{A(p) \leq \frac{(1-p)^2}{2}} & \end{cases}$$

OPTIMAL TARIFF A^*, p^* ?

* Assume the monopolist is selling to both Groups

$$\text{MAX}\,\Pi(p) = 3(1-p)\cdot p + 2\cdot A(p)$$

ifff

$$A(p) \leq \frac{(1-p)^2}{2} \Rightarrow A(p) = \frac{(1-p)^2}{2}$$

$$\underset{p}{\text{MAX}}\,\Pi(p) = 3(1-p)\cdot p + \cancel{2A}\left(\frac{1-p}{\cancel{2}}\right)^2$$

$$= 3p(1-p) + (1-p)^2$$

$$\frac{d\Pi(p)}{\delta p} = 3 - 6p + 2p - 2 = 0$$

$$\Rightarrow \cancel{t\,A}\ p = \frac{1}{4} > 0$$

$$(= mc)$$

optimal value of subscription fee

$$\Rightarrow A(p^*) = \frac{(1-1/4)^2}{2} = \frac{9}{32}$$

optimal value of profit

$$\Pi(p^*) = 3(1-1/4)\cdot\frac{1}{4} + (1-1/4)^2 = 9/8$$

$$CS_1(p^*) - A(p^*) = 0$$

$$CS_2(p^*) = \left(1-\frac{1}{4}\right)^2$$

$$CS_2(p^*) - A(p^*) = \frac{9}{32} > 0$$

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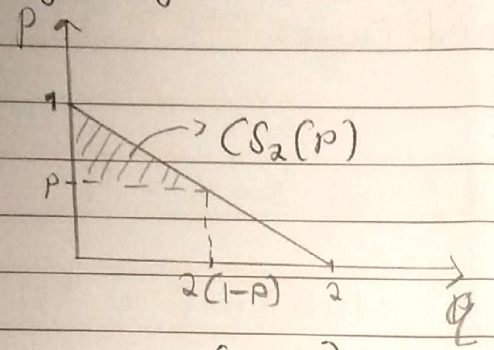
Scenario 2

Selling Only To Group 2.



$$q_2 = 2(1-p)$$

$$CS_2(p) = (1-p)^2$$

$$\max_p \Pi(p) = A(p) + 2p(1-p)$$

$$A(p) \leq (1-p)^2 \longrightarrow A(p) = (1-p)^2$$

$$\max_p \Pi(p) = (1-p)^2 + 2p(1-p)$$

Optimize → $\frac{\delta \Pi(p)}{\delta p} = 0 \Rightarrow p = 0 \equiv MC$

$$\Rightarrow A(p^*) = (1-p)^2 = 1$$

$$\Pi(p^*) = \underline{1}$$

$$CS_2(p^*) - A(p^*) = 0$$

(a) Only to Group 2

$$\Pi(p^* = 0) = 1$$

(b) both Groups

$$\Pi(p^* = \tfrac{1}{4}) = \tfrac{9}{8} > 1$$

$$p^* = \tfrac{1}{4} > 0 \ (\equiv MC)$$

$$A(p^*) = \tfrac{9}{32}$$

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Another Scenario

$C(q) = \frac{1}{3}q^3 - 40q^2 + 1800q + 5000$

$q_1 = 320 - \frac{2}{5}P$
$P = A - Bq_2$
] Demand Curves

$*A ? \; B ?$

- Group Pricing

① $q_1^* + q_2^* = 60$
② $\Pi^* = 5000$
} OPTIMAL SOLUTION

$MR_1 = MC$
$MR_2 = MC$
} optimal Solution for the firm.

$MC(q) = \frac{\delta C(q)}{\delta q} = q^2 - 80q + 1800$

$(q_1+q_2) \quad (q_1+q_2)$

we have to find inverse demand curve

$q_1 = 320 - \frac{2}{5}P \rightarrow P = 320 \cdot \frac{5}{2} - \frac{5}{2}q$

$\rightarrow \boxed{P = 800 - \frac{5}{2}q_1}$ inverse Demand

$\rightarrow MR_1 = 800 - 5q$

$MR_2 = A - 2Bq_2$

① $MR_1 = MC \rightarrow 800 - 5q_1 = 600 \Rightarrow q_1 = 40$

$MC(q^*) \rightarrow 60$

② $A - 2Bq_2 = 600 = MC \qquad q_2 = 20$

$A - 40B = 600$

we know that

$\Pi^* = 5000$

$\Pi^* = TR^* - TC^*$

$C(q^* = 60) = 41000$

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$$TR^* = TR_1^* + TR_2^*$$

$$P = 800 - \frac{5}{2} \cdot \underbrace{q_1^*}_{40} = 700$$

$$P = A - B \cdot 20 = A - 20B$$

$$\therefore \Pi^* = \underbrace{700(40)}_{TR_1} + \underbrace{(A - 20B) \cdot 20}_{TR_2} - 41000 = 5000$$

$$\Rightarrow \Pi^* = 900 = A - 20B$$

$\therefore$ we solve for A and B

$$A - 20B = 900$$
$$A - 40B = 600$$

$$A = 1200 \qquad B = 15$$

DURABLE GOODS ⟷ Multiperiod lifetime
INTERTEMPORAL PRICE DISCRIMINATION

Multiperiod Lifetime
↓
Stream of Service

(1) Buy today ⇒ Will not buy tomorrow

(2) How much to buy? Like with non durable Goods
When to buy.

(3) Strategic Waiting
postpone buying ≠ not buying at all

Costs
⇒ lost benefits (Not consuming in period 1)
⇒ Delayed buying waiting for reduced price.

Assumption:
- 2 periods $(t=1,2)$
- Consumers have unit demand. Which means a consumers buys atleast one unit or not buy at all.
- No Second ~~Market~~ Hand Markets
- u: Valuation of the durable good
$u \in [0,1]$ Uniform Distribution with interval

Net Surplus (Buy)

Period 1: $(u - P_1)$

Period 2: $\delta (u - P_2)$

δ: intertemporal discount factor (<1)

TIME VALUE OF MONEY

$100 + 100 \cdot r$

$\hookrightarrow 100(1+r)$

Period 1	period 2
$\frac{100}{1+r}$	100
$\frac{1}{1+r}$	

Buy Tomorrow +

$$u - p_1 < \delta(u - p_2)$$

$$u - \delta u < p_1 - \delta p_2$$

$$u < \frac{p_1 - \delta p_2}{(1-\delta)} = \tilde{u}$$

critical level

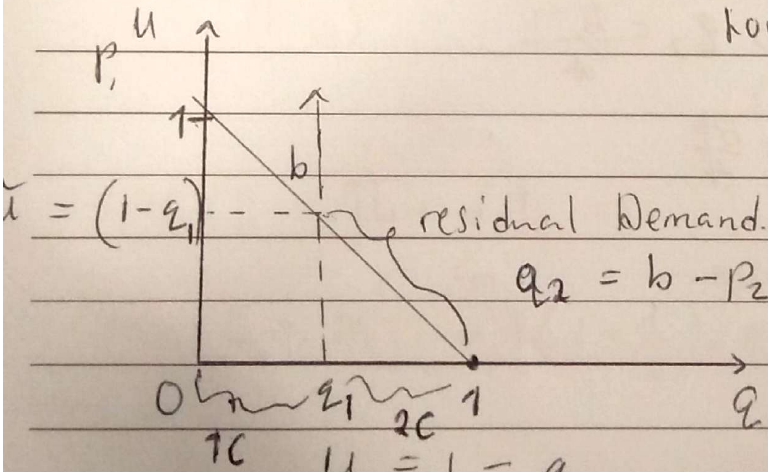
implications

period 2

2 classes of Consumers — Those already bought in period 1

Those who still have to buy

low valuation



$u = 1 - q$

if $q = 0$ evalution $= 1$

if $q = 1$ evaluation is 0

Implication on firm

1) $P_2 < P_1$ + for the firm

intertemporal Price Discrimination

2 Strategic waiting — for the firm.

$U - P_1 > 0$

net Surplus $\delta (U - P_2) > (U - P_1)$

The postpone buying, of greater surplus.

Suppose we have a given amount of the quantity sold in period 1 to period 2

P_2?

Assumption: Rational Expectation

⇓

Firm will maximize profit in period 2 (Based on residual Demand.)

Period 2

$P_2 = b - q_2 \rightarrow P_2 = b - q_2 \Rightarrow P_2 = \frac{b}{2}$

HYP: $MC = 0$

$$\max_{q_2} \Pi_2 = (b - q_2) \cdot q$$

$$\frac{d\Pi_2}{dq_2} = 0 \rightarrow b - 2q_2 = 0$$

$$\rightarrow q_2 = \frac{b}{2}$$

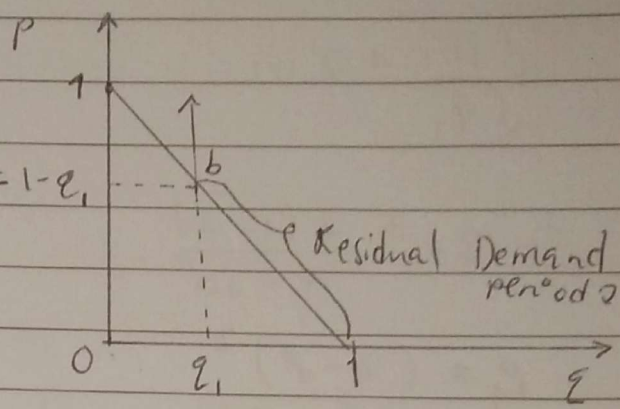
$$\Pi_2 = P_2 \cdot q_2 = \frac{b^2}{4}$$

CHECK ⇔

Durable Goods

- 2 periods

$U \in [0,1]$ UNIF. DIST



q_1 Quantity sold in period 1

$q_2 = b - q_2$

$\rightarrow P_2 = b - q_2$

Period 2

$\underset{q_2}{\text{MAX}}\ \Pi_2 \longrightarrow P_2 = \frac{1-q_1}{2}, \quad q_2 = \frac{1-q_1}{2}$

$\Pi_2 = \frac{(1-q_1)^2}{4}$

$U \in [0,1]$

$\tilde{U} - P_1 \qquad \delta(\tilde{U} - P_2)$

Period 1 $\qquad$ Period 2

$P_1 - \delta P_2 = \tilde{u}(1-\delta)$

expressing the expected price in period 2 to what happens in period 1

$P_1 = \tilde{u}(1-\delta) + \delta P_2 \quad \Rightarrow \quad P_1 = (1-q_1)(1-\delta) + \delta\left(\frac{1-q_1}{2}\right)$

$\tilde{u} = (1-q_1), \quad P_2 = \frac{1-q_1}{2}$

$P_1 = (1-q_1)\left(1-\frac{d}{2}\right)$

↳ ~~Inverse Demand in~~ period 1

$\text{MAX}\,\Pi = \Pi_1 + \delta \Pi_2 \Rightarrow$

ASSUMPTION: No Production costs

$\text{MAX}\,\Pi \Rightarrow \left[(1-q_1)\left(1-\frac{\delta}{2}\right) \cdot q_1\right] + \delta \cdot \frac{(1-q_1)^2}{4}$

depend on q_1

$$\frac{\delta \Pi}{\delta q_1} = 0$$

$$\Rightarrow q_1 = \frac{2(1-d)}{4-3d}$$

$$P_1 = \frac{(2-\delta)^2}{2(4-3\delta)}$$

Non - Durable Good

$d = 0$

$$P_1(d=0) = \frac{1}{2} = p^m$$

$$p^m = \frac{1}{2} > P_1 > P_2$$

Non, D G $\longleftrightarrow$ Durable G

STRATEGIC WAITING

$u - P_1 > 0$

$\Rightarrow$ BUY

Pere $\delta(u - P_2) > (u - P_1) > 0$

Main Goal of the firm is to convince Consumers That Price will NOT be reduced.

1) Leasing (instead of selling) the Durable Good.
   - → Selling the consumption service in Each period.
   - → This is like a firm selling non-durable good.
   - → The monopoly sets the Rental Price.

2) Commit to Contractual Clauses (Best - Price Clauses / most -favonred Clauses

$P_2 < P_1$ Consumers who buy in the first period will be refunded $P_1 - P_2$

3) Capacity Constraints
   - → Commits to have a more production capacity

   Reduced Supply $\Rightarrow$ Consumers

   → Rush to buy in Period 1

4) Planned OBSolescence

LIMITING DURABILITY OF THE GOOD

⇓

Causes an increase in Demand.

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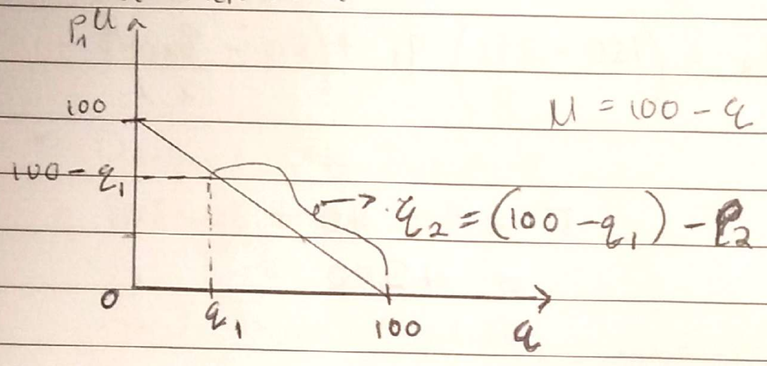
Examples:

- 2 periods
- Durable Good
- Productions costs Zero
- $\mu \in [0, 100]$

  uniform Distribution
- Unit Demand ξ_i Valuation of the services provided by the good in each period.
- $d = 1$
- $P_1 = ?$ $\quad P_2 = ?$

Ans:

First Demand curve



Assume we have sold some quantity during the first period and relate to what happed in the second period

$$P_2 = (100 - q_1) - P_2$$

$$\Rightarrow P_2 = (100 - q_1) - q_2$$

Period 2

$$\max_{q_2} \Pi_2 = \left[(100 - q_1) - q_2\right] \cdot q_2$$

$$\frac{d\Pi_2}{dq_2} = 0 \longrightarrow 100 - q_1 - 2q_2 = 0$$

$$\Rightarrow q_2 = 50 - \frac{q_1}{2} \longleftarrow \text{insert} \longrightarrow P_2 = (100 - q_2) - q_2$$

we get

$$P_2 = 50 - \frac{q_1}{2}$$

$$\Pi_2 = \left(50 - \frac{q_1}{2}\right)^2$$

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To Be revised

$q_1 = ?$ We have to find q_1

We start by going through the assumption
In terms of the net benefit is exactly the same

Net Surplus

period 1 period 2.

$$2\cdot(100-q_1)-P_1 = \left[(100-q_1)-P_2\right] \quad P_2 = 50 - \frac{q_1}{2}$$

$$\therefore P_1 = 150 - \frac{3q_1}{2}$$

Profit:

$$\max \Pi = \Pi_1 + \Pi_2 = \left(150 - \frac{3q_1}{2}\right) q_1 + \left(50 - \frac{q_1}{2}\right)^2$$

$$\frac{\delta \Pi}{\delta q_1} = 0 \qquad \Pi = 90\cdot 40 + 30\cdot 30 = 4500$$

$$\rightarrow q_1 = 40$$

$$q_2 = 50 - \frac{40}{2} = 30$$

$$P_2 = 30$$
$$P_1 = 90$$

LEASING

NON-DURABLE GOOD

$$\max_{q_t} \Pi_t \qquad t = 1,2$$

$$MR(q_t) = MC(q_t)$$

$$p = 100 - q$$
$$MR = 100 - 2q$$
$$\Rightarrow 100 - 2q_t = 0$$
$$\rightarrow q_t = 50 \qquad t = 1,2$$
$$p_t = 50$$

$$\Pi_t = (50\times 50) + (50 \times 50) = 5000 > \Pi$$

Bundling → Content: pay TV, Software, movies
→ Infrastructure: Ink/toner + Printer
+ maintenance services
audio equipment

Tying varying proportions
- Pure bundling
- Mixed bundling

* Cost efficiencies
- assembling cost
- ~~Scabe~~ Scale economies
- fixed costs
- Shared input

* Demand-side Incentives
- Sorting Consumers
↓
price discrimination

Comparison with Menu Pricing
- adding consumer heterogenity
- Many options

Bundling
- Single price for a package
- Reduce consumer heterogenity

Examples
2 products X, y
2 consumers
unit demand (0,1)
pure bundling (or buy both or more)

	X	y
C_1	H	L
C_2	L	H

price table

Suppose:
a) Independent Selling
$P_x = L$ both C_1, C_2 buy
$P_x = H$ C_1 buys

$P_y = L \Rightarrow$ both C_1, C_2 buy
$P_y = H \Rightarrow C_2$ buys

i) $P_x = P_y = L \Rightarrow$ 4 units
$\pi(P_x = P_y = L) = 4L$
ii) $P_x = P_y = H \Rightarrow$ 2 units
$\pi(P_x = P_y = H) = 2H$

$\Rightarrow P_x^* = P_y^* = H \Leftrightarrow H > 2L$

b) Pure bundling (read table by the rows)
reserve price of $C_1 = H + L$ } they have differe. evaluation of single Product
reserve price of $C_2 = L + H$ } but the same for the overall buying

PURE BUNDLING INCREASES PROFIT

→ Consumers have negatively correlated preferences

→ Imagine a situation where you use a single price

- This means you have to take into account.

→ In positive correlated preferences bundling has no effect

MIXED BUNDLING

⇒ PACKAGE + SINGLE PRODUCTS

If a firm sales both the bundle and single package usually.

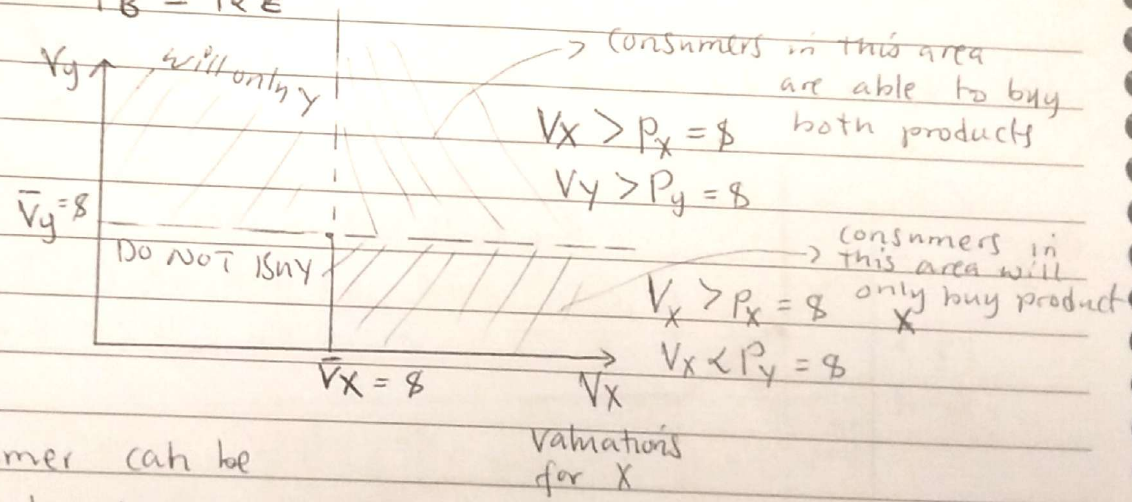
Price of Bundle < Price X + Price Y

→ involves non-linear pricing.

⇒ Assume we have two different products X and Y

⇒ we assume $P_x = P_y = 8$ €

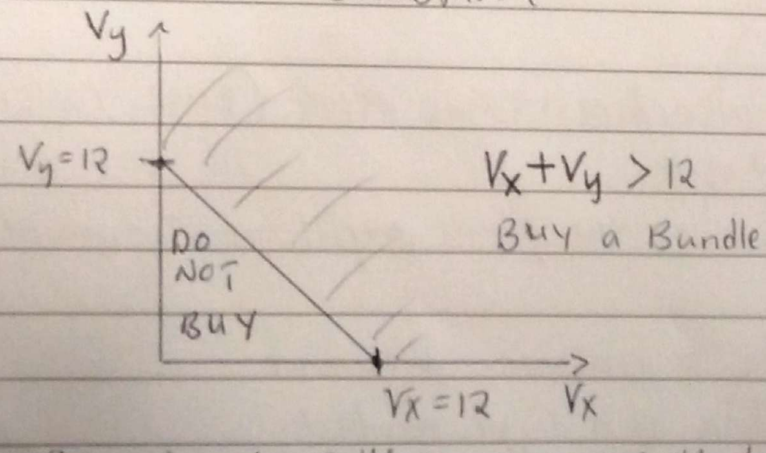
$P_B = 12$ €



Any consumer can be evaluated by the combination of the two products

⇒ Assume the firm is selling each product independently

PURE BUNDLING



The firm is only selling packages that include only X or Y

We have to make comparisons
$V_X + V_Y \geq P_B = 12$

© MIXED BUNDLING
The firm sells the package and also each single product in a separate way
→ package, X ALONE, Y ALONE

CONSUMERS BUY BUNDLE IFF

i) $V_X + V_Y > P_B = 12$ This means we have consumer

ii) $\underbrace{V_X + V_Y} - P_B > V_X - P_X$

$\cancel{V_X} + V_Y - P_B > \cancel{V_X} - P_X$ under this condition only will buy

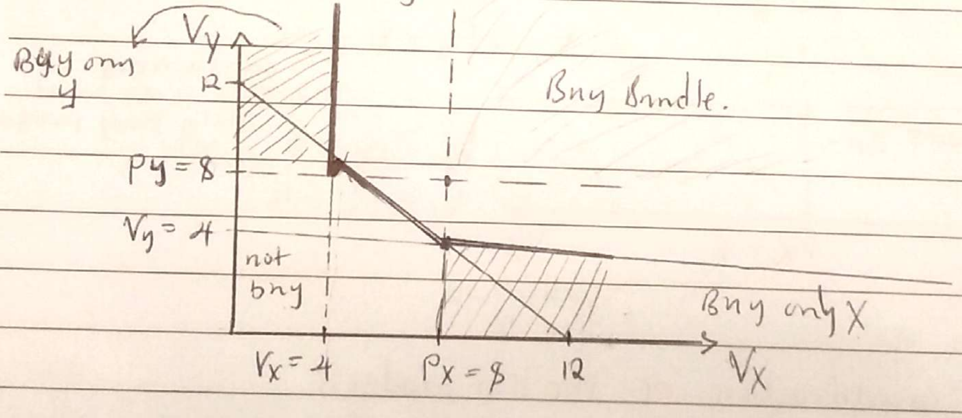
$V_Y > P_B - P_X$ The incremental price y in the Bundle

we have

$V_Y > P_B - P_X = 12 - 8 = 4$

iii) $V_X + \cancel{V_Y} - P_B > \cancel{V_Y} - P_Y$

$V_X > P_B - P_Y$



X Alone $\begin{cases} V_X > P_X \\ V_Y < 4 \end{cases}$

MIXED BUNDLING INCREASES TOTAL SALES (LESS CONSUMERS DO NOT BUY)
Implications on Profits

⇒ mixed bundlings increases the firm's profits as compared to the single Bundling.
⇒ There is distribution of consumer preference
The cost of production of a single product.

primary BUNDLING ANTICOMPETITIVE STRATEGY

MARKET A — FIRM 1 (monopoly)

MARKET B (secondary) — FIRM 1 (competition) Firm 2

Same Package Bundle

↓ Demand for rival

Scale economies

Anticompetitive strategy

- leverage market power
- Protect monopoly.

Examples:
- 2 products
- No cost
- 3 consumers
- Unit Demand: 0 / 1

	X	Producto Y	Bundle
C1	4	0	4
C2	3	3	6
C3	0	4	4

independent Selling.

$P_x = 3 \Rightarrow C_1$ and C_2 buy X $\Rightarrow 3 \cdot 2 = 6$

~~Ry~~ $P_x = 4 \Rightarrow C_1$ will buy x $\Rightarrow 4 \cdot 1 = 4$

$P_y = 3 \Rightarrow C_2$ and C_3 will buy $\Rightarrow 3 \cdot 2 = 6$

$P_y = 4 = C_3$ will buy $= 4 \times 1 = 4$

1

$P_x = P_y = 3 \rightarrow \Pi = 6 + 6 = 12$

2

$P_x = P_y = 4 \rightarrow \Pi = 4 + 4 = 8$

Monopolist will then choose option 1

PURE BUNDLING (ONLY PACKAGES)

i) $P_B = 4$ => C_1, C_2, C_3 Buy => $4 \cdot 3 = 12$

Monopolist will choose option 1

ii) $P_B = 6$ => C_2 Buy => $6 \cdot 1 = 6$

Mixed Bundling (Sells both bundles and single products)

Bundle + single products

$P_B = ?$ → $P_B = 6$ → C_2 buys bundle

$P_x = P_y = ?$ → $P_x = P_y = 4$ → C_1 buys X and C_3 buys Y

~~mdu~~ pure bundling

$\pi = 6 + 4 + 4 => 14 > 12$

Example 2.

$P = 2 - q_A$

$P = 2m - q_B \quad 0 < m < 1$

(a) - PRICE DISCRIMINATION (NO COST).

(B) - COSTLESS ARBITRAGE

→ OPTIMAL CHOICE?

(c) - $m < \sqrt{2} - 1$ => FIRM / CONSUMERS better off with/without arbitrage.

Answers

a) PRICE DISCRIMINATION

Market A inverse demand curve $q_A = 2 - P$ Direct

$P = 2 - q_A$

$\max_{q_A} \pi_A \to MR(q_A) = MC = 0$ General case

$$MR(q_A) = 2 - 2q_A$$

we can prove:

$TR_A = P \cdot q_A = (2 - q_A) q_A = 2q_A - q_A^2$

$MR_A = \frac{\delta TR_A}{\delta q_A} = 2 - 2q_A$

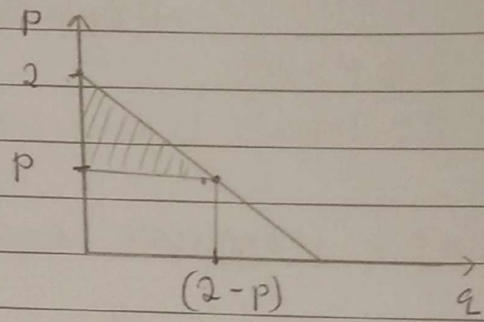
$\therefore \max_{q_A} \Pi_A = MR(q_A) = MC = 0$

$$\downarrow$$

$$2 - 2q_A = 0 \rightarrow q_A^* = 1 \rightarrow P_A^* = 1$$

$$= \Pi_A^* = 1 \cdot 1 = 1$$

$$CS_A^* = \frac{(2-1)^2}{2} = \frac{1}{2}$$



Market B

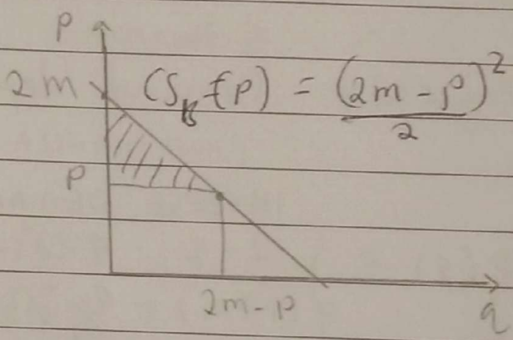
$P = 2m - q_B$

$MR_B = 2m - 2q_B = 0 = mc$

$q_B = m; \quad P_B^* = m$

$\Pi_B = m^2$

$CS_B(P) = \frac{(2m-p)^2}{2}$



$$CS_B^* = \frac{(2m - m)^2}{2} = \frac{m^2}{2}$$

b) COSTLESS ARBITRAGE (reselling between consumers)

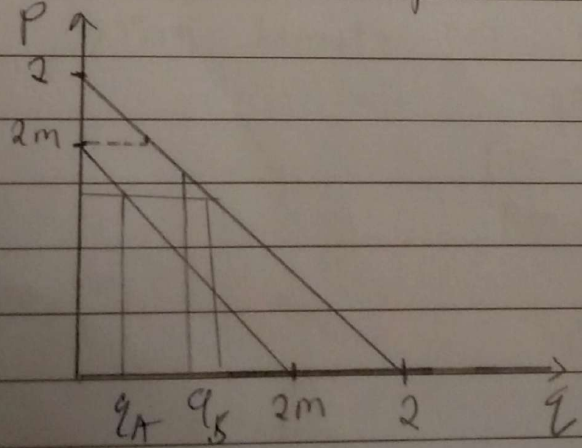
$\rightarrow$ OPTIMAL CHOICE? (Therefore price discrimination is not possible

$P_B^* = m \qquad P_A^* = 1$

$m < 1$

Then the firm is forced to put a uniform price so that arbitrage is removed.

i) Find we have to find the aggregate demand curve.



Now we have to find for each possible price what is the total quantity sold in each product

$q = q_A + q_B$?

$P = 2m - q_B \rightarrow \begin{cases} q_B = 2m - P \\ q_B = 0 \end{cases}$

$2 \geq P > 2m$

$P \leq 2m$

Aggregate Demand

$$q = \begin{cases} 2 - P & 2m < P \leq 2 \\ 2 + 2m - 2P = 2(1 + m - P) & P \leq 2m \end{cases}$$

Aggregate Demand depends on the price we are setting

INVERSE DEMAND

$$P(q) = \begin{cases} 2 - q & q < 2(1-m) \\ (1+m) - q/2 & q \geq 2(1-m) \end{cases}$$

critical value

$2 - q_A = 2m$

$q_A = 2(1-m)$

we impose the optimality condition

$MR(q^m) = MC = 0$

$$MR(q) = \begin{cases} 2 - 2q & q < 2(1-m) \\ (1+m) - q & q \geq 2(1-m) \end{cases}$$

i) $2 - 2q = 0 \rightarrow q = 1 \Leftarrow$ optimal quantity

$P = 1 \Leftarrow$ optimal price

This is only feasible iff

$P = 1$ if $q < 2(1-m)$

meaning $1 < 2(1-m)$

$m < 1/2$

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(ii) $(1+m) - q = 0$

$\Rightarrow q = 1+m$ — we have to impose the feasibility where

$P = \frac{(1+m)}{2}$ — $(1+m) \geq 2(1-m)$

$\Rightarrow m \geq 1/3$

if we look at the solution

$\frac{1}{3} \leq m < \frac{1}{2} \Rightarrow$ Both solutions are feasible

How will the monopoly choose the optimal choice.

$\Rightarrow$ we have to compare the profits

$\Pi = P \cdot q = \frac{(1+m)^2}{2}$ — we impose $\Pi = \frac{(1+m)^2}{2} > 1 = \Pi_A$

$\Rightarrow \cancel{m \geq \sqrt{2}+1} \Rightarrow m \geq \sqrt{2} - 1 \Rightarrow$ means we sell to both markets

if $m < \sqrt{2} - 1 \Rightarrow$ means we sell only to market A

(ASK)

c) Hypothesis $m < \sqrt{2} - 1$ Assumption; if holds

with Arbitrage

$\Pi_A = 1 < \Pi_A^* + \Pi_B^* = 1 + m^2$

$CS_A = \frac{1}{2} < CS_A + CS_B = \frac{1}{2} + \frac{m^2}{2}$

If No Arbitrage (we have to consider the solution in case of price discrimination)

$\Pi_A^* + \Pi_B^* = 1 + m^2$

$CS_A^* + CS_B^* = \frac{1}{2} + \frac{m^2}{2} = \left(\frac{1+m^2}{2}\right)$

SWITCHING COSTS

⇒ Systems
* Durable investments
* Different economic timelines

(i) Search costs
(ii) Training costs
(iii) long term contracts
(iv) portability of information

Switching costs
↓
lock-in

= In the real scenario consumers would prefer to avoid lock-in
⇒ Firms are interested in creating installed base of consumers
⇒ In order to achieve this consumer retention is essential.

Competitors ⇒ New Firms
ATTRACT CONSUMERS
→ SUBSIDIZE

Regulation Antitrust Agencies
⇒ prevent abuse from lock-in

Installed Base of Consumers

For any consumer (the level of total switching costs which is given by " Consumer costs and New Supplier Costs."

Consumer costs: 50 €

New Supplier Costs: 25 € — marketing, set up.

∴ Switching costs ⇒ (50+25) €

⇒ Switching regarded as "revenue anticipated per consumer"
⇒ The supplier can subsidize the consumer costs hence incurring the consumer switching costs

The case of perfect competitive markets

revenue per consumer = Total switching costs.

" also = ~~Cot~~ TSC + (Higher quality costs / Lower quality costs) we are assuming no price discrimination

Switching Costs Trade off

price competition

1) Invest in market share
- Low price for products to attract consumers in order to build installed base of locked-in consumers

2) Collecting short term Profits
- High price in order to exploit the installed base of users.

Ex. Post Analysis
(consumers have already purchased in the past)
→ Assume we have 2 different Firms that supply Homogeneous product
→ N consumers in total and each one with a unit demand

$\left.\begin{array}{l}\sigma_A \\ \\ \sigma_B\end{array}\right\}$ Fraction of A's/B's consumers $\equiv$ Market shares

$MC_A = MC_B = C$

V_i: Reservation price

S: Switching cost for changing supplier

Assumption:

$S \geq V - C > 0$

Firm A's Behaviour (Same for Firm B)

① Sell to its own customers

$P_A = V \qquad P_B = V$

② Sell to all consumers in the market

means Firm A has to get some consumers from Firm B

$P_A = P_B - S = V - S > C \Rightarrow \underline{S < V - C},$

This is against the condition that the switching cost should be greater

Therefore, the firm will decide as;

$$P_A^* = P_B^* = V$$
$$\Pi_A^* = (V-C)\cdot \sigma_A N$$
$$\Pi_B^* = (V-C)\cdot \sigma_B N$$

Monopoly outcome
Switching costs freeze competition
This is the typical case when consumers are locked-in.

General case of Building installed Base of users
Ex-Ante Analysis
"Consumers have not purchased in the past"
We are moving from static to dynamic
- 2 periods involved
(i) In period 1 No switching cost involved
(ii) In period 2 there will be switching costs that are induced by consumers behavior period 1
Consider 2 Firms and 2 consumers with same willingness to pay
V: valuation
C: marginal cost
(i) Consider for period 1
- 2 firms, with Homogeneous products
- These firms set the price $P_A > P_B$
- Above situation all consumers will buy from B
Assume firm reduces price by $\varepsilon > 0$
$$P_A^o = P_B^o - \varepsilon$$
"All consumers buy from A"
Strategy ⇔ "undercutting" However the price should by > MC

$$P^1 = MC$$
$$\Rightarrow P_*^1 = P_A^* = P_B^* = C$$
No switching costs
$$\Rightarrow P^2 = C = P^1$$
Bench mark case

Consider Period 2.

Assumption: $S \geq V - C > 0$

"SUFF.. HIGH"

$\Rightarrow p^2 = V$

$\Pi^2 = (V - C) > 0$

per customer

Period 1

$p^1 = ?$

$(p^1 - c) + (p^2 - c) \geq 0$

$\Downarrow$

V

$\Rightarrow (p^1 - c) + (V - C) = 0$ Equilibrium case

SWITCHING COSTS

$p^1 = 2C - V$

$p^2 = V$

NO SWITCHING COSTS <Benchmark case>

$C = p^1$

$C = p^2$

$p^1 = 2C - V < C = p^1_{\text{Benchmark}}$

$\Rightarrow C < V$ always True

In EX ANTE switching costs increase as they get locked in

Aggressive price competition EX ANTE

- Introductory offers*
  - * - Banks
  - * - ISP
- Reduced Price Competition EX POST*
  - * upgrading / Extending version of Software
  - * Complementary products

HOMOGENEOUS PRODUCTS

HIGHER PERIOD 2 - PROFIT =>

=> SMALLER PERIOD 1 -> PRICE

- Differentiated products
  * Variety
  * Quality

Assume firms offer Differentiated products

Period 2

$\Pi_i^2(\sigma_i^1)$ $i = A, B$

$\downarrow$

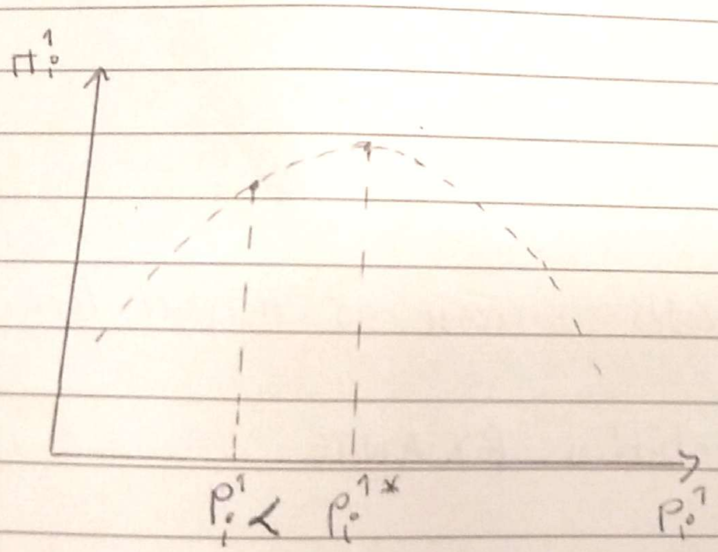
market share

Period 1

$\Pi_i^o = \Pi_i^1 + \Pi_i^2(\sigma_i^1)$

~~price will have impact on our~~ market share hence profits

$$\frac{d\Pi_i^o}{dP_i^1} = 0 \quad \underbrace{\frac{d\Pi_i^1}{dP_i^1}}_{>0} + \underbrace{\frac{d\Pi_i^2}{d\sigma_i^1}}_{>0} \cdot \underbrace{\frac{d\sigma_i^1}{dP_i^1}}_{<0}$$



$$\frac{d\Pi_i^1}{dP_i^1} = 0$$

No switching costs

Example 3

$C = 4$ for each Unit of Service

$f = 10$ Connection Cost

INDIVIDUAL DEMANDS CONSUMERS

$p = 10 - q_L$ α

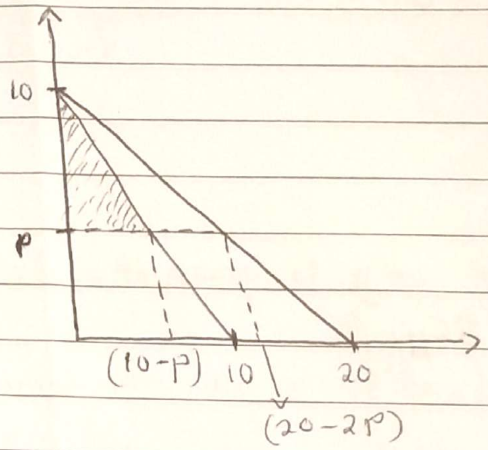
$p = 10 - \frac{1}{2} q_H$ ~~q_H~~ $1-\alpha$

- Optimal Two-part Tariff?

Ans: Demand curve

$q_L = 10 - p$

$q_H = 20 - 2p$



Two groups of consumers

TWO-PART TARIFF

$T(q) = \underbrace{A}_{\text{fixed Subscription fee}} + \underbrace{pq}_{\text{variable price}}$

* The monopolist has to decide either to sell to both groups or just one group.

(i) Suppose the monopolist is selling to both groups

$\Pi = (A - f) + (p - c) \cdot q_{(p)}$

$q(p) = (10 - p)$

$q_L(p) = (10 - p)\alpha$

$q_H(p) = (20 - 2p) \cdot (1 - \alpha)$

Therefore

$A \leq SC_L(p)$

The firm's problem is to maximise Π

SC_L is a function of price

$SC_L = \frac{(10-p)^2}{2}.$

$$MAX\ \Pi = (A - f) + (p - c)\left[(10-p)\alpha + (20-2p)(1-\alpha)\right]$$

$$A \leq SC_L(p) = \frac{(10-p)^2}{2}$$

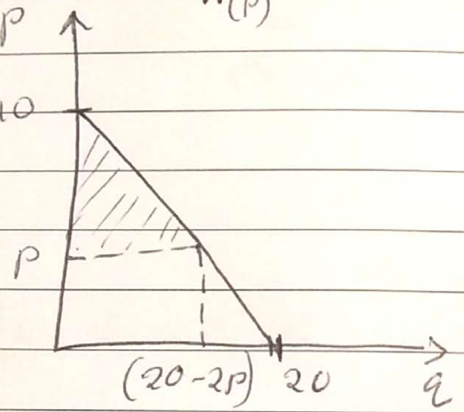
$$MAX\ \Pi = \left[\frac{(10-p)}{2} - 10\right] + (p-4)\left[(10-p)\alpha + (20-2p)(1-\alpha)\right]$$

$$\frac{\delta \Pi}{dp} = 0 = p^* = \frac{2(7\alpha - 9)}{2\alpha - 3} \quad mc = 4 < p^* < 10 \ \forall \alpha$$

A

ii) Selling only to group H

$A \leq SC_{H(p)} =$



$$MAX\ \Pi = (A - f)\cdot(1-\alpha) + (p-c)\cdot(20-2p)(1-\alpha)$$

$$SC_H(p) = \frac{(10-p)(20-2p)}{2} = A$$

$MAX\ \Pi =$

$$\frac{\delta \Pi}{\delta p} = 0 \Rightarrow p = c = 4$$

$$A = \frac{6 \times 12}{2} = 36$$

$$MAX\ \Pi_H = (A-f)(1-\alpha) = 26(1-\alpha)$$

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Comparing the profits from the 2 scenarios
(i) Selling to both

$\Pi_{(p^*)_1} = \frac{25}{2} + \frac{9}{6-4\alpha} - 9\alpha$

$\Pi(p^*) \geq \Pi_H \Rightarrow 0.69 \leq \alpha < 1$

Example 4
2 periods
i) Durable Good
$MC = C_D$
ii) Non-DURABLE Good
$MC = C$
- Consumption Services needed in both periods
- 1 Consumer (type)
- Unit Demand (means consumer can buy or not buy)
Durable ~~and~~ or Non-Durable?

Ans:
Valuation for per-period Services (V)

$$q = \begin{cases} 1 & P \leq \text{Valuation (which is } V) \\ 0 & P > \text{Valuation (which is } V) \end{cases}$$

*Suppose: Non-Durable good

$$q = \begin{cases} 1 & P \leq V \\ 0 & P > V \end{cases}$$

*Suppose: Durable good

$$q = \begin{cases} 1 & P \leq 2V \\ 0 & P > 2V \end{cases}$$

NON-DURABLE GOOD
$P = V \Rightarrow \Pi_{ND} = 2 \cdot (V - C)$
$= 2V - 2C$

Durable-Good
$P = 2V \quad \Pi_D = 2V - C_D$
$\Pi_D \geq \Pi_{ND} \Leftrightarrow C_D < 2C$

SWITCHING COSTS AND PRICE COMPETITION

PERIOD 1

EX ANTE

- AGGRESSIVE COMPETITION
- LOW PRICE

PERIOD 2

EX POST

- LOCKED-IN CONSUMERS
- HIGH PRICE

ENDOGENOUS SWITCHING COSTS

=> Come up because of other firm strategies
eg Loyalty programs & frequent flier mileage.)

PERIOD 1
- High price

PERIOD 2
Low Price

SWITCHING COSTS AND INDUSTRY STRUCTURE (ENTRY)

FIRM A (MONOPOLY) at Start

FIRM B (POTENTIAL ENTRANT)
- Firms with homogenous product
- $MC_A = MC_B = C$

*- Consumers have to incur some switching costs to move from A to B

"TRUE" marginal Cost

$MC_B = C + S$ where $MC_A = C < C+S = MC_B$

$\Longrightarrow P_A = C + S - \varepsilon > C$ * $\varepsilon > 0$

$\Pi_A > 0$

$\Pi_B < 0 \implies$ DETER ENTRY or INDUCE EXIT

Suppose firms do not have the same marginal costs

HYP

$MC_A = C_A > C_B = MC_B$

In the presence of Switching Costs

$MC_A = C_A < C_B + S =$ "TRUE" MC_B

=>

SWITCHING COSTS AND INTERNET

⇒ Reduces consumer switching costs.
⇒ There are also switching costs
⇒ Firms check for consumer buying behaviour and then make tailored offers patterning to the buying behaviour

NETWORK EFFECTS

OLD ECONOMY ⇒ supply side scale-economies
⇒ cost leadership drives the economy

NEW ECONOMY ⇒ Demand - side scale economies
→ positive network effects - when the benefit of the consumer receives after buying a specific product depends on the number of users that are buying similar product.

Demand side – Consumers' expectations
Independent UTILITY FUNCTIONS
– Users' COORDINATION {Conflicting opposite preferences}

Supply side
– Compatibility / incompatibility
–

→ Technology Adoption
→ Characterize market Demand
(i) – CRITICAL · MASS
(ii) – MANAGE EXPECTATIONS

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⇒ Characterizing network effects in the presence of Direct Network effects

Ques: Suppose

* (=) Fulfilled - Expectations Equilibrium ⇒ This is when the expected number of users to join a networ is indeed the number of ~~who~~ users who joined the network.

* Potential Users

$X \in [0, 1]$

Uniform Distribution

(UNIT DENSITY)

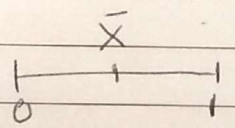
If we have sorted our users in the order of willingness to pay then.

- LOW X ⇒ HIGH WTP
- HIGH X ⇒ LOW WTP
- UNIT DEMAND (Subscribe or not)
- NET UTILITY

$$U(x) = \begin{cases} n(1-X) - P & \text{Subscription} \\ 0 \end{cases}$$

$n(1-x) \Rightarrow$ WTP

$n \Rightarrow$ Subscribers



$\bar{X}$ = Marginal Consumers is exactly between buying or not buying

$X \in [0, 1]$ USERS

DECREASING WTP

$\bar{X}$ has the net benefit = 0

$n(1-\bar{X}) - P = 0$

$$\boxed{\begin{matrix} \forall X < \bar{X} \\ n(1-\bar{X}) - P > 0 \end{matrix}}$$

$$\boxed{\begin{matrix} \forall X > \bar{X} \\ n(1-\bar{X}) - P < 0 \end{matrix}}$$

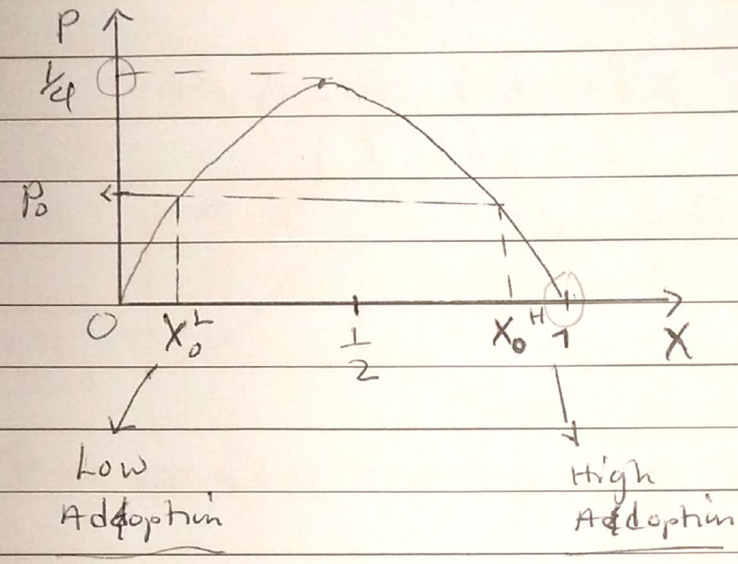
$n = ?$ $\quad\quad n = \bar{x}$

$n(1-\bar{x}) - p = 0$

$\bar{x}(1-\bar{x}) - p = 0$

$\Rightarrow \boxed{p = \bar{x}(1-\bar{x})}$

Demand Curve



Demand for A Network Service $x \in [0,1]$

$V(x) = \int_0^n (1-x) - p$ Subscribes

number of users

static WTP

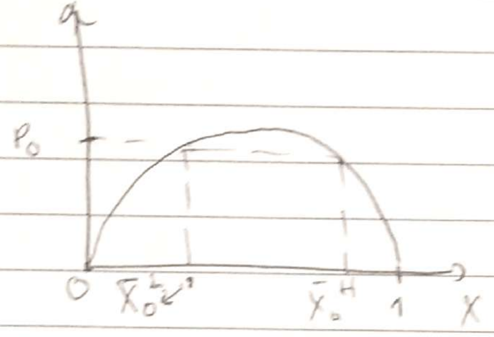
$\Rightarrow n(1-\bar{x}) - p = 0 \Rightarrow \bar{x}(1-\bar{x}) - p = 0$

$n = \bar{x}$

$p = \bar{x}(1-\bar{x})$

$\bar{x}$ Marginal Consumer

Demand Curve



Low Adoption

High Adoption

$\Rightarrow$ Although both demand levels are possible there is only one which gives equilibrium of Demand

$\Rightarrow$ High adoption level has this equilibrium level

$\Leftrightarrow$ Assume Consumers are ~~living~~ the market

WTP < Price

$\Downarrow$ result

Market Collapses

$\Rightarrow$ Assume small increase in number of C. starting from the ~~Low to~~ right. Means

$x \in [\bar{x}_0^L, \bar{x}_0^H]$

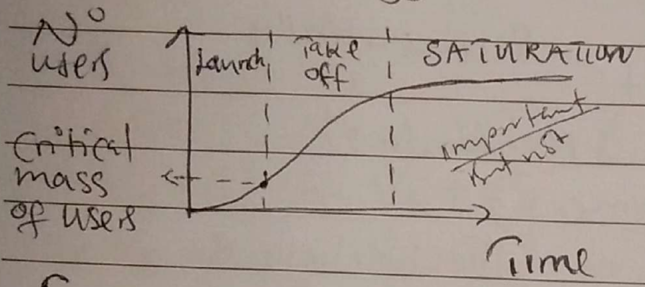
$\Rightarrow$ WTP > PRICE

Means $\Rightarrow$ Market Expands

Critical mass of users $\Rightarrow$ Smallest number of users needed for the market to stay.

What is the probability to reach Critical mass
* Depends on the initial price.
* Critical mass ⟷ minimum level of Demand
What firms can do to reach Critical mass.
① Penetration pricing (Low introductory Price)
Band wagon Effect

Technology Adoption



logistic Curve

Take off is due to presence of network effects

* Negative Network effect
⇒ especially when there is congestion
⇒ means a network will have lower value for the network service to all users
* Reverse Network effects
— Few users ⇒ Means each user is critical to the firm
If we have a great number of users the opposite is the case. Means alternative network effects may be better.

SINGLE TECHNOLOGY

COMPETING TECHNOLOGIES

- 2 TECHNOLOGIES

INCOMPATIBLE => Network effects specific to any given technology

COORDINATION PROBLEM FROM DEMAND SIDE NETWORK EFFECTS

2 Incompatible TECHNOLOGIES A, B with specific network effects

- Consumers Arrive in the market — Sequentially / Randomly

- Different preferences (consumers)

	Technology A	Technology B
A Supporters	$\mu_A + n_A^t$	$\mu_B + n_B^t$
B Supporters	$V_A + n_A^t$	$V_B + n_B^t$

n_A^t => ~~Surplus~~ network benefit ⟨Measure of direct network effect⟩

μ_A => Basic willingness to pay

A Supporters ⟺ $\mu_A > \mu_B$

B Supporters ⟺ $\mu_B > V_A$

Consider where consumers arrive sequentialy and randomly, consider how they decide which technology to adopt

1) Benchmark CASE;

No network effects

$\delta^t = n_A^t - n_B^t$ $\quad \{\delta^t\} \quad t = 1, 2, \ldots$

There is no network effects because of the way consumers arrive in the market

$\{\delta^t\} \rightarrow 0 \quad (t \rightarrow \infty)$

Small historical Events Do not matter

δ^{t+k} Independent of δ^t

when k is sufficiently large

ERGODIC SYSTEM

2) Consider the case where network effects are presents

t+1 consumers

A Supporter

Adopts Technology A $\Leftrightarrow \underline{u_A + n_A^t} \geq \underline{u_B + n_B^t}$

Then;

$\Rightarrow n_A^t - n_B^t \geq -(u_A - u_B)$

$\Rightarrow \delta^t \geq \Delta_A = \underbrace{-(u_A - u_B)}_{<0}$

B Supporter

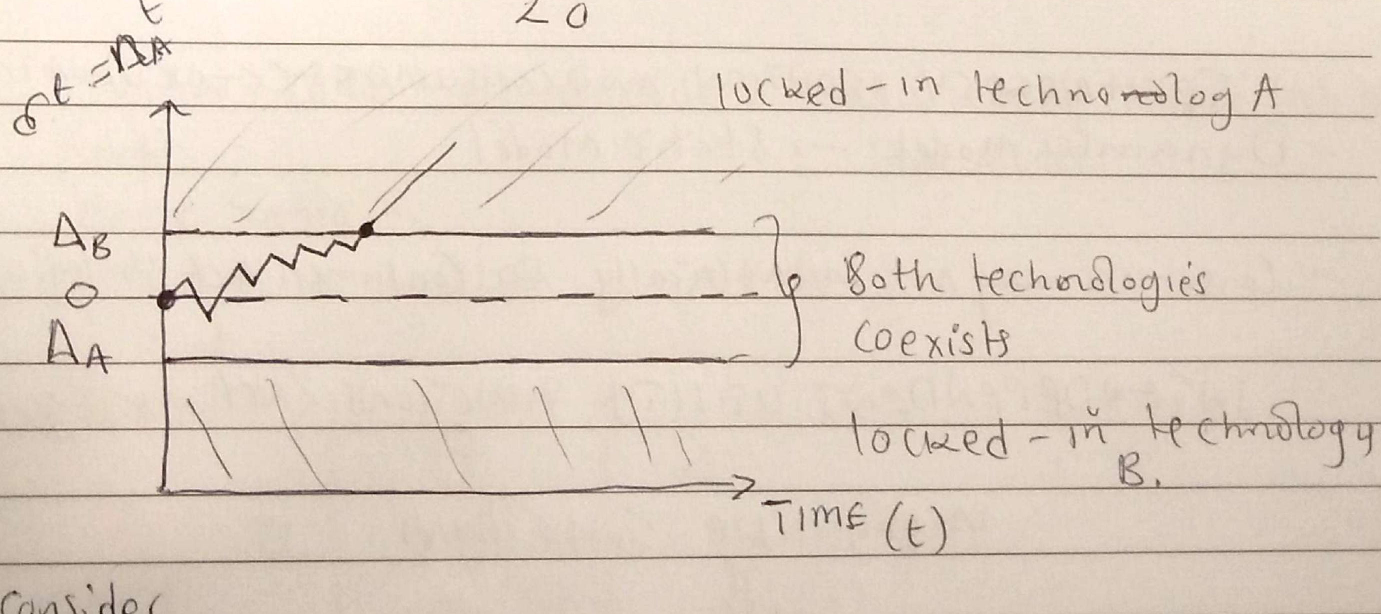
ADOPTS Techohology B $\Leftrightarrow$

$\Leftrightarrow V_B + n_B^t \geq V_A + n_A^t$

$\Leftrightarrow V_B - V_A \geq n_A^t - n_B^t \rightarrow \delta^t$

$\Leftrightarrow \delta^t \leq \Delta_B = \underbrace{(V_B - V_A)}_{>0}$

$\delta^t \geq \Delta_A = -(u - B)$
<0



Consider

$\Delta_A \leq \delta^t \leq \Delta_B$

How does the value of d^t evolve over time?

- Starting point is in the centre region

$\{d^t\} = n_A^t - n_B^t$

In Initial period $d^0 = 0$

As long as wer are in the centre region, each consumer adopts there preference.

If we are above the critical mass

$n_A^t - n_B^t >>> 0$ this means that now network effects are induced such that even B consumers get locked-in to A

Final outcome comes to "Winner-takes-all" Market Dominance

Which Technology will Prevail?

⇒ Difficult to predict since this is a path dependent process

⇒ This may also mean that we may have inefficient outcome

TECHNOLOGY ADOPTION AND CONSUMERS CO-ORDINATION

- Dynamic Model → Static Model

- Consumers ~~may~~ Act mechanically → Consumers Act Strategically

INTERDEPENDENT UTILITY FUNCTIONS (Network Effects)

Incompatible Technologies

⇓

Inefficiente outcome

Technology adoption outcomes

(1) Excess Inertia

(2) Excess Momentum

$\Rightarrow$ Consumers rush to adopting a new technology even if they are already satisfied with the current technology

- 2 Technologies (incompatible)
- 2 users — Old Technology (O) / New Technology (N)
- Network effects. $\longrightarrow$ $u(q)$: User's Utility when the network size is q $(q = 1, 2)$

  $v(q)$: User's utility when she/he adopts new technology and Network size is q

Networks effects

1) $u(2) > u(1)$; $v(2) > v(1)$
2) $u(2) > v(1)$; $v(2) > u(1)$

These conditions are important because

WHEN consumers decide simultaneously which tech to adopt "static model"

Basic GAME

	OLD	NEW
USER 1		
USER 2		

		User 2 O	User 2 N
User 1	O	$u(2)$, ~~$v(2)$~~ $u(2)$	$u(1)$, $v(1)$
User 1	N	$v(1)$, $u(1)$	$v(2)$, $v(2)$

2 EQUILIBRIA $\Rightarrow$ Each player is choosing the best choice considering the choice made by the first player

Etercise 1

MONOPOLY $\rightarrow$ PRODUCT X

MONOPOLY $\rightarrow$ PRODUCT Y

ZERO COSTS

X, Y PERFECT COMPLEMENTS

DEMAND $Q = a - p$

1) PRICES, QUANTITIES PROFITS

INDEPENDENT FIRMS

(Solution) SYSTEM 1:1

Notation

Good	Pric	QUANTITY
X	P_x	X
Y	P_y	Y

what is Q? and P?

(i) $Q = X = Y$

(ii) $P = P_X + P_Y$

product x

$$\max_{P_x} \Pi_x = P_x \cdot (a - P_x - P_y)$$

$$\frac{\partial \Pi_x}{\partial P_x} = a - 2P_x - P_y = 0$$

$$\Rightarrow P_x = \frac{a - P_y}{2} \quad (1)$$

product y

$$\max \Pi_y = P_y \cdot (a - P_x - P_y)$$

$$\frac{\partial \Pi_y}{\partial P_y} = a - P_x - 2P_y = 0$$

$$\Rightarrow P_y = \frac{a - P_x}{2} \quad (2)$$

$$\begin{cases} (1) \\ (2) \end{cases} \Rightarrow P_x^* = P_y^* = a/3$$

$$Q^* = X^* = Y^* = a - \frac{a}{3} - \frac{a}{3}$$

$$= a/3$$

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$$\Pi_X^* = \Pi_Y^* = \frac{a^2}{9}$$

2 Case 2 Integrated firm

Suppose there is a MERGER between the single firm

→ Single firm produces X and Y

→ However, the firm now sells complete systems.

Now; $\text{MAX } \Pi_S = P_S \cdot (a - P_S)$

P_S : Price of the system

$$\frac{\delta \Pi_S}{\delta P_S} = a - 2P_S = 0$$

$$\Rightarrow P_S = a/2$$

$$Q_S = a - \frac{a}{2} = \frac{a}{2}$$

$$\Pi_S = PQ$$

$$\Pi_S = \frac{a^2}{4}$$

Now: COMPARISON in TWO CASES

1 $P_S = \frac{a}{2}$ $\cancel{<}$ (2) $P^* = P_X^* + P_Y^* = \frac{2}{3}a$ prices

(2) $Q_S = \frac{a}{2} >$ $Q^* = \frac{a}{3}$ Quantity

3 $\Pi_S = a^2/4$ profits

$$\Pi_X^* + \Pi_Y^* = \frac{2}{9}a^2$$

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Exercise 2

3 Groups of Consumers

TYPE H

$V(q) = \begin{cases} 5q - p & \text{Subscribe} \\ 0 & \text{NOT} \end{cases}$

20 consumers

- monopoly
- $f = 10$ connection cost per user

TYPE M (10 consumers)

$V(q) = \begin{cases} 2q - p \\ 0 \end{cases}$

TYPE L (10 consumers)

$V(q) - \begin{cases} q - p \\ 0 \end{cases}$

Answering the Question

$\Rightarrow$ First find the market demands curve which is a function that relates the number of consumers to the quantity sold.

i) Suppose that only type H consumers connect.

$U(q) = 5q - p \xrightarrow[q=20]{} 100 - p$ -> utility

$\Rightarrow$ Reservation Price is 100 for each consumer.

ii) Suppose that type-M consumers are connecting

$V(q) = 2q - p \rightarrow 2(30) - p = 60 - p$

$q = 10 + 20$

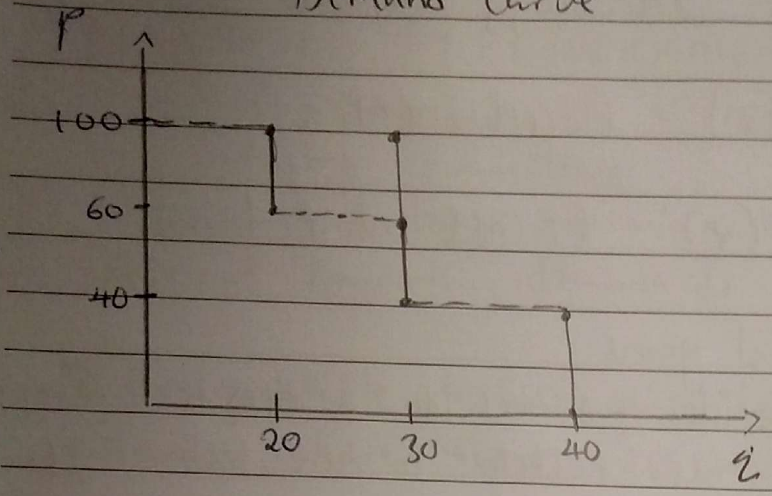
$\Rightarrow$ Reservation Price is 60 for each consumer

iii) Suppose that type-L consumers are connecting

$V(q) = q - p = 40 - p$

Reservation price is 40 for each consumer.

Demand Curve



OPTIMAL PRICE / PROFIT?

Posibilities

i) Selling only to consumers with the highest willingness to pay

$\Rightarrow$ Reservation Price = 100

$\rightarrow$ $P = 100$

$\Pi = (100 - 10) \cdot 20$

$= 1800$

ii) Selling to both Group M and H.

$\Rightarrow$ Both To H and M

reservation price 60

$\rightarrow$ $P = 60$

$\Pi = (60 - 10) \cdot 30 = 1500$

iii) Selling to All Consumers

RES_Price = 40

$\rightarrow P = 40$

$\Pi = (40 - 10) \cdot 40 = 1200$

Users' co-ordination on Technology Adoption

Equilibrium

① (0,0) But $V(2) > U(2)$ Excess Inertia

② (N,N) But $U(2) > V(2)$ Excess momentum

What if we have Sequential game

⇒ Here one of the users can decide to switch to a new technology whereby the other user will also switch to new technology. due to network effects

→ Conflicting preferences

→ Incomplete information

lack of co-ordination however may still lead to excess inertia

Q How to Reduce excess Inertia?

Ans:→ Along communications among users.

→ Public policy should play a role in reducing the risk of excess inertia by inducing users to switch to new tech.

(i) Government Subsidies

(ii) mandate the switch off of the old technology.

Firms Produce Compatible Technologies

→ This means that the network benefits are for all users.

⟨No users' coordination problems in such a scenario.⟩

Supply Side of the Market

Standardization of the market when all users decide to adopt the same technology.

STANDARDS

- Reduces users search and co-ordination costs (+)
- Eliminates duplication of research and development costs (positive effect)
- Have negative effect of consumers considering product variety.

STANDARD SETTING

1) MANDATED BY GOVERNMENTS (e.g Digital TV)
2) Standards come up as a result of a negotiation process by industry committees.
3) There might be a dominant firm that sets the standard.
4) Different competing standards (Standards War) e.g HD-DVD

Incompatible technologies leads to winner takes all situation where there will be market dominance

Compatibility ⟶ large network size/value
⟶ However, the network size is shared by other firms.

Incompatibility ⟶ Small network size/value
⟶ Large share for the firm

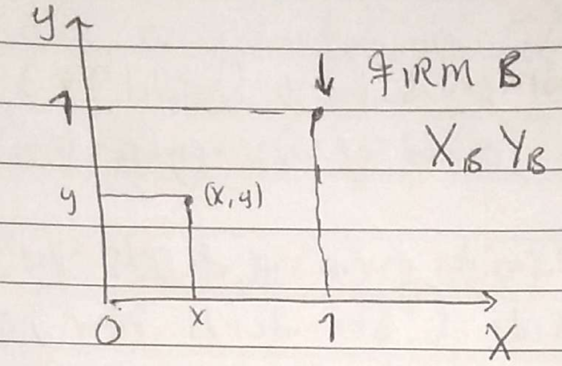
COMPATIBILITY VS. INCOMPATIBILITY

Consider: Systems of Complementary Products.
two Scenarios
(i) Compatibility
Here consumers can mix and match products

(ii) Incompatibility

Assumptions

2 firms A, B
2 complementary products ⟨components⟩ X_i, Y_i $i = A, B$
Products are differentiable ⟨Not Homogeneous⟩



Market for Systems

FIRM A

X_A Y_A

means (x,y) "IDeal System" for the consumer.

(1) (x,y) "move" to firm A in betwn Distance. $(x+y)$

This is the measure of the loss of benefit for the consumer. called ⟨Disutility⟩

(2) Can also move to firm B

Disutility $= (1-x) + (1-y)$

$=$

Generalized Price

System$_A$: $P_A + t(x+y) = \bar{P}$

Parameter t is taste parameter

if $t \to 0 \to P_A$

System$_A$: $P_B + t((1-x)+(1-y)) = \bar{P}_B$

System consumers buys is given by $\text{MIN}\{\bar{P}_A, \bar{P}_B\}$

Compatibility → mix and Match

Systems — $X_A Y_B \to P_{AB} = P_A^x + P_B^y + t(x+(1-y))$

$X_B Y_A \to P_B^x + P_A^y + t((1-x)+y)$

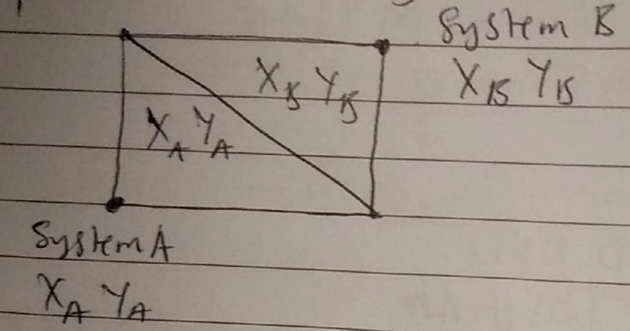
4 Diff. Systems

$\text{MIN}\{\bar{P}_A, \bar{P}_B, P_{AB}, P_{BA}\}$

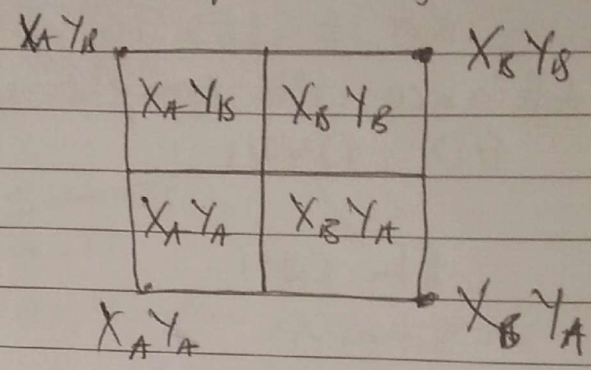
ASSUMPTION

- SAME COSTS $\Rightarrow$ SYMETRIC EQUILIBRIUM

i) Incompatibility



ii) Compatibility



INCENTIVES FOR COMPATIBILITY

1) Icreases market demand since the generalised price the customer has to pay is reduced.

2) Relaxes price competition between firms

+ incentives for choosing compatibility

Suppose that firm A reduces P_A^X

$\Rightarrow$ Increases Demand for systems including X_A

Incompatibility

$X_A Y_A$

$\Rightarrow$ All Benefits to firm A

Compatibility

$X_A Y_A$ $X_A Y_B$

Part of Benefits goes to firm B

Firm A has less incentives to reduce price.

Assymetric Market shares

$\Rightarrow$ Dorminant firm

Small Rival

will force their items to be incompatible

- Reduces demand for rival firm
- Price competition increases

SYMMETRY → COMPATIBILITY
→ Standards War
- incompatible nets technologies

STRATEGIES TO WIN STANDARM WAR

(i) - Alliance with complementors

HD DVDs

Blu RAY
- SONY
- PANASONIC

HD DVD
- TOSHIBA
- MICROSOFT

(ii) - Penetration Pricing to build installed Base of users. ⟨AD words, Google Fiber⟩

(iii) - Managing Consumer Expectations
- Product Pre-announcements.

TWO-SIDED MARKETS

Buyers — GROUP i — Consumers (Gamers)
— Card Holders

↑ ↓

E-commerce site — PLATFORM — Game Console
— Credit Card
— ISP

↑ ↓

Sellers — GROUP j — Game developers
— Merchants
— Content / Application provides

(1) CROSS - GROUP NETWORK EFFECTS ⟨cross-side⟩

In markets like this it is important to attract agents from the other group. Getting one side on board important also getting the other group.

(2) STRUCTURE OF PRICES

- prices depends on the relative size of cross network effect

Two types of prices

(i) membership fee (fixed) {for joing the platform}

(ii) USAGE FEE (variable price)

example; CREDIT CARD

CARDHOLDERS; CARE about card acceptance

Merchants : Care card usage.

It is reasonable for card holders to pay no usage fee and merchants not to pay membership fee.

Assumption: - Monopoly Platform
- 2 Groups of Agents
Sellers (S) Buyers (B)
- Number of Agents of the Other Group.

Considering the UTILITY (Net + Benefit)

$$U_S = \underbrace{\alpha_S}_{\text{Benefit}} \, \underbrace{n_B}_{\text{Number of Buyers}} - \underbrace{P_S}_{\text{Price.}}$$

$$U_B = \alpha_B \, n_S - P_B$$

$n_B = n_B(u_B)$
$n'_B > 0$

$P_s = \alpha_s n_B - u_s$
$P_B = \alpha_B n_s - u_B$

$n_s = n_s(u_s)$
$n'_s > 0$

PLATFORM PROFIT

$$\Pi = (P_s - f_s) \cdot n_s + (P_B - f_B) \cdot n_B$$

$$\Pi = (\underbrace{\alpha_s n_B - u_s}_{P_s} - f_s)\, n_s + (\alpha_B n_s - u_B - f_B)\, n_B$$

$n_s = n_s(u_s)$ $\quad$ $n_B = n_B(u_B)$
$n'_s > 0$ $\quad$ $n'_B > 0$

$$\Pi = \alpha_s n_B n'_s + \alpha_B n_s n'_B - (u_s + f_s)\, n_s - (u_B + f_B)\, n_B$$

$$\frac{d\Pi}{du_s} = \alpha_s n_B n'_s + \alpha_B n'_s n_B + -n_s - u_s n'_s - f_s n'_s = 0$$

$$\Rightarrow (\alpha_s n_B + \alpha_B n_B - u_s - f_s) = \frac{n_s}{n'_s}$$

$$\Rightarrow u_s = \alpha_s n_B + \alpha_B n_B - f_s - \frac{n_s}{n'_s} \xLeftrightarrow{\text{insert in}} P_s = \alpha_s n_B - u_s$$

$$P_s = \alpha_s n_B + \frac{n_s}{n'_s}$$

$$P_B = f_B - \alpha_s n_s + \frac{n_B}{n'_B}$$

optimal prices
cost of serving each buyer
Elasticity of buyer's participation
Benefit of each buyer for the sellers

The monopolist may set;

$P_B < f_B$ Buyers are subsidized.

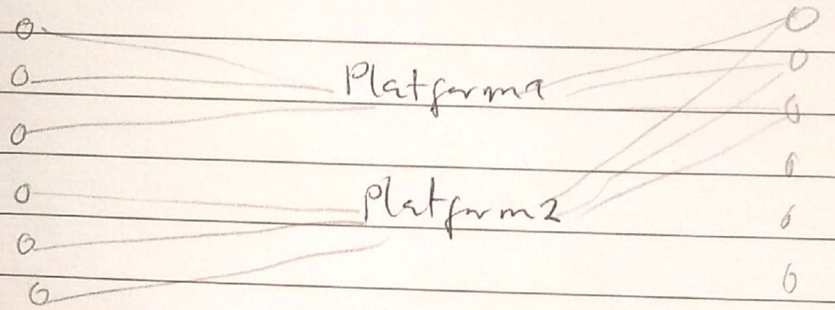
$P_B < 0$

$P_B = 0$

properties of one sided Market have new impact.

1. like prices should reflect costs
   - However, cross side network effects hugely affect prices
2. Price < MC is anti-competitive
3. High Price - cost margin
   ⇒ Market power.
4. Platform Competition on the structure of prices

Buyers SingleHome Sellers MultiHome.



Main Analysis Two-Sided Markets

1) Consider Both sides
2) The structure prices is relevant to determin -

3) Competition does not necessarily yield Balanced Prices