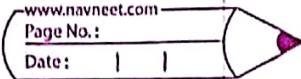


Microeconomics

KG



Utility - want satisfying power that can generate welfare to us.

Wants are unlimited, resources limited, hence we need an economic behaviour so that we maximise our satisfaction level with what available.

We prepare our preference list ^{item}, topmost that which maximises our satisfaction level.

Generalising / similarities inspite of differences

2 schools of economics

- Cardinal measure of utility - we can quantify utility (quantitative)

- ordinal " " " relative measurement of utilities
which means there needs to be ^{at least} two

(Qualitative) - greater than or less than

e.g. Biryani is more satisfying than pens.

Cardinal - we measure utility based on what money we are ready to pay for it at a particular point of time. not necessary what is its market value but how much we are ready to pay.

e.g. I am ready to pay 5 ₹ for pen.

someone else " " 10 ₹

depending on how desperate we are to get it.

After eating Biryani, we cannot ignore the need for 2nd plate (only for a fraction of sec), we may be ready to pay lesser, then 3rd plate etc.

Conclusions:

i) individual utility decreases in succession. (because its no. is plenty, value is decreasing)

1st - $60/-$ individual utility is
2nd - $40/-$ equivalent

marginal utility = ΔU

ΔU no. of units

Total utility = $100/-$

from 0 to 1 = $60 - 0$

$\frac{1}{1}$ TU at 2nd is 100

from 1 to 2 = $100 - 60$

1

Change in Total utility because of consumption / possession of any commodity.

- Generality - MU decreases because in succession, the no. of that commodity increases so its value decreases.

Assumption: for above descriptions - consumer must be a rational human being.

- you are following your own preference list
in 15₹, fruit first with 1000₹, anything first but not

order & .

- We cannot quantify satisfaction level for e.g. everything in terms of profit / loss.

as long as utility

utility is additive

follows law of diminishing marginal utility

- when a consumer consumes more of a certain comm., want satisfying power decreases. for each & every successive commodity

e.g. After 2nd plate, we will think because 3rd plate 10/- and notebook 30/-

Then we are ready to pay for 2nd notebook for 10/-, then comparison with 3rd plate, we become indifferent - can't decide

- income is unlimited

- consumer is yet to reach satiety

- marginal utility of money remains constant

Price you are ready to pay

law of equimarginal utility

$$MU_x = P_x \cdot MU_m$$

constant value

$$\Rightarrow MU_x = MU_y = MU_m$$

$$MU_y = P_y \cdot MU_m$$

$$\frac{MU_x}{MU_y} = \frac{P_x}{P_y}$$

- as long as MU of 1 is greater than MU of other, we are ready to pay for it

100₹ has diff meaning for a beggar and billionaire.

Then how do we say money has constant MU.

For this, cardinal utility definitn given \Rightarrow money measured relative

Utility measured ordinally.

L limited money income

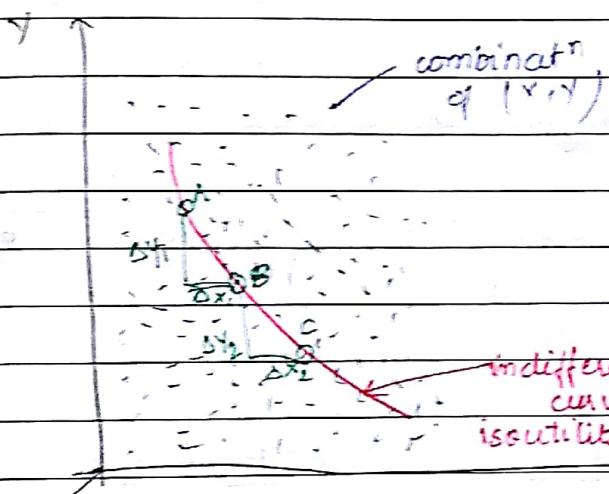
L rationality - every consumer has his separate list of goods, I know what gives him maxm utility

L transitivity A preferred over B, B over C \Rightarrow A over C

L diminishing rate of substitution.

L consumer yet to reach satiety

Suppose we consume 2 commodities X & Y.



Indifference curve (joining points where I feel my level of satisfaction is same)

\Rightarrow each & every point represents particular utility

Properties:

- negatively sloped / we cannot have +ve, law of diminishing rate of substitution

- convex to the origin

$$\text{rate of substitution} = \frac{\partial Y_1}{\partial X_1} \frac{\Delta Y_1}{\Delta X_1} > \frac{\Delta Y_2}{\Delta X_2} > \frac{\Delta Y_3}{\Delta X_3}$$

as ~~our~~ X is increasing, \Rightarrow want satisfying ~~area~~ ^{point} w.r.t X
so is decreasing

\Rightarrow we are becoming more & more ~~more~~
indifferent w.r.t X

\Rightarrow ~~we~~ w.r.t Y in X is becoming more
valuable

\Rightarrow There will be a point beyond which we will not be ready to substitute Y.

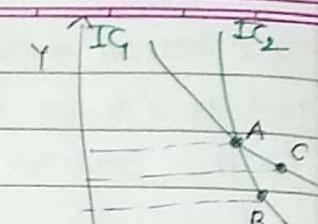
- two indifference curves never intersect.

A, C on I_1 \Rightarrow Utility same

A, B, C on I_2 \Rightarrow " " $= D/A$

By law of transitivity, ~~use~~ $U_A = U_B$

Hence, should be parallel.



To compare U_A with U_B .

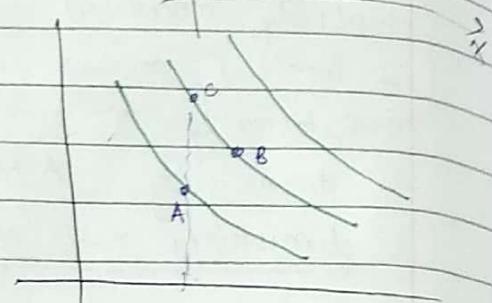
$$U_B = U_C$$

C is higher (same X)

$$\Rightarrow U_C > U_A$$

$$\Rightarrow U_B > U_A$$

\Rightarrow higher ~~to~~ the curve, higher the welfare.



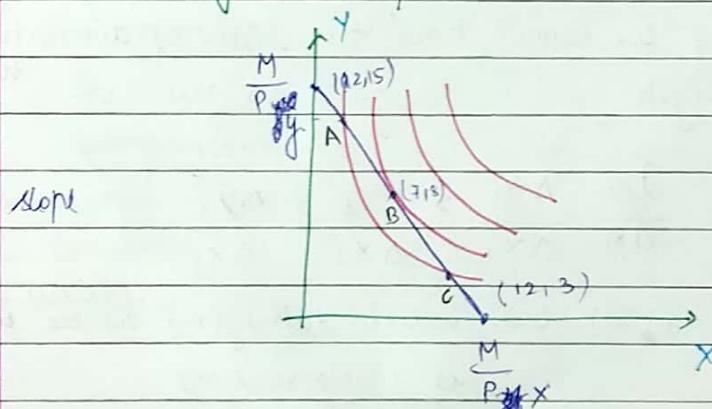
Suppose income (only for purchasing X + Y / total) increases, ~~so~~ their value will also increase(s).

$$M = P_x X + P_y Y$$

$$X = M - \frac{P_y Y}{P_x}$$

$$Y = M - \frac{P_x X}{P_y}$$

Budget line / curve



Point of Tangency

~~so~~ A, B, C lie on budget line
but we choose B because
we want to maximise
utility.

B is called consumer's equilibrium point

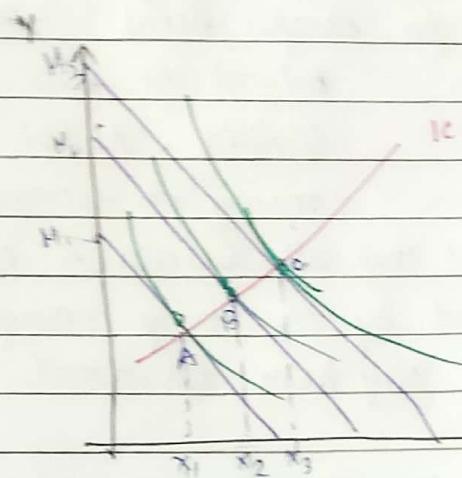
defined when consumer maximises his utility
under a given budget constraints.

Assumptions/ conditions:

- 1) Marginal rate of substⁿ must be equal to ~~com~~ price ratio

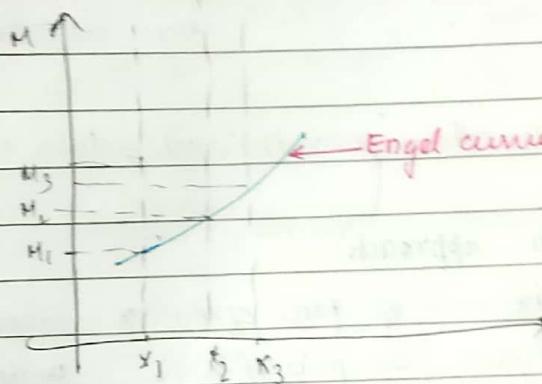
$$MRS = \frac{P_x}{P_y} \quad (\text{price ratio})$$

- ii) 1st condition must be fulfilled at highest possible indifference curve \Leftrightarrow budget line must be tangent to \Rightarrow curve



ICC (income consumption curve)

Locus of points of consumer's eqm that is generated due to change in budget line (income)
- shows

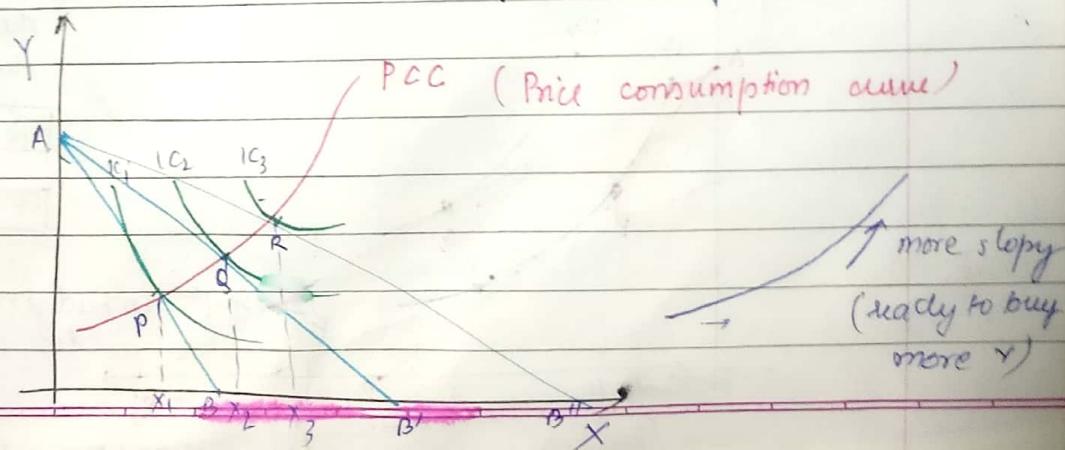


Engel curve (considers eq "quantity" of one commodity can't be generated without ICC)

Income effect of price change:

if price of a commodity decreases, for a fract" of inc we feel income has increased.

Ex: 20 Rs, price of tomato = 10Rs/kg \Rightarrow purchased 1 kg tomato rest for comm. Y



PCC (Price consumption curve)

more slopy
(ready to buy more Y)

Price change is a consequence of

- income effect
- substitut "

\downarrow quality of 2 items nearly same, we have a tendency of looking for cheaper items. Why?

- behind the scene, our resources are limited, do not want to waste money on unnecessary items

but this all depends on satisfaction level.

Some can be satisfied by one thing, may not be unnecessary for him, hence cannot say him irrational.

30.0

- o normal goods - income increases then demand \uparrow
- o inferior " - " " then demand \downarrow
- o By default, unless otherwise mentioned - take as normal.

PCC (Hicksian approach)

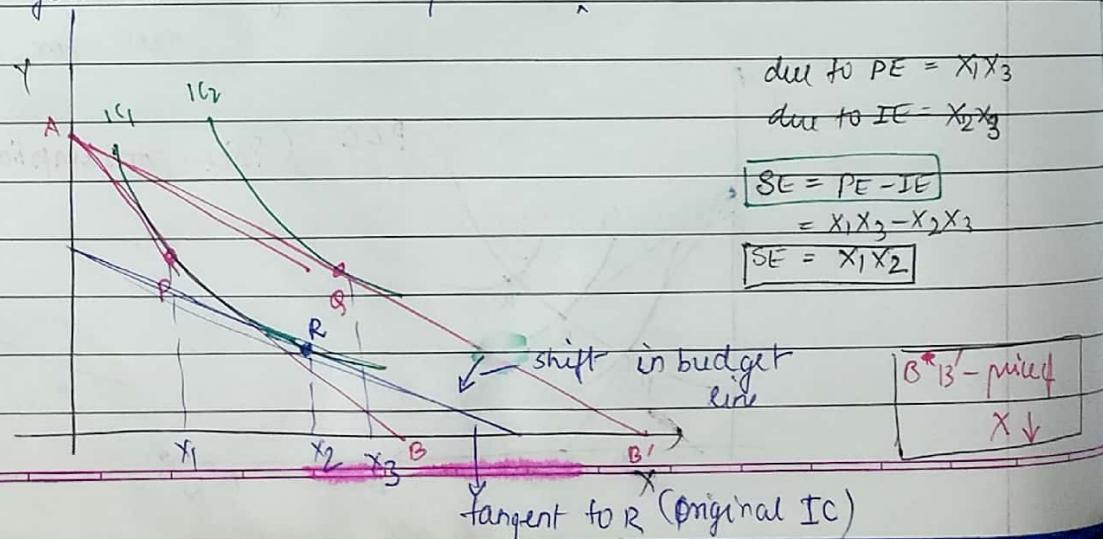
\rightarrow because of decrease of price of x_1 , x increases by $x_3 x_1$

for Giffen goods, as price of $x \downarrow$, demand also decreases

Let, because of some reasons, income \downarrow

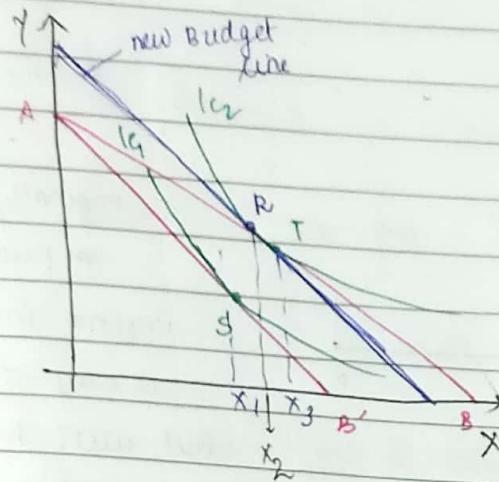
then budget line will shift downward (parallelly if all other factors remain same)

Hicks assumed that the budget line will shift in such a way that you will return to previous ^{original} I.C.



$P \rightarrow Q$ PCC $Q \rightarrow R$ ICE

(steeper because more of Y will also decrease with price income decrease).



Silent about Y

$$PE = x_1 x_3$$

$$IE = x_1 x_2$$

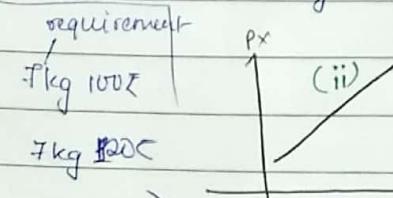
$$SE = x_1 x_3 - x_1 x_2 \\ = x_2 x_3$$

BB' - price of X ↑

ticks assumed because of some factors your income increase in such a way

that you will shift towards original IC

Total Income	X poor qua	Y good qua
100	4 kg × 10 £	3 kg × 20 £
120	2 kg × 10 £	5 kg × 20 £



$$Qx + y = 15$$

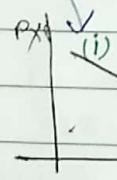
$$12x + 20y = 200$$

$$12(15-y) + 20y = 200$$

$$180 + 8y = 200$$

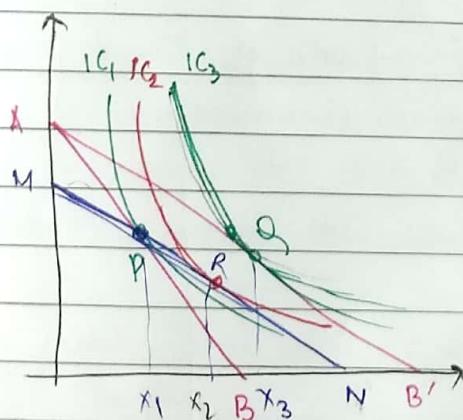
$$y = \frac{20}{8}$$

Total Income	X poor qua	Y good qua	require.
200	10 kg × 10 £	5 kg × 20 £	15 kg × 20 £
	18.5 kg × 12 £	5 kg × 20 £	20 kg × 20 £



$$Qx$$

Slutsky's approach :



$$PE = x_1 x_3 \quad IE = x_2 x_3$$

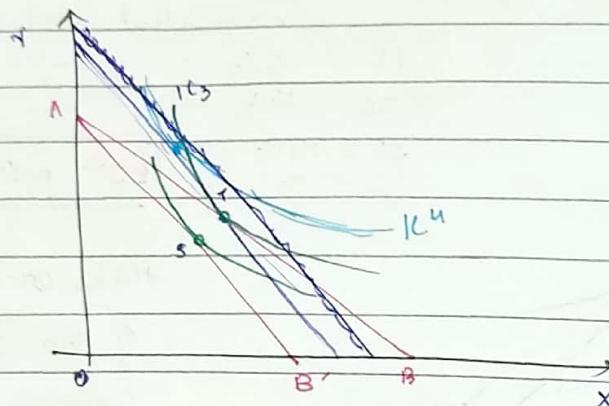
$$SE = x_1 x_2$$

Slutsky assumed because of some ext factors, your income reduce.

It will reduce in such a way that if you wish you can purchase original combination of X & Y.

e) It will pass through P

But P is not an eq^m point now, however it will cut another IC (IC_2) and here the utility also increases.



income ↑

originally IC_3 ,

~~⇒~~ $p_{max} \uparrow$, then to s

income increase in such

a way, is no more eq^m

but will be tangent
to another IC_4

Demand - desire for something supported by purchasing power and willingness to pay for it. (individual demand)

Potential buyer - has money in pocket but not willing to pay.

When all ind. demands are added up, it becomes market demand

*

- Dynamic economy - for a long period?

- Static economy -

P_x
market price
For short time period

→ price determines whether one is actually buying or willing to pay.
→ If P_x less, demand more and vice-versa.

Assuming linear relationship

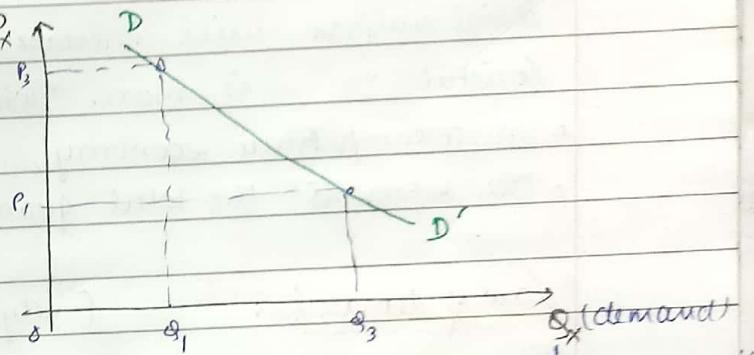
$$P_x \uparrow$$

$$Q_x = f(P_x)$$

$$Q_x = a - bP_x \quad / \quad Q_x = aP_x^{-b}$$

Determinants of demand

$$Q_x = f(P_x, \dots)$$



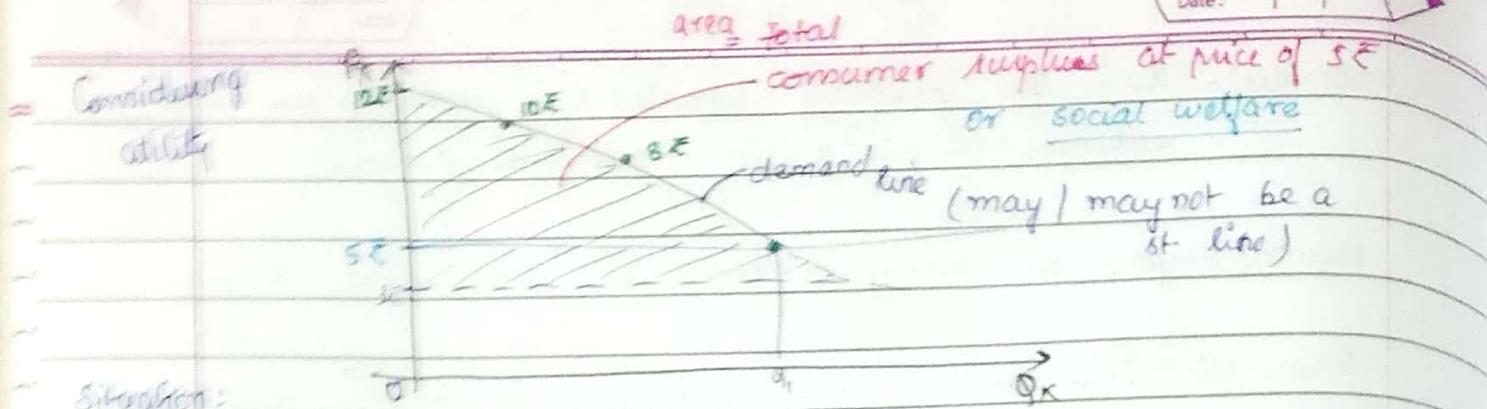
When other things are at certain (same) level,

- ① if **price** increases, demand will decrease
and when price decreases, demand will increase

* Consumer credit facilities - if for the same product at one place, there is instant payments in installment facility and direct payment as well, demand in that place will increase in comparison to another place where this facility is not there.

* Other factors that will determine demand -

- (2) income



Situation:

Suppose I'm desperate to get a pen and ready to pay max 12 ₹ so that is its utility. But the price of the pen is 5 ₹ , hence I paid 5 ₹ .

So, in this case I'll assume that I'm making a surplus of 7 ₹ .

But all are not like me. Suppose, someone else is ready to pay 10 ₹ . Consumer Surplus equivalent = 5 ₹ .

Social welfare will increase when price decreases.

Social " " is more where price is less.

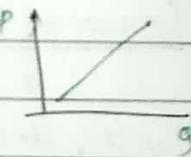
- In a competitive economy, it is less (welfare)
- OQ₁ represents the total quantity demand

Law of demand : (-vey sloped)

Exceptions: Where this law doesn't work for short period

1. Expectation of rise in price in future. (to avoid a bitter situation)

Crop failure - prices ↑ day by day - you estimated that it will shoot in few days
⇒ demand will increase.



2. Less bothered about price on particular occasions before, price ↑ You don't want to avoid that commodity on that day.

(not necessarily special commodity)

3. Giffen goods - any essential commodity consumed by poor HH

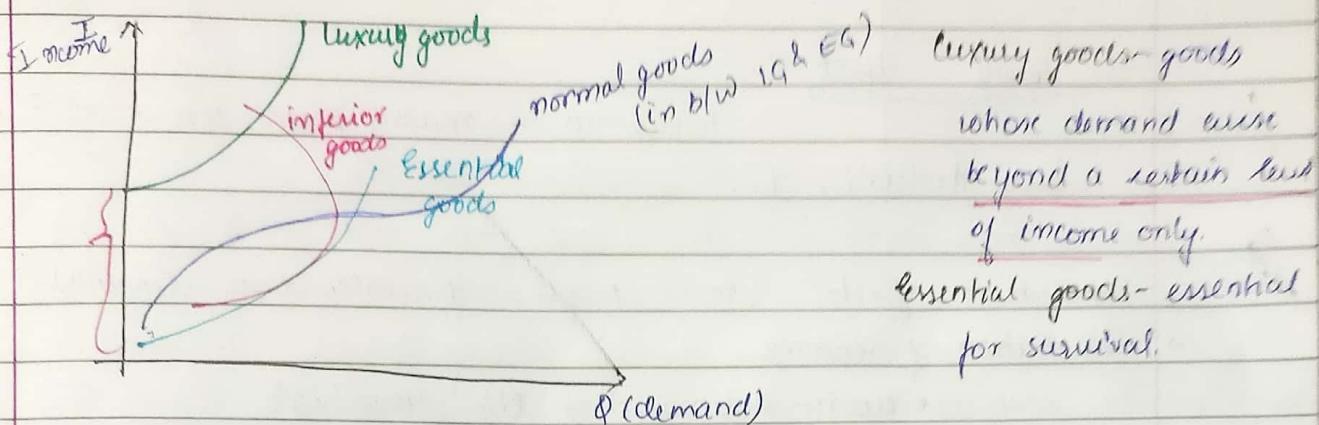
poor	10/-	4 kg	60/-	comprising major portion of their income
good	20/-	3 kg	60/-	

If price of poor quality increase to 12 ₹

5 poor + 2 kg good qual.

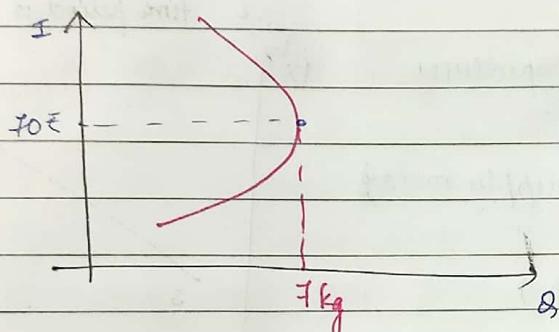
Hence price ↑, demand ↑

Q6.02



normal goods - demand ↑ with income

inferior " - demand ↓ " increase in income



Extreme case - 30 ₹ income,
no priority is to fill stomach. As it increases to 40, 50, 60, 70, you will increase consumption hence demand ↑.

After you reached 7 kg, now income ↑ you can think of substituting inferior good with good ones.

Other factors determining demand:

Related goods:

- | | |
|--|--|
| <p>(3) coffee = X</p> <p>P_x is same, but $P_y \downarrow$</p> <p>more demand of X (due to existing customer buying more or new consumer → who decreased coffee, started tea also)</p> | <p>- price of substitute</p> <p>$tea = Y$</p> <p>$P_x \downarrow$, demand of $c \uparrow$</p> <p>\Rightarrow demand of $x \uparrow$</p> |
| <p>(4) consumer credit facilities</p> | |
| <p>(5) demonstration effect</p> | |
- complementary good
- $X = butter$ $C = bread$
- demand $x \downarrow$



1) Band wagon effect -

remote areas - one person bought TV, seeing him, others also start buying it, demand ↑

uplifting social status
(may be perceived for actual)

2) Snob effect -

Nokia 110 - many people use it so I will buy android. (.

→ Population effect (more people, generally more demand)

→ Distribution of income

- even - demand of NG very high

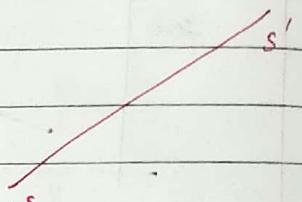
- uneven - demand for EG more

SUPPLY

Consider yourself producer.

price time period is v.v short

$P_x \uparrow$



- if demand ↑, I will supply more
price ↑, " "
(short term)

- long term

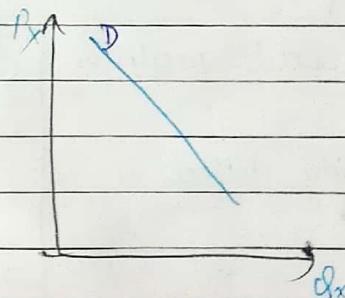
- govt policies (restricting raw material from other country)
- price same but COP very high, you will reduce your scale of production

Market price ^{not} influenced by seller if their seller no is large
in " " " " market where monopoly is there
because consumer has no option.

For monopoly,

cost + produces ↑ 400, 300, 1000

consumer to shift to other alternatives (shower)



you cannot randomly set prices in monopoly because consumer can find other alternatives too.

Law of supply

says that when all other things are at certain level, when a price of a com. ↑, quantity supplied will be more and vice versa.

Cost of prod = 3₹ M. Price = 5₹ you are making a ~~no~~ profit of 2₹, so you will try to supply more.

You never know how long you'll be in profit, ~~but~~ so you supply more for the time being.

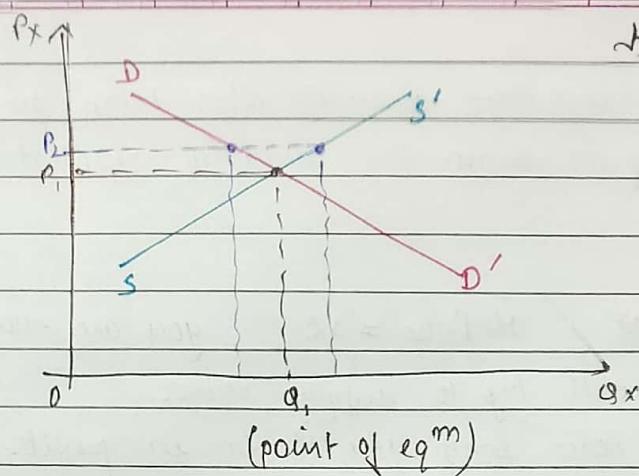
How much you'll supply will mostly depend on m. price. If price is less & you make no profit, you may not even produce, hence supply ↓.

long term basis, this may not be the same. (not necessarily price determines it)

1. Govt policies changed in such a way that you can not more import. So no more to product & supply.
2. Technology use - your product is more for the same input - hence more supply. (curve shifting)
3. input cost increases but m. price is same, you will reduce production.
4. ~~no~~ price of product substitute.

In ~~set~~ a company making similar types of goods, shift from one unit to another is easy.

For eg - ~~no~~ makes refrigerator & AC. In summer, it will shift labour & other resources to make more AC as its price is increasing due to more demand. In winter, it will again shift



Market eq^m-

a state in market

when Quant demanded
= quant. supplied

In TechM, shopkeeper brings 20 kg tomato, sells all. We can assume that there is no storage facility or it is perishable good.

Market eq^m under static economy :-

everything is still (for very short time)

no. of organisatⁿ, ↓ consumer's taste, income.

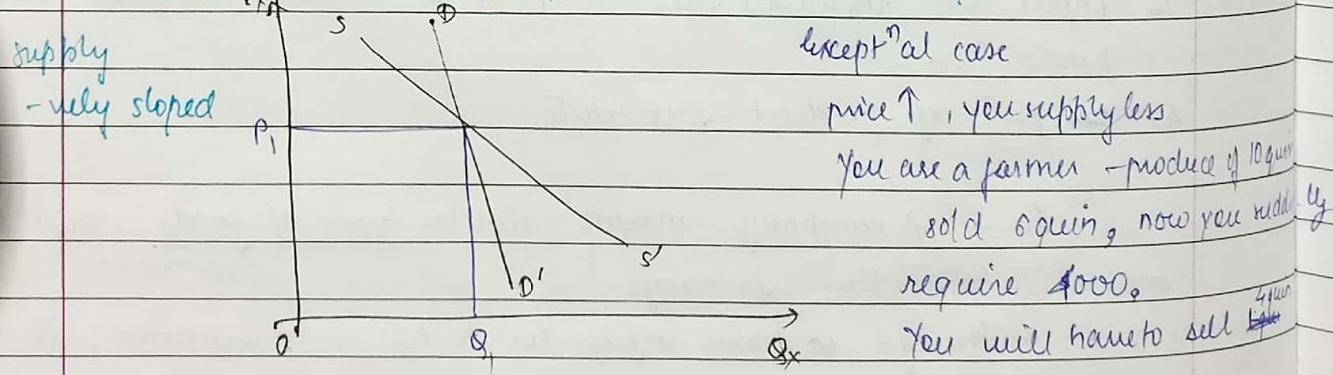
3 diff eq^m in such situations

↳ stable eq^m -

say because of some ext. factor, price ↑

from P_1 to P_2 . From graph, demand ↓, supply

↳ unstable eq^m - very diff to return back to eq^m



exceptⁿal case

price ↑, you supply less

You are a farmer - produce 10 quin sold 6 quin, now you need 4 quin

require 4000.

You will have to sell 10 Re per kg.

If price is 20 Re per kg
You will sell 2 quin.

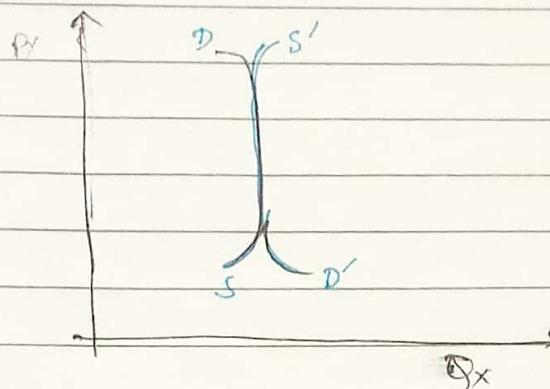
Hence price ↑, supply ↓ because you know

you'll have to buy.

sick person, needs food Rs. no. of hours worked ↓ when

price of each hour ↑

↳ neutral eq^m



price change, no
change in $\Delta D, S$ for
that range.

Dynamic Economy :- - for a ~~long~~ time
- everything keeps on changing.

e.g. - you went to market with 20€, but came to know that price
is 40€/kg, so you will buy $\frac{1}{2}$ kg. Because you can't
afford. On the spot decision.

From supplier side, you took 50 kg thinking 20€/kg but you came
to know it is 40€/kg. very happy. Next day you'll take more
kg to market. Supply is a time lag of price. Today's supply
determined by yesterday's ~~as~~ price.

Cobb-Douglas theorem:

① stable eq^m - when $(slope)_D < (slope)_S$
at eq^m now.

Suppose t , $P \Rightarrow P_3 \rightarrow P_6 \Rightarrow D \downarrow$

(tomorrow) $t+1$, $S: S \uparrow, Q_6$

Demand: Q_1 ,

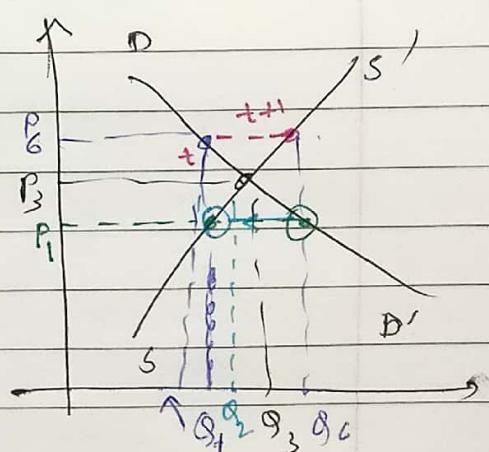
Supply: Q_6

Q_1, Q_6 unsold stock

excess supply, price will decrease. to P_1

immediately demand \uparrow to Q_2

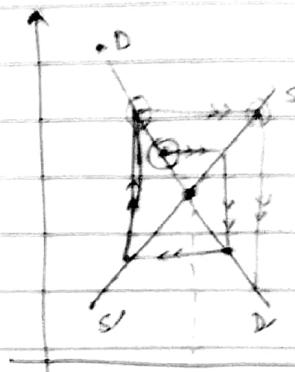
next day: supply will come to Q_2



(ii) unstable eq^m:

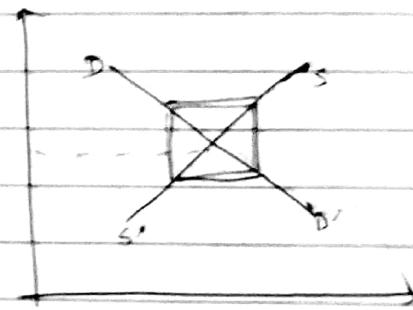
$$(\text{slope})_D > (\text{slope})_S$$

eq^m never reached.



(iii)

$$(\text{slope})_D = (\text{slope})_S$$



Elasticity of demand

Want to maximise profit.

Changing the price will depend on how sensitive my product is towards price change (Price elasticity).
Change in demand

(i) Price

Elasticity of demand:

$$\epsilon_p = \frac{\text{percentage change in Qty demanded}}{\text{% change in price of same commodity}}$$

$$\epsilon_p = \frac{\text{percentage change in Qty demanded}}{\text{% change in price of same commodity}}$$

I sell a pen for £5. I want more demand = 1000, cost of production = £3. Then, total profit = 2000.

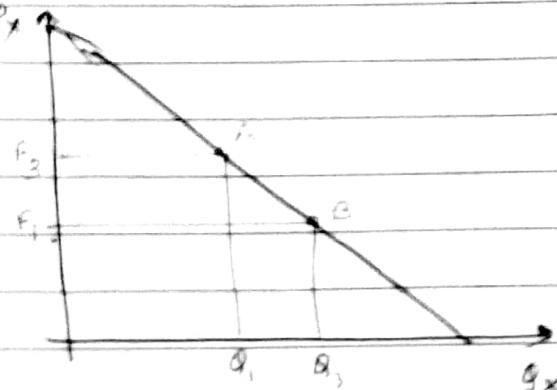
If I increase price to £5.5, demand = 900. But total profit = 900×2.5 (increased)

$$E_p = \frac{\Delta Q}{Q} \div \frac{\Delta P}{P}$$

$$= \frac{\Delta Q}{Q} \cdot \frac{P}{\Delta P}$$

$$= \frac{\Delta Q}{\Delta P} \cdot \frac{P}{Q}$$

Arc elasticity: when on changing price, there is considerable change in demand



Point elasticity:

$$E_p = -\frac{dQ}{dP} \cdot \frac{P}{Q}$$

+ve to make E_p +ve ; multiplied by - sign

Taking $\frac{dQ}{dP}$ at * when price change very close to original price

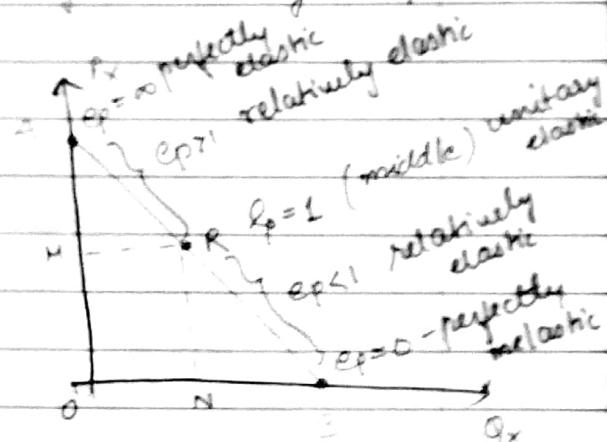
elasticity

We are interested to measure at R

$$\frac{dQ}{dP} = \frac{NB}{RN}$$

$$\therefore E_p = \frac{NB}{RN} \cdot \frac{RN}{ON}$$

$$= \frac{NB}{ON}$$



$$= \frac{NB}{MR}$$

) similarity of ΔMR & ΔRN

$$= \frac{RB}{RA} = \text{lower segment}$$

$$RA = \text{upper segment}$$

(But this does not give accurate results always)

$$\text{Profit function: } \Pi = \overbrace{TR - T_{\text{cost}}}^{\text{revenue}} \\ = P \cdot Q - TC$$

can be fixed cost, some other

$$\text{Total revenue} = TR = P \cdot Q$$

$$\text{Average revenue: } AR = \frac{P \cdot Q}{Q} = P$$

Marginal revenue - Change in TR per unit change in Q

$$MR = \frac{d(TR)}{dQ} = \frac{d(P \cdot Q)}{dQ}$$

$$MR = P + Q \cdot \frac{dP}{dQ}$$

$$= P \left(1 + Q \cdot \frac{dP}{dQ} \right)$$

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

$$MR = AR \left(1 - \frac{1}{e} \right)$$

$$\text{say } Q = 100 - 5P$$

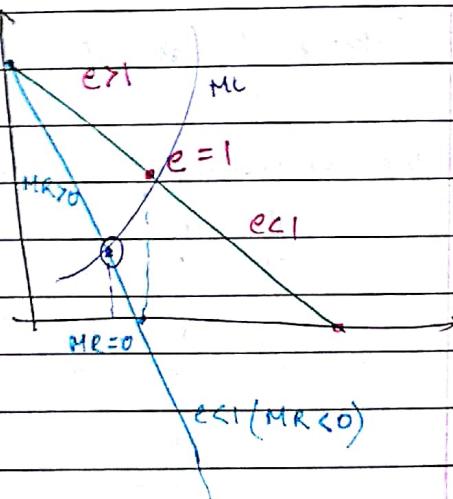
$$AR = P = 20 - 0.2Q \quad \textcircled{I}$$

$$TR = PQ = 20Q - 0.2Q^2$$

$$MR = 20 - 0.4Q - \textcircled{II} \left(\frac{d(TR)}{dQ} \right)$$

Comparing \textcircled{I} & \textcircled{II},

slopes different.

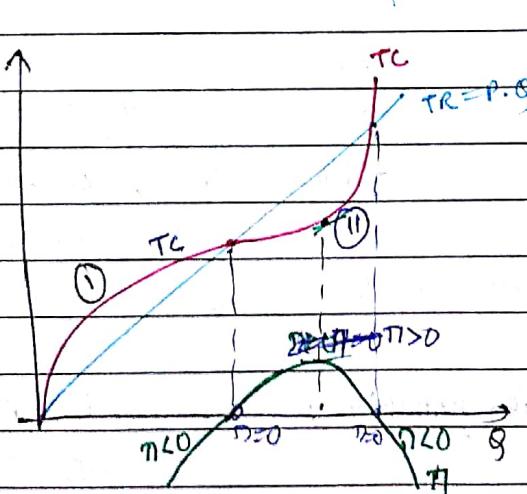


- \textcircled{I} TC is more than TR
setting up of industry
so, $\pi < 0$

- \textcircled{II} Stable production

$$TC < TR$$

$$\pi > 0$$



factors determining price elasticity :

(1) price of substitute goods :

elasticity

Closer the substitute, higher is the elasticity

(2) nature of good :

essential - less elastic

luxury - highly "

(3) eg - ^{salt} bread, AC

<u>fraction of income spent</u>	- very small fraction	- inelastic
	very large "	- elastic.

(4) Time required to adjust with new price

for salt - 10 to 12 weeks, easily adjusted (inelastic)

AC - highly elastic

(5) No. of alternative uses of that commodity -

eg - milk -

- o if you use it for many purposes - price increase - you will decrease consumption (elastic)
- o if your use is limited - inelastic (you can buy the same amount)

more consumption, more uses means possibility of reducing consumption is also more.

Income elasticity :

$$e_i = \frac{\% \text{ change in } Q \text{ demanded}}{\% \text{ change in income of consumer}}$$

Relatⁿ is always +ve

$$e_i = \frac{dQ}{dM} \cdot \frac{M}{Q}$$

(Normal good)

(negative for inferior)

Cross elasticity.

$e_c = \frac{\% \text{ change in qty demanded of a commodity}}{\% \text{ change in price of its substitute or complementary}}$

$$e_{t,c} = \frac{dQ_t}{dP_c} \cdot \frac{P_c}{Q_t}$$

(+ve for substitute
-ve for complementary)

Price elasticity of supply :

$e_s = \frac{\% \text{ change in quantity supplied}}{\% \text{ change in price}}$

$$= \frac{dQ_s}{dP} \cdot \frac{P}{Q_s}$$

10.03.11

Production

It is the conversion of input into output, but we add value too.
We in the process of production, we make the product more useful.

Without run

certain ^{inputs} machines will be fixed, certain variables will be variable.

Long run

no. of employees, spaces, inputs ^(machines) everything changes.

fixed irrespective no. of units produced, they remain fixed

Variable - \rightarrow they vary
consumptⁿ of electricity

If you are using plastic, will vary with number.

" " labour for huge product", they'll be more
labour represents all variable inputs

① short run: $Q = f(L, \bar{K})$

(capital), in short run it is fixed

representatⁿ of other variables which are fixed

long run : $Q = f(L, K)$

everything is variable, except technology.

because tech changes in very very long period.

Short run

If I am producing pens, & ~~are~~ everything (raw materials) are fixed except labour. I am yet to start production, everyday labour is changing.

I brought in one labour, output started.

I started adding more labour, output increased.

$$Q = f(L, \bar{K}) \\ = -L^3 + 15L^2 + 10L$$

Total product (TP) = output = Q [TP_L when we say short run]

Average " (AP_L) = $\frac{Q}{L} = \frac{TP}{L}$ (product of per head or labour force on average basis - individual can be different)

(MP_L) Marginal product = change in Q output wrt change in labour.

10 L, 100 output
added 11L, 107 "]

$$MP_L = \frac{dQ}{dL} = -3L^2 + 30L + 10$$

eh

L $TP = Q$ $AP_L = -L^2 + 15L + 10L$ $MP_L = -3L^2 + 30L + 10$

1.

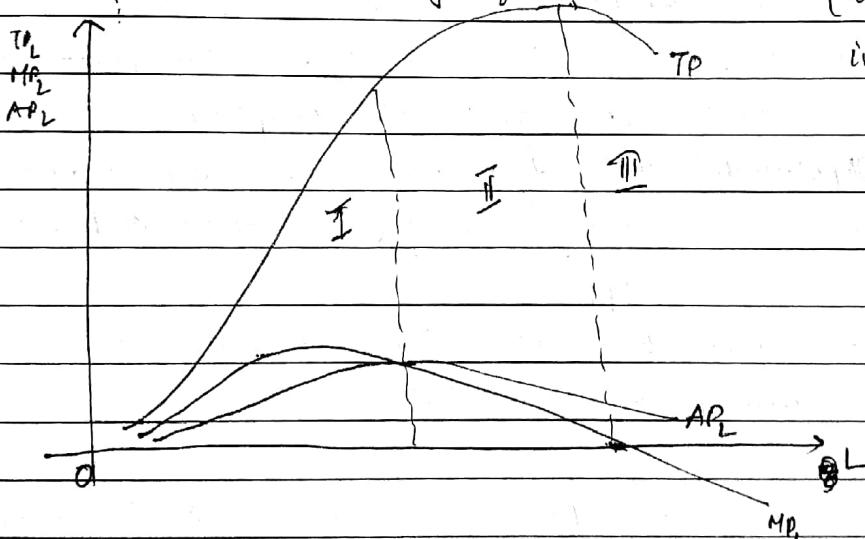
2.

3.

4.

3 stages of production

(considering one variable input is variable)



Variable input may be diff from labour. eg-fertilisers in case of agriculture

I: TP, MP is also increasing, MP increases and reaches \max^M in stage I itself.

Total product increasing at an increasing rate.

MP starts decreasing in I itself.

Throughout, AP is increasing

if ends when AP is \max^m or $AP = MP$

II. Starts from $AP_L = MP_L$. Both start decreasing.
 But MP_L decreases more than AP_L
 Ends when $MP_L = 0$.
 Corresp. TP is max^m.

III. MP_L is negative
 TP starts decreasing.

Q Which stage are you producing & why?

III^d stage: On adding labour, total prod. decreases.

I^d stage: TP is not important when you are producing proportionally.
 You cannot produce endlessly if 1 labour is contributing
 more & more.

- You will be concerned about Labour cost (say 500)
- how much ~~or~~ that labour will contribute ($<, >, = 500$)
 ($MP_L = 0$ or decreasing means you are producing paying
 500 but labour gives 300 output)
- Opportunity cost - If I utilize this labour somewhere else
 they may produce 1000. But I am losing
 opportunity.
- In complex product system, not possible to measure each
 & every person's contributⁿ.

* We are concerned about AP_L . As long as AP_L , average cost of
 productⁿ is decreasing. As long as, ~~if~~ $AP_L > 1$, we can add
 more & more labour.

But practically, we don't use graph but comparison with
 previous cases. A stage will come when AP_L decreases with
 1 unit additⁿ of labour. You realize now your AP was max^m
 earlier.

So, when AP_L is max^m, you are producing.

Optimization Techniques : Linear Programming

Objectives

producer - maximise profit, utility maximisation

Sometimes, our objective may not be profit maximisation, expressing in different way - minimise cost.

But, we face many constraints while producing like space, land, capital limitedness (resource) comes into picture.

Although it may be possible to produce more but we're looking for max^m profit under resource constraints.

Constraints - linear

When your market share is low, you're a price taker not a maker.

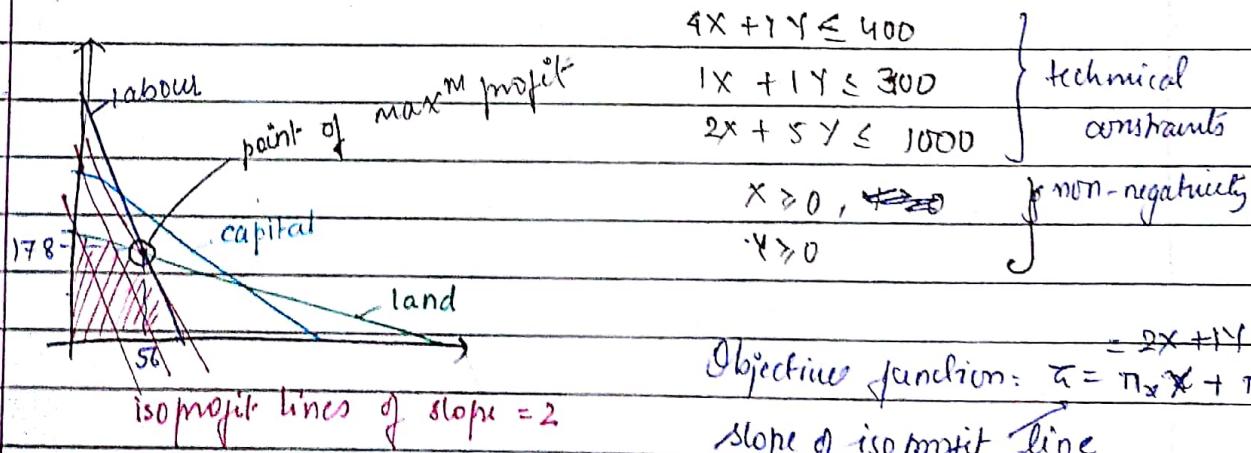
(i) so, you don't have an upper limit and you can produce as much \$ you want for profit maximisat"

(ii) When no upper limit, you minimise cost to increase profit.

When market is competitive, you cannot sell unlimited no. of products

How is maxm answered.

It tells \$ you can use x labour to produce y products but does not tell how you will implement it.



Dual problem in this case is minimising cost

If primal converted to dual, we've \leq^n in form of x & other in y

Imputed costs - opportunity cost (similar to shadow prices)

I'm utilising my family members as labour and not paying them.	return from the next best alternative you are choosing
--	--

labour here - output 300

somewhere else - output 500

If I am utilising here, I'm sacrificing 500
return from business investment is

" " saving in bank

opportunity cost of



Contd... Production

Labour

Law of diminishing marginal return: When more and more units of a variable input is added to a certain amount of fixed input output initially increases at an increasing rate, then output will increase at a constant rate, then output will increase at a decreasing rate.

It has nothing to do with the graph.
 Last stage (when you add more & more fertiliser to your crop, because of more toxicity), output will decrease

- (i) When you add 20 labour when you required 10, the extra 10 will indulge in non-productive activities like trade unions, gossiping. Hence, output will decrease.

(ii)

LONG RUN:

nothing is fixed except technology
 capital, labour

Real life → In irrigation - HYV, Irrigation, (machine + animal) labour, machines
 [many factors]

Say, we increase all the inputs by 100%. Output will increase.
 The amount of increase will depend on the position we are at

Cobb-Douglas

$$Q = AK^\alpha L^\beta$$

in most of the cases,

$\alpha + \beta = 1$ has been found

Why this form?

Suppose I increase input by k times, then Q increases k times

$$kQ = A(kK)^\alpha (kL)^\beta$$

$$RQ = k^{\alpha+\beta} AK^\alpha L^\beta$$

y

$\alpha + \beta = 1$, then $RQ = k$ \Rightarrow output will increase by same proportion as input.

output
increasing

law of constant returns to scale.

10 - 20 - 30 -

in all
cases

$\alpha + \beta > 1$, $RQ > k$ law of increasing returns to scale

10 - 20 - 50 - 100 - 200

$\alpha + \beta < 1$, $RQ < k$ law of decreasing returns to scale

↑ laws of returns to scale

machine	1	42	54
labour	5	10	20

one labour doing

there is division of labour in this case, hence more specialization
 \Rightarrow more output.

III (i) fisherman : you're increasing your nets & other equipments
output will not necessarily increase due to less no. of fish.

(ii) mining - you were earlier mining in a shallow area. Now,
you are mining in very deep areas, may not get same output.

Q may not be continuous. It can be binary. I want to know,
based on no. of factors, the economic behaviour of a person
the output will be either 0 or 1.

not E entrepreneurs

factors like risk taking, income, etc.

By default, we assume $\alpha + \beta = 1$. constant returns to scale

Properties
(i)

Short run, MP, AP dependent on L only
But here, it depends on both L & K.

$$\frac{MP_K}{\text{wrt } K} = \frac{dQ}{dK} = \alpha A K^{\alpha-1} L^\beta$$

$$= \alpha A K^{\alpha-1} L^{1-\alpha}$$

$$= \alpha A \left(\frac{K}{L}\right)^{\alpha-1} \text{ it depends on both}$$

$$MP_L = \frac{dQ}{dL} = \beta A K^\alpha L^{\beta-1}$$

$$= \beta A K^{1-\beta} L^{\beta-1}$$

$$= \beta A \left(\frac{L}{K}\right)^{\beta-1}$$

(ii) we can use log also to express thus eqⁿ. Because L can be in small numbers but capital is in millions...-

$$\log Q = \log A + \alpha \log K + \beta \log L$$

what are α, β - elasticity.

Elasticity of output wrt capital $e = \frac{dQ}{dK} \cdot \frac{K}{Q}$

$$= \alpha A K^{\alpha-1} L^\beta \cdot \frac{K}{Q}$$

$$= \alpha A K^{\alpha-1} L^\beta$$

$$= \alpha$$

Elasticity of output wrt capital $= \underline{\alpha}$

$$\text{Elasticity of output wrt labour} = \frac{dQ}{dL} \cdot \frac{L}{Q} = \beta A K^\alpha L^{\beta-1} \cdot \frac{L}{Q}$$

$$= \underline{\beta}$$

Linear form: to calculate e , we need to calculate $\frac{dQ}{dK}$ then one more step.

But Cobb Douglas form .

$$Q = A K^{0.8} L^{0.5} \quad (\alpha + \beta > 1)$$

$$Q = A K^{0.2} L^{0.8} L^{\alpha}$$

$$\alpha + \beta + \gamma > 1$$

there can be more inputs

If I increase K by 1%, Q will increase by 0.8%.

We use different forms of f^n to get required form of curves, best fit curves.

Sometimes, we may also be interested to know intensity of adoption. To what extent, how frequently technology is adopted and not just how many are adopting it. Accordingly, we use different models.

level of

iv) Cobb-Douglas f^n is homogeneous and homogeneity is dependent on $\alpha + \beta$. (sum of its exponents)

"Product" depends on certain assumptions:

(i) Technology is constant (short & long run both)

(ii) Input price is not changing.

(iii) SR - labour variable, \leftarrow one input is inelastic in nature \Rightarrow capital

LR -

v) You can use a small quantity of labour & K to produce a small quantity of output.

↓

Cobb f^n is continuous. It is divisible. You can produce small output using small quantity of labour & say, you do not have some raw material. When you bring some amt, you produce some amount.

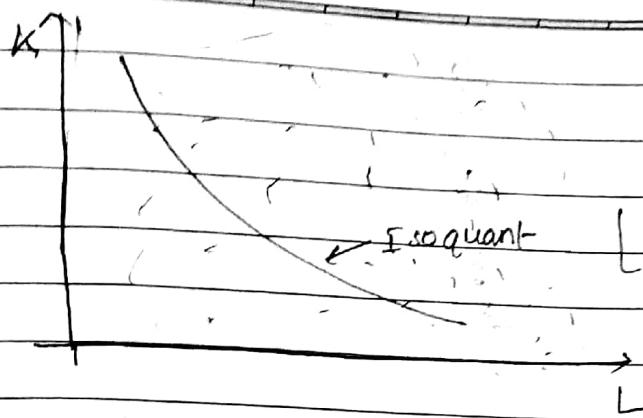
vi) α, β represent distribution share on capital output wrt labour,

more & more fertiliser - lodging

shoot stronger, root unable to support

then toxicity.

Divisibility: on adding 1 labour in thousands, it can be considered small. We do not do it practically but possibly told.

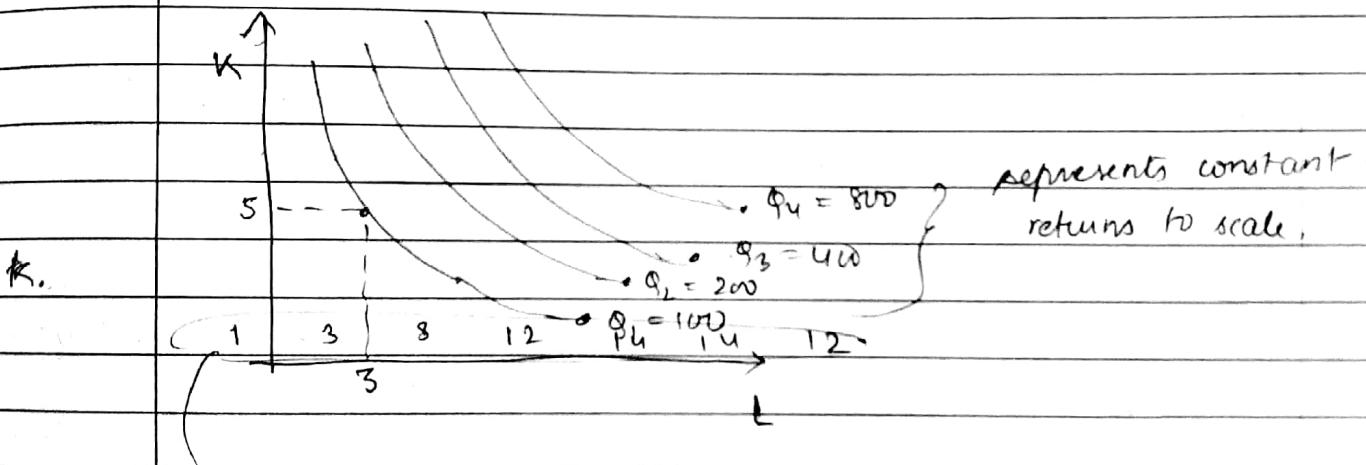


Isoquant [joining those points where output is same]

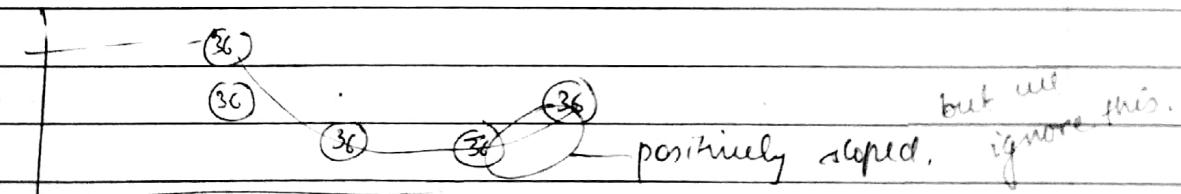
Locus of points that represent diff. combination of (labour & capital) or two inputs where level of output is same.

Properties:

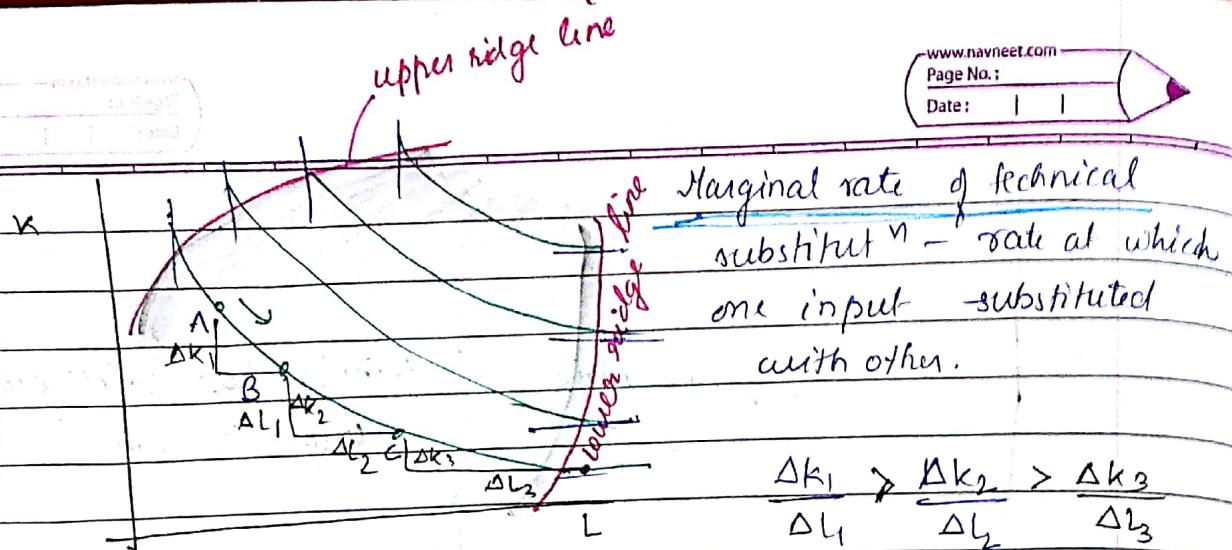
- i) negatively sloped
- ii) convex towards origin
- iii) never intersect
- iv) higher isoquant means higher level of output



keeping K fixed, see the trend of L , follows law of diminishing marginal return.



But if I am a rational producer, my decision should be technically efficient, no under utilising resources. I can produce 36 from less labour also. So, I will not go for more.



Every isoquant has 2 extreme points.

If we join all extreme points, we get 2 curves which separate +vely & -vely sloped curves.

Now, we are silent about ~~no~~ budget, depending on which isoquant we choose. But, here we will obviously use -vely part

Area b/w upper & lower ridge line is called economic region of product. Technical efficiency is more.

Like consumer's eq^m, here we get the best point with minimum input to produce same level of output.

$$L.P.: C = P_L \cdot L + P_K \cdot K$$

If P_L, P_K given, we can find Budget line. Point of tangency of this with isoquant will be best combinatⁿ.

03.04

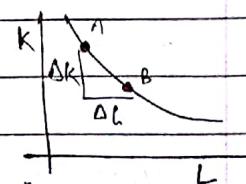
$-\Delta K \cdot MP_K$ is total loss in product^r due to change in labour, capital

To ~~get~~ get same product^r, we must substitute by labo

$$-\Delta K \cdot MP_K = \Delta L \cdot MP_L$$

Marginal rate of technical substitut ⁿ	$= -\frac{\Delta K}{\Delta L} = \frac{MP_L}{MP_K}$
---	--

But there's a limit



We cannot substitute one for other by 100%.
Even if my product " is ~~not~~ labour-intensive

I Cannot replace capital fully by labour because atleast one is needed to start the machine.

Cost

(Do not compare one other but one written with other)

Actual cost : all kinds of cost I am incurring in business.

Opportunity cost - not actually a cost. It is the return from the next best alternative you are present day's sacrificing because of your present expenditure.) alternative of business.

Labour in different works outputs are 500, 300, 200.

ii) Business cost : all kinds of cost I'm incurring in business.

Full cost = business cost + opp. cost + minimal/normal margin
minimal margin - the minimum amount of profit you expect to remain in business.

If your return is less than this, you will no more invest there.

not actually incurred.

iii) Explicit & implicit cost -

~~what~~ similar to opportunity cost

Actually what you I'm owner & manager of same company. If I worked somewhere else, I could produce more.

I need to deduct managerial cost, otherwise I'm overestimating profit.

Imputed / implicit value of family labour.

N) Private and social cost -

whatever I'm actually resing to produce

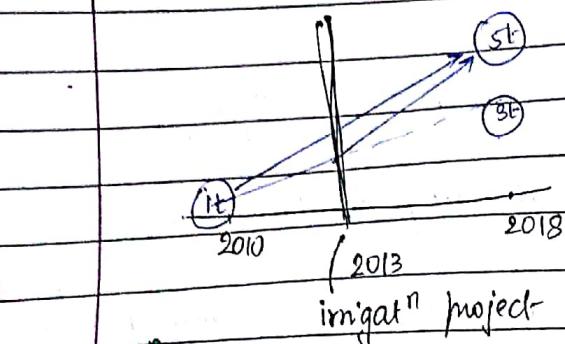
(social cost = private

+ external cost

I'm producing pens dumping waste in a river.

people fall sick. The whole society has to bear that cost.

we cannot tell that it increased purely because of the project.



$$\text{TC} = 100 + 50Q - 20Q^2 + 5Q^3$$

fixed cost TVC

Total cost depends on how much you're producing.

$$\text{TC} = \text{Total fixed cost} + \text{TVC}$$

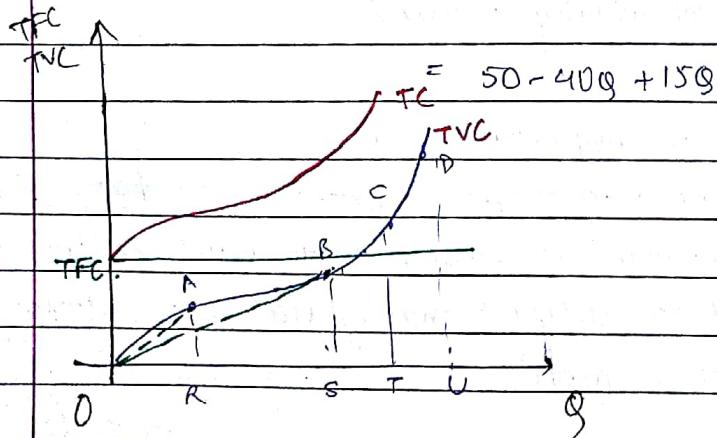
$$\text{Average cost} = \frac{\text{TC}}{Q} = \frac{100}{Q} + 50 - 20Q + 5Q^2$$

$\overbrace{\text{AVC}} = \frac{\text{TVC}}{Q}$

$$\text{AFC} = \frac{\text{TFC}}{Q}$$

$$\text{Marginal cost} = \frac{d\text{TC}}{dQ}$$

additional cost due to
unit addition of one unit.



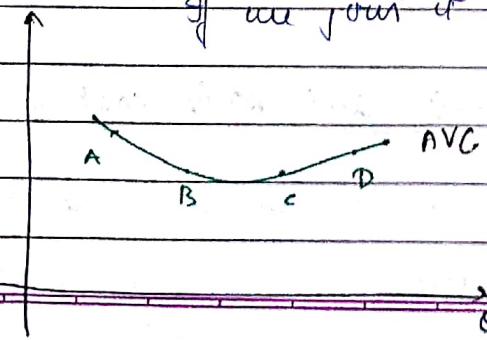
$$\text{At } A, \text{AVC} = OA$$

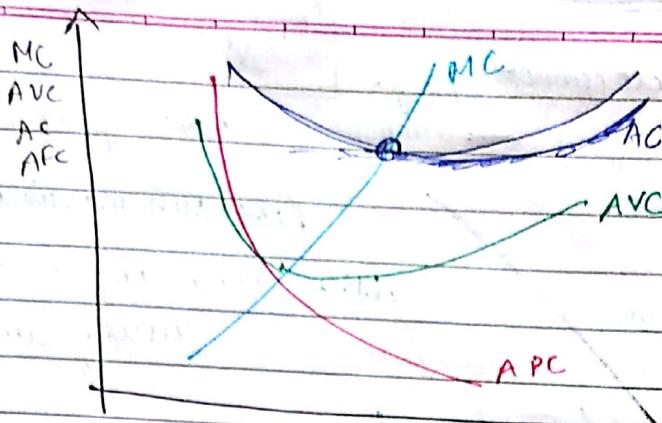
OR

$$\text{AVC}|_B = OB \text{ (less than } OS \text{ at } A)$$

at c it again increases

If we join it





Suppose, eqⁿ not given: ⑧

- ① Suppose I want to see relatⁿ b/w MC & AC, so I convert TC into AC. $[TC = AC \cdot Q]$

$$MC = \frac{d(TC)}{dQ}$$

$$= \frac{d(AC \cdot Q)}{dQ} = AC + Q \cdot \frac{dAC}{dQ} = MC$$

$$\Rightarrow \frac{dAC}{dQ} = \frac{1}{Q} [MC - AC]$$

∴ There are possibilities:

i) $MC < AC$, RHS \rightarrow ve

\therefore Slope of AC curve is -ve.

ii) $MC = AC$, slope = 0.

iii) $MC > AC$, slope > 0

TC
Q

MC curve touches AC curve at its minimum ~~for~~ value.

done sun

You can make him work somewhere else.

You have many production cycles. After one, you retrospect what was your performance. ^{next cycle} You can remove 1 of 5 labours Avg production increases (denom^r decreases) - efficiency but avg. cost of prod^m decreases.

CP. 6

S.P. 5

(-1)

FC + VC

3+3

↓

permanent labour,
machines,
land.

average fixed cost

www.navneet.com

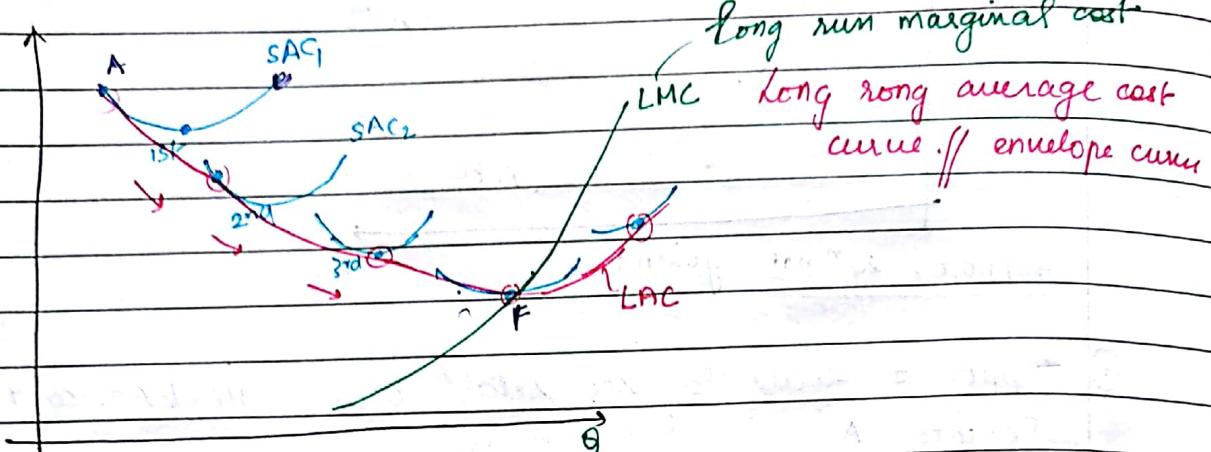
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with

At market price, you cannot play.

When market is highly competitive, elasticity increases.



After 1st cycle - I'm inexperienced, I do not know optimum labour, etc.

I have bought machine but it is not fully utilised.

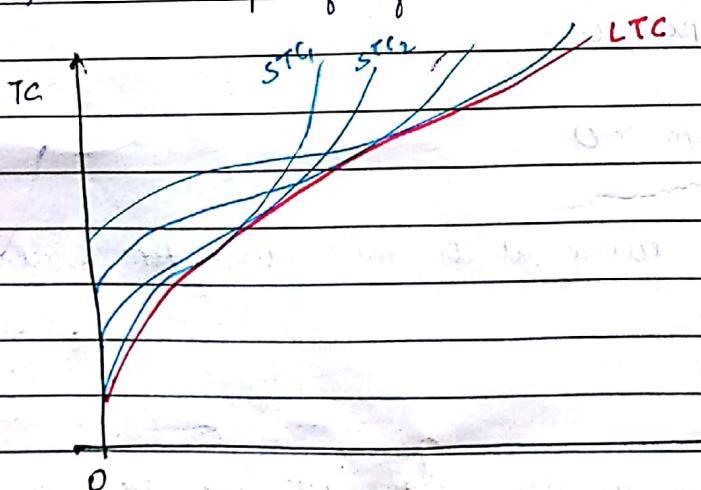
Lot of space in land. Transport cost unnecessarily high.

You reach A

2nd cycle - you're a bit experienced, bring in efficiency.

Joining points where you are producing in every cycle.

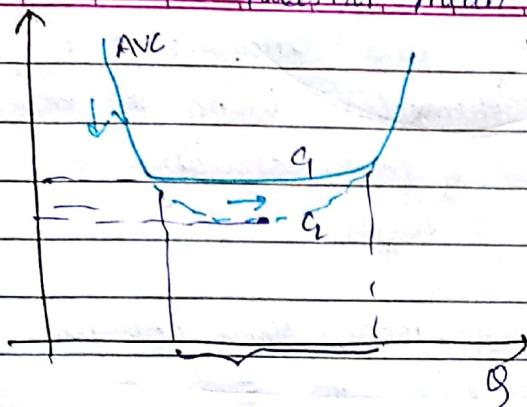
- Long run ~~average~~ total cost will start from '0' because there is no concept of fixed cost.



You can never reach F. You cannot say, I'm 100% efficiency because there will always be alternate ways to increase " ". Someone can be near, someone far from F.

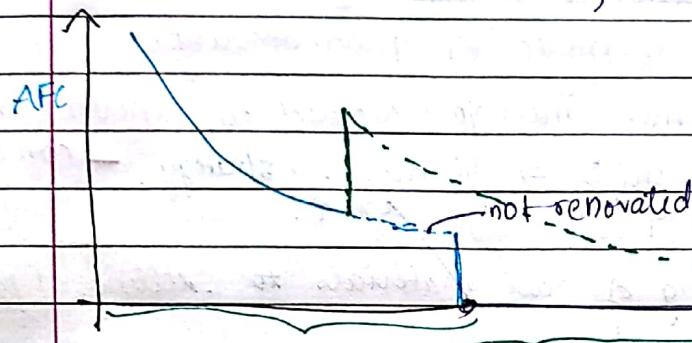
Managerial cost economics

seasonal demand in product demand, you can quickly expand your output
doesn't mean dumping in godown.



They are:

Instead of reducing ~~AFC~~, they focus on Reserved capacity - so that depending on you want to maintain sustainable output to gain trust.



Machine gets worn ~~worn~~ out.

If we renovate, the machine's life increases and it can produce more output - or run for more years to increase output.

ECONOMIES OF SCALE (scale of product)

In long run, ATC decreases because of better efficiency.
↳ because of huge production.

① Economies in product - because of large Q , Average cost is ↓ because fixed cost not ↑ in that proportion.

(+ve sloped initially)

② Diseconomies in product - you can produce 1 million in this room.

But you want to produce 1.5 " or 5 million, then if to do this, you'll have to do it in some other place, buy ~~fixed~~ capital. Your TC ↑. (+ve sloped)
then it can be -ve sloped because of large production, stable prod for 10-15 yrs. That set up

③ Dis

Economies in buying & selling - I produce a self pen. Using its mill, I buy raw materials. With that I buy sell produce & sell. Someday, " " not available → price ↑. So, I cannot produce, couldn't supply to retailers. Demand for my ~~go~~ commodity ↓ because I'm not supplying regularly.

Economics in buying

But if I arranged some money and thought to buy raw materials in bulk, suppliers will themselves bring the materials in 10% discount. Also my cost of prod. decreases. Even, because of this, other producers will suffer.

(i) sometimes, your prod. is fixed = 1000, your COP was 5; MP = b then you decrease to decrease it to 5.

(ii) You have possibility of increasing prod. amount.

You're producing for 8 hrs. Then you decided to increase hrs by making shift. 2 shifts \Rightarrow 16 hrs. — strategy. — can cause diseconomies depending on proportionality of cost. T.

* Product includes gathering of raw materials to selling of product main heading

Economics

Diseconomies of buying: You were normally producing. Then because of some reasons, you could buy only on weekly basis because of buying shortage of money.

Diseconomies of selling: You were selling to wholesaler. Then you thought to supply on own, you have to buy things for transportation, labour. Because of mismanagement, your products demand & instead of profit, you have loss.

Economies in transportation: A. cost goes down.

Dis

Economics in storage:

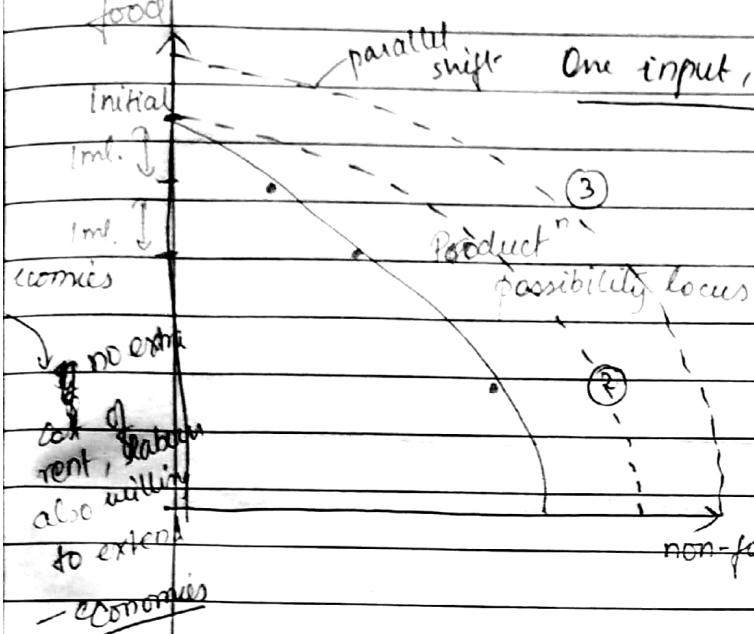
Economics

in Managerial: you're looking after 1 factory for 4 hrs. Another factory — your managerial

Diseconomies in man. — you ask him to manage 3rd unit of factory also. So, he can't do that. His skill set not used properly. Machine breakdown can last to be unattended for 3 days. Because only one manager.

Assumption: no immigration, same technology.

Hence, All labour utilised for productⁿ of foodgrain. If realisa non-food items is t. I diverted some to non-food grain. So, prod. of food & items will ↓ by 1 million tonnes. because labour is fixed.



One input, two output

- ~~Convex~~ Concave towards origin
- Opport cost of producing non food item will go up. because more labour will gradually & cause decrease in prod. of non-food items.

- Reductⁿ in prod of food grain will increase, MP_f decreases.

(2) If immigration occurs/technological change in non-food you can produce more & more without diverting labour. Prod. of non-food item decrease ↑.

lighting
cost
new labour
will have
to pay

(3) Technological adv. in both food & non-food.

Practical situatⁿ can be complex due to two input, two output

PF, extra labour → no method can be good/bad unless cost ↑, may not work efficiently interpreted & executed.

overhead prod.
Diseconomies