

Consumer behaviour :

In consumer behaviour we are a very ^{principle} assumption which is the ~~same~~ say x and y taken for study are goods. $\rightarrow$ those commodities where more is preferred to less.

As demand is desire backed by ability, consumer behaviour analysis is understood with 2 things i.e. consumer preferences and consumer budget line (set).

Consumer preference

It studies how does consumer rank diff bundles of commodities (x, y) .

Note: It has nothing to do with what the consumer can do.

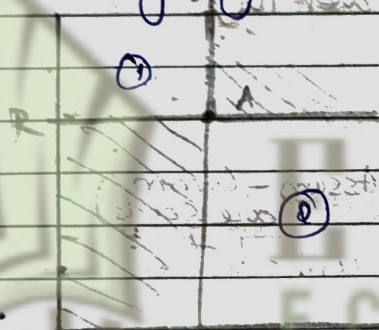
Indifference Curve.

It is the locus of all bundles which gives the consumer the same level of ~~of~~ welfare / the consumer is indifferent b/w those bundles.

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Now we need to know how the IC will be, through which area it will pass and in what manner.

Consider a point A (say). Let us understand, what area it be the way in which IC passing through A will pass and which area it not be by the defn of IC.



Any bundle in LAM will be no less of both good and more of atleast one good.

Defn of IC
more welfare than A.

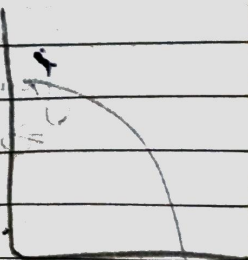
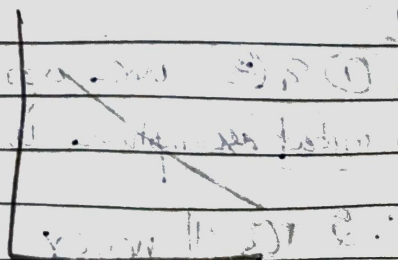
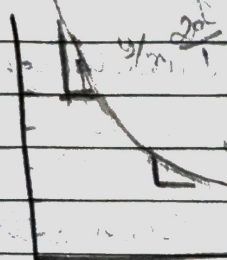
Any bundle in RAS will be no more of both good and less of atleast one good.

Thus IC through A must pass (1) & (2).



But the curve shouldn't contain humps because in such a case (as shown in fig) as we move from bundle Q to bundle P, Bundle P gives more welfare than Q because it has more of both goods.

So it'll be either of these cases.



x_1, y_1

x_1, y_1

x_1, y_1

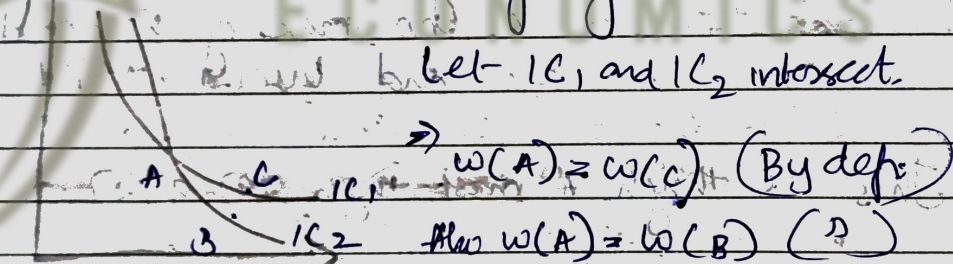
(i) ICs are downward sloping G02 - 10 - 14

By the very defn of ICs and the assumption that the commodities are goods, it is understood that the curve must be $\downarrow$.

For an additional unit of x , the consumer must forgo unit of y . Cost of x can't be increased in any other manner as it'll contradict the defn of ICs and the assumption.

(ii) No two ICs intersect (Assum - Commo are goods)

Proof by contradiction



$$\Rightarrow W(C) > W(B) \quad \text{[Transitive prop.]}$$

— (1)

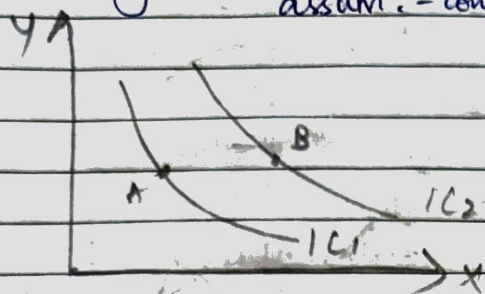
Now considering bundle B and C, bundle C has more of both goods x and y .

$$\therefore W(C) > W(B) \text{ by defn. — (3)}$$

from (1) & (2) we arrive in contradiction
 $\Rightarrow$ initial assumption is wrong

$\therefore$ 2 ICs'll never intersect each other

(ii) Higher IC corresponds higher welfare
 assum: - cons free goods.



Welfare associated with
 all bundle on $IC_2 >$ welfare
 associated with all bundle on IC_1

$$w(IC_2) > w(IC_1)$$

$\forall$ bundle on IC_1 & IC_2

Proof by deduction:

Consider bundles A and B.
 clearly bundle B contains more of both goods
 compared to A.

$$\Rightarrow w(B) > w(A) \quad \text{--- (1)}$$

consider any bundle R on IC_2 .

$$w(R) \geq w(B) \quad \text{--- (2) By defn}$$

$$\text{from (1) and (2)} \quad w(R) > w(A) \quad \text{--- (3)}$$

Consider any bundle S on IC_1 .

$$w(A) \geq w(S) \quad \text{--- (4) By defn}$$

$$\text{from (1) and (4)} \quad w(B) > w(S) \quad \text{--- (5)}$$

thus from (1) - (5), it can be said that (1)
 will be true $\forall (x, y)$ in IC_1 and IC_2 .

Note:- (i) (ii) and (iii) are based on the assumption
 that comm are goods.

(iv) ICs are convex to origin

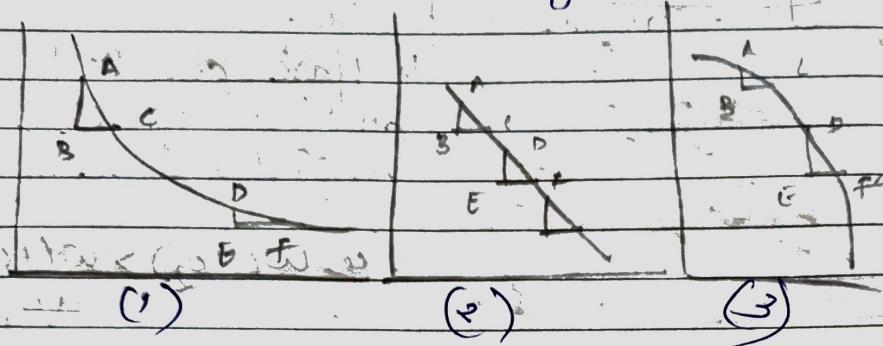


Fig (1) as $x \uparrow$ $|S|$ on IC $\downarrow$

Fig (2) as $x \uparrow$ $|S|$ remains constant

Fig (3) as $x \uparrow$ $|S|$ on IC $\uparrow$

In all ~~para~~ fig.

BC , (EF) represent unit change in x and AB represents the amt of money consumer is willing to give up for BC change (unit) of x , while keeping the welfare 'same'. DE also represents the same thing for 1 unit change in x .

Thus as we move along the right of IC,

In fig (1) $DE < AB \Rightarrow |S| \downarrow$

In fig (2) $DE = AB \Rightarrow |S|$

In fig (3) $DE > AB \Rightarrow |S| \uparrow$

When more and more add'l unit of x is consumed, consumer's will be less willing to give up lesser and lesser amt of y . Thus ICs are convex to origin.

when we talk about slope it is $|S| = \Delta y$ because slope as it is $\frac{dy}{dx}$ where the change in x is infinitely small.

In addition to the first assumptions that commodities are goods, in order to get the convex to origin shape we need another assumption for which MRS must be defined.

MRS_{xy} at a point on the IC is the amount of commodity y the consumer's willing to give up for an add. unit of x , while keeping welfare same.

MRS_{xy} at a pt on IC $> |S|$ of the IC at that pt
 $\therefore$ 2 assumptions

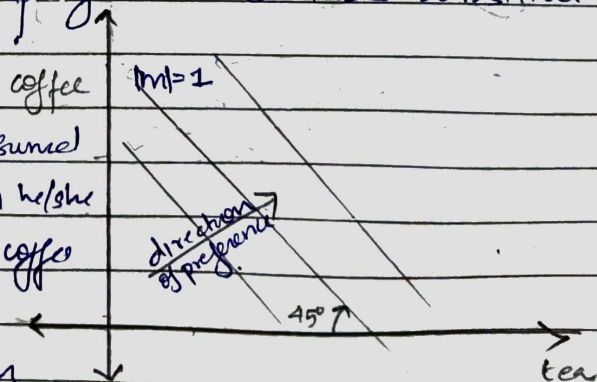
- ① Commodities are goods ($\Rightarrow$ Curve is $\downarrow$)
- ② MRS_{xy} $\downarrow$ along IC as $x \uparrow$ ($\Rightarrow$ Curve is $\searrow$).

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① A consumer: 1 cup of tea can be substituted by 1 cup of coffee.

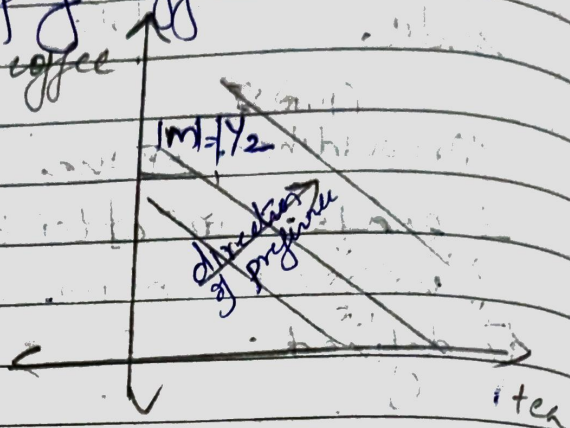
Here, each add. unit of cup's consumed by the consumer only, after he/she is willing to give 1 cup of coffee.

MRS_{te} = $|S|$ at any pt on the IC
 $= +1$



(II) A consumer: 2 cups of tea can be substituted for 1 cup of coffee.

$$MRS_{tc} = |S| = \frac{1}{2}$$

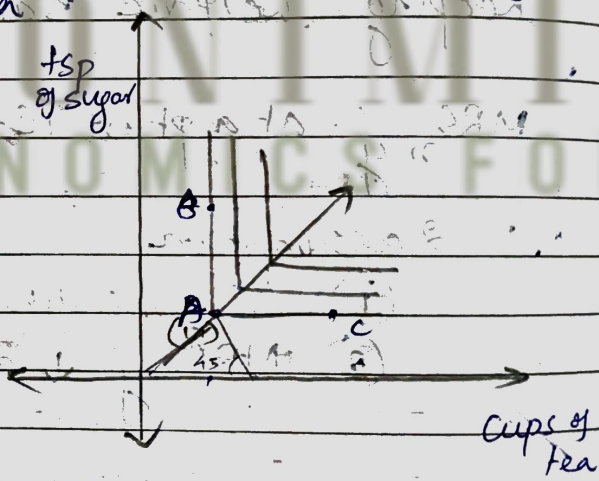


(III) Consumer: likes to consume 1 tsp of sugar for every cup of tea.

$$MRS_{tc} = 0$$

$$MRS_{tc} = \infty$$

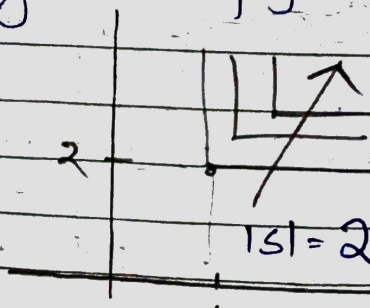
$$MRS_{tc} = (0, \infty)$$



(2, 0) (3, 1)

(1, 2) (1, 3)

(IV) Consumer: 2 tsp of sugar & cup of tea

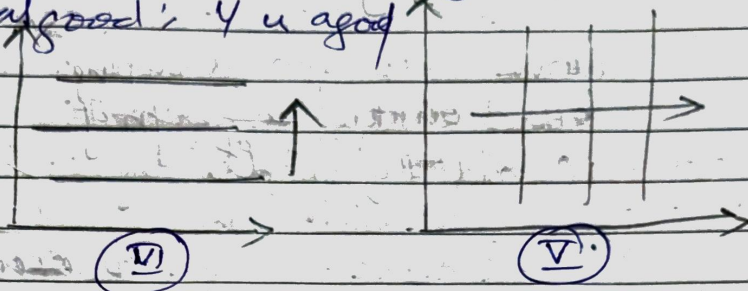


(V) x is a good ; y is a neutral good .

(VI) x is a neutral good ; y is a good

(VII) $MRS = \infty$

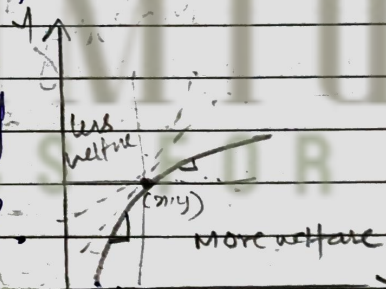
(VIII) $MRS = 0$



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(VII) Commodity x is good and Commodity y is bad (less is pref to more) .

By the defn of IC and the commodities it is clear that it'd be an upward sloping IC. But is it concave to origin / convex or straight line?



$MRS \downarrow$ as $x \uparrow$. Because the consumer is willing to give up lesser and lesser amt of y for each addl unit of x as y is always preferred .

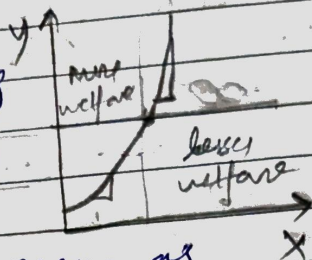
Thus IC will be convex to origin

Direction of Preference

(VIII) Commodity

✓ III Commodity X is bad and Y is good.

Curve II be upward sloping based on the ~~ass~~ defn of IC and the ^{name of} goods.



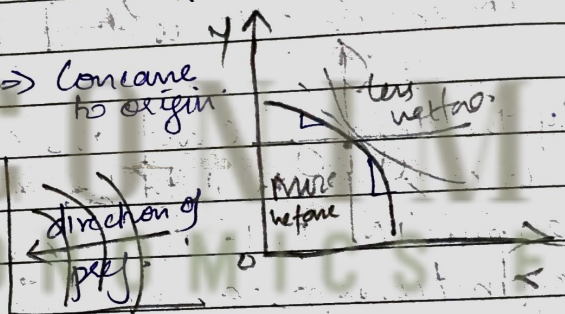
It is ~~convex~~ concave to origin as

$MRS_{xy} \uparrow$ as $x \uparrow$.

direction of pref.

✓ IV Both commodities are bad.

$MRS_{xy} \uparrow$ as $x \downarrow \Rightarrow$ Concave to origin



Note:- When it is about consumer's preferences, nowhere we talk about the price of commodities / income of the consumer or what the consumer can buy.

Consumer's ability

Here we learn about what the consumers 'can' buy. It is independent of what they ~~can~~ want to buy or what they're willing to buy.

Let 'M' be the income of a consumer with P_x and P_y being the price ^{per unit} of good X and good Y.

All possible bundles of goods that the consumer can buy using the entire income will be all those bundles that satisfy the equation.

$$P_x \cdot x + P_y \cdot y = M \quad \text{--- (1)}$$

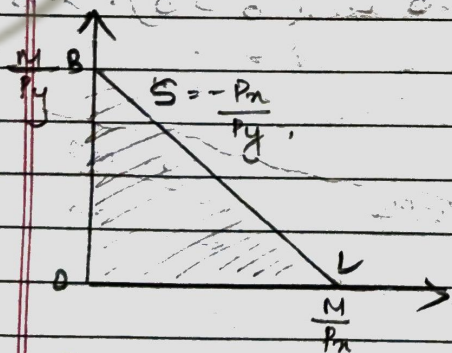
All possible bundles of goods that consumer can buy when full income isn't spent will be those bundles that satisfy the eqn.

$$P_x \cdot x + P_y \cdot y \leq M \quad \text{--- (2)}$$

All the possible bundles a consumer can buy in this case would satisfy the eqn

$$P_x \cdot x + P_y \cdot y \leq M \quad \text{--- (3)}$$

Graphically (1) is line BL, called as budget-line and (3) is as (OBL), called as budget-set.



For an eqn $P_x \cdot x + P_y \cdot y = M$, graph can be drawn if -

(a) 2 pts are known

(i) if slope $(-P_x/P_y)$ and any 1 pt on line is known.

Slope of the budget line

tells us how much of one good the consumer has to give up for each addl unit of another good when the consumer is spending all the income.

$$P_x \cdot x + P_y \cdot y = M$$

$$P_y \cdot y = M - P_x \cdot x$$

$$y = \left(\frac{-P_x}{P_y} \right) x + \frac{M}{P_y}$$

$$y = m \cdot x + c$$

Slope can be better understood with an example.

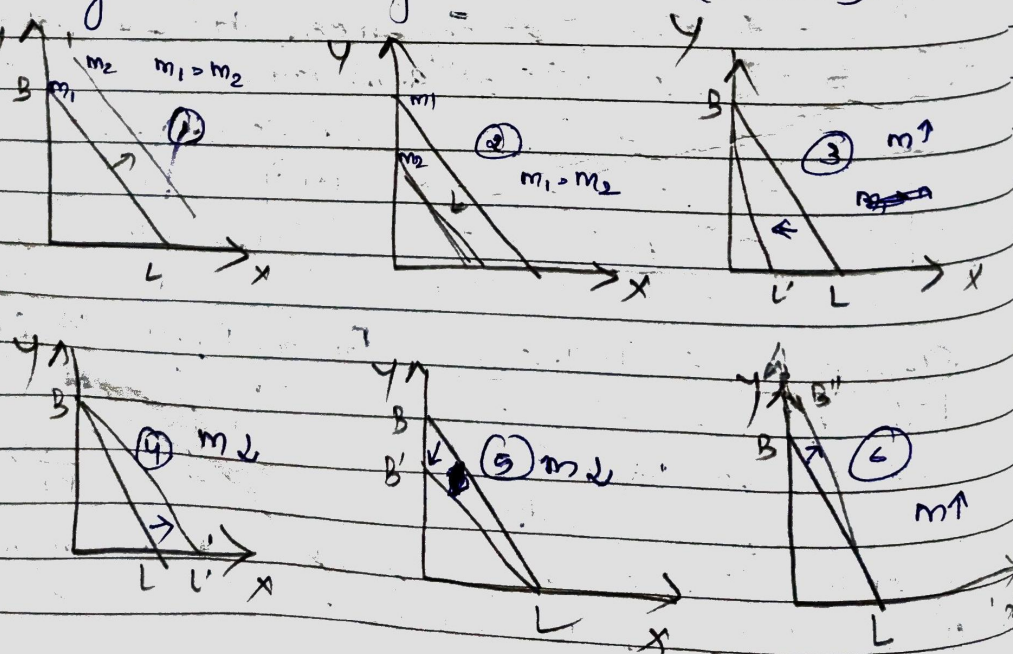
$M = 100$ $P_x = 5$ $P_y = 10$

Then $(0, 10)$ id be the bundle where the C_s spend entire 'M' on good 'y'.

In order to shift to $(1, 4)$ the C_s need $\$25$. Since we're on BL, entire income is used. Thus $\$25$ can only be procured if the C_s give up $\$5$ worth of good 'y' (here is $\frac{1}{2}$ a unit of 'y').

Change in budget line

- (1) If $M \uparrow$ then BL shift $\parallel$ to the right, ceteris paribus.
- (2) If $M \downarrow$ BL shift $\parallel$ to the left, c.b.
- (3) If $P_x \uparrow$, BL shifts to $B'L'$ ($L' < L$), c.b.
- (4) If $P_x \downarrow$, BL shifts to $B'L''$ ($L'' > L$), c.b.
- (5) If $P_y \uparrow$, BL shifts to $B'L$ ($B' < B$), c.b.
- (6) If $P_y \downarrow$, BL shifts to $B''L$ ($B'' > B$), c.b.



What makes Budget line downward sloping?

The nature of prices of comm/income determines slope. As long as $P_x > 0$, $P_y > 0$, $M > 0$, slope'll be negative and hence the curve'll be downward sloping.

The case of $P_x < 0$, $P_y < 0$, $M \leq 0$ is trivial in real life situations.

The case of $P_x = 0$ and $P_y > 0$ might exist if when y/n is sold free.

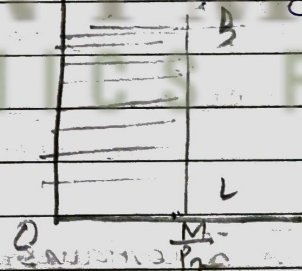
When x is free, $P_x = 0$.

The eqn of budget line becomes.

$$P_y \cdot y = M.$$

The curve'll be a vertical line where $y \in \mathbb{R}$, and x is at $\frac{M}{P_x}$.

The shaded region is budget set.



Consumer Theory

Preferences

Ability

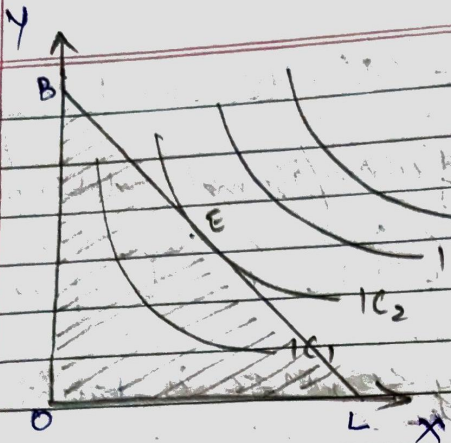
'want' (IC)

'can' (BL)

pref rank

P_x, P_y, m

what C will actually buy.



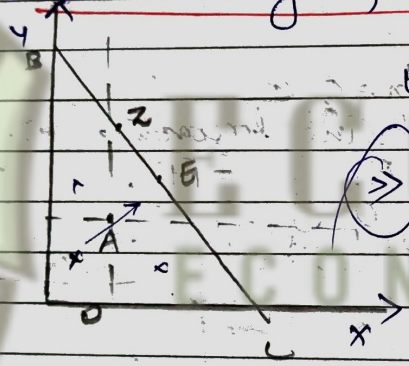
Bundle which maximizes consumer welfare = E

S at E of BL = $-P_x/P_y$

S at E of IC = $-MRS_{xy}$

$\therefore$ at E $MRS_{xy} = \frac{P_x}{P_y}$

E is the only equilibrium pt.



Why 'A' is not an equilibrium?

$\Rightarrow$ Points below budget line

Assume A is equilibrium

$\Rightarrow$ Welfare is max at A, while remaining in budget set. — (i)

Consider a point Z.

Z contains more of both commodities by ass. 1, consumer will prefer Z over A.

$\Rightarrow$ Z has more welfare than A.

we arrive in contradiction with (i)

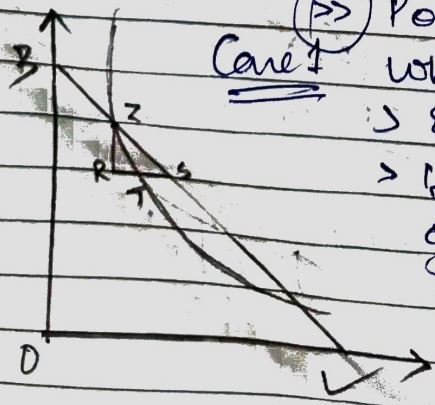
$\therefore$ A is not equilibrium

$\Rightarrow$ Points on the budget line

Case 1 Why Z not an equilibrium?

$\Rightarrow$ Suppose Z gives maximum welfare

$\Rightarrow$ If the consumer gives up ZR amt of comm y, then RS amt of comm x will be received in exchange.



M 11 11

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> when consumer gives up $2R$ amt of comm x , it requires add unit of RT amt of comm x to be provided to keep the welfare constant/same.

Considering Bundles T and S , S is preferred over T - (1)

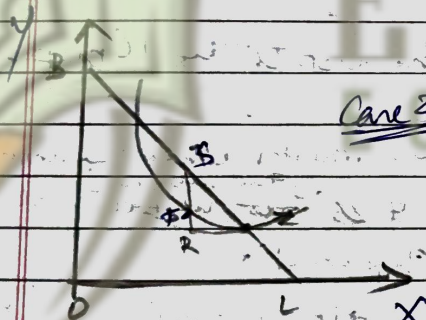
Considering Bundles T and Z , cons is indiff. b/w T and Z - (2)

from (1) & (2), by transitivity

S is preferred over Z also $S \in OBL$

This we arrive in contradiction but

$\therefore Z$ is not the equilibrium bundle



Case 2 why Z is not the equilibrium bundle?

> let Z be the equilibrium bundle that gives maximum welfare

> if the consumer gives up $2R$ amt of comm x , then RT amt of commodity y would be provided using all income.

> But giving up $2R$ amt of x would mean an addl procurement of RT units of commodity y (RT is the unit to keep the welfare level same)

Take bundles T and S , S is preferred over T - (1)

Take bundle S and Z , cons is indifferent b/w them - (2)

(1) & (2), by transitivity

S is preferred over Z

this we arrive in contradiction that Z give max welfare.
 $\therefore Z$ is not equilibrium.

In case 1 $MRS_{xy} > \frac{P_x}{P_y}$

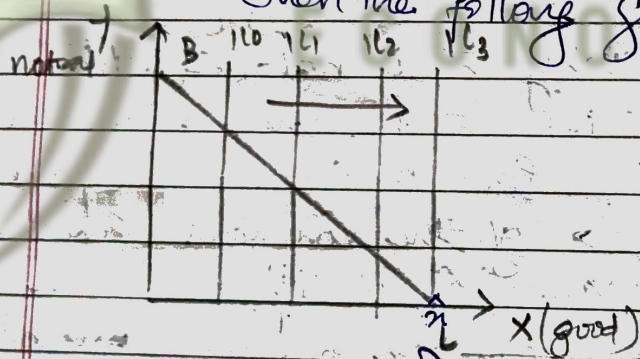
In case 2 $MRS_{xy} < \frac{P_x}{P_y}$

Now is $MRS_{xy} = \frac{P_x}{P_y}$ a necessary condition for equilibrium.

Does Equilibrium at $p_1 \Rightarrow MRS_{xy} = \frac{P_x}{P_y}$ holds true always?

(i) Take the case of x being a good and y being a neutral good.

Then the following graph illustrates the IC map.



No matter what the amt of y is ^{the consumer's} ~~his~~ welfare isn't affected.

Hence equilibrium will be

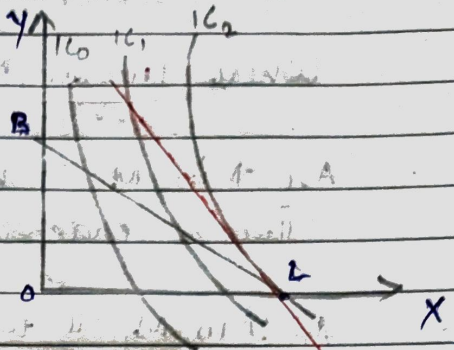
at 'L' $(\hat{x}, 0)$ but slope of $IC_3 \neq$ slope of BL at L i.e. $MRS_{xy} \neq \frac{P_x}{P_y}$ at eq point L.

$\therefore MRS_{xy} = \frac{P_x}{P_y}$ is not a necessary condition for equilibrium.

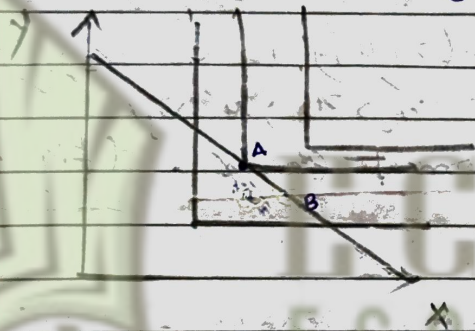
- Even when ICs are downward sloping.

(1) When ~~both goods are~~ these can be cases where $MRS_{xy} \neq \frac{P_x}{P_y}$ in equilibrium.

$$MRS_{xy} > \frac{P_x}{P_y}$$



(2) When x and y are complementary goods.



At point A:
Slope of IC = ∞

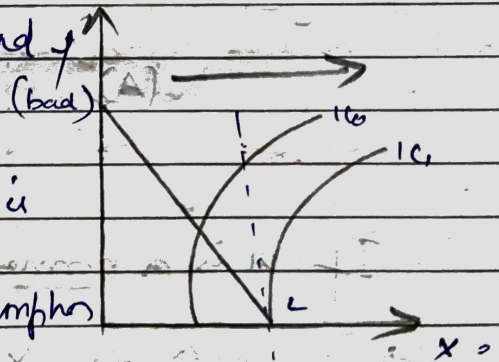
$$MRS_{xy} \neq \frac{P_x}{P_y}$$

No substitutability is available
and the only possible point of tangency
is A.

(3) In case of substitutes - refer - PMG lectures.

(4) When x is good and y is bad.

Welfare is maximized at L
where 0 units of bad good is
consumed and the entire
income is spent on consumption
of good x .



But here clearly $\frac{P_x}{P_y} \neq MRS_{xy}$.

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Effect on equilibrium due to change in income

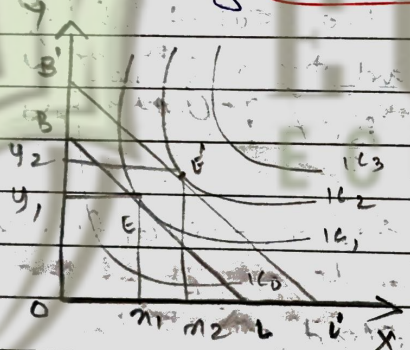
When income (M) increases, *ceteris paribus*.

An $\uparrow$ in M will not affect the indifference curves as they are independent of income.

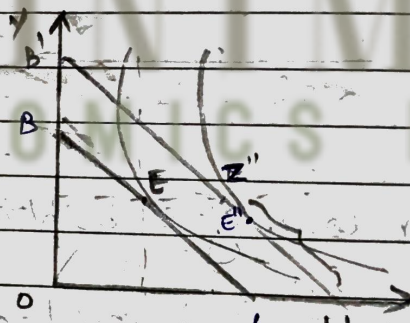
An $\uparrow$ in M will lead to a rightward parallel shift of the budget line BL to BL' .

Equilibrium changes from $E(x_1, y_1)$ to $E'(x_2, y_2)$
 $x_2 > x_1$; $y_2 > y_1$

Here both goods are normal goods. (fig A)



(A)



(B)

If x is a normal good and y is an inferior good,
then $M \uparrow \Rightarrow x \uparrow$ and $M \uparrow \Rightarrow y \downarrow$.

$\Rightarrow$ The new equilibrium will be in such a way that more of x and less of y will be consumed. Somewhere in southeast direction between E and L' . The IC curve here meets at R b/w BL and BL' (fig B)

change is in wt to quantity of B and C goods.

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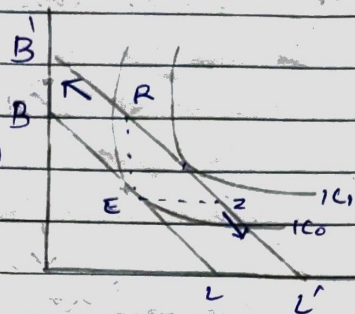
when both goods are inferior.

when this change in IC changes in IC.

Since both are goods (ie more pref over less)

new equilibrium must be on $B'L'$ — (1)

Since Y is inferior, new equlb would a point to the down of Z along $B'L'$ — (2)



Since X is inferior also, new equlb would be a point to the up (left) of R as shown in the fig along the line $B'L'$ — (3)

(1), (2) and (3) is impossible to occur simultaneously.

Two commodities cannot be inferior. Prove

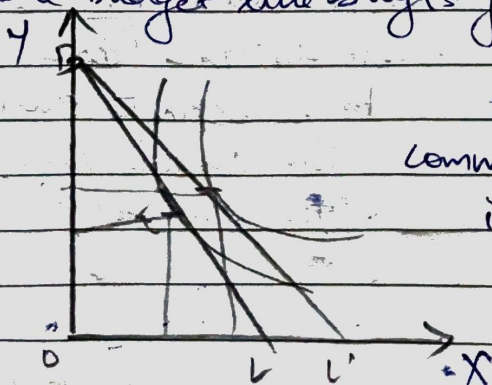
When income decreases, more consumption of both goods is expected, but it is not possible because the budget constraint has shrunk again. Thus, two goods cannot be inferior.

Effect on equilibrium due to change in price.

Suppose price of X becomes cheaper that is

$P_x \downarrow$, ceteris paribus.

The budget line shifts from BL to $B'L'$ as shown.



The consumer buys more of commodity X and less of commodity Y i.e. the consumer substitutes away from the costlier to cheaper good.

when price of x reduced, eventually more of x and y were consumed.

Price effect (E to E')

$\frac{P_x}{P_y}$

x is relatively cheaper compared to good y

= relative change in the price

Real income (command over y of the consumer is changing)

$OB L$ to $OB' L'$

($B' L'$ is now available

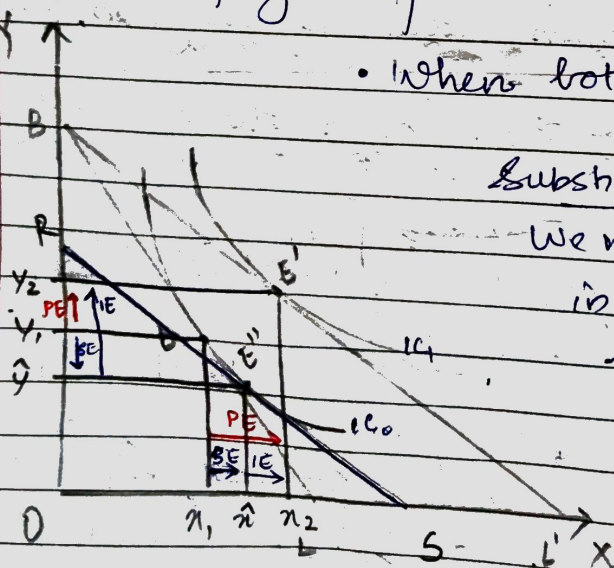
while M - the nominal income is constant

= relative income change

Substitution effect + Income effect

→ To understand subst. effect in the price effect, we need to keep ^{real} income constant (by means of keeping welfare constant) and vice versa.

• When both are normal goods.



Substitution effect

We need to show the change in price ratio $\frac{P_x}{P_y}$ which leads the consumer to substitute away from the costlier good (y) to the cheaper good (x).

That is shown by BI' . However BI' cannot be taken into consideration, because that would mean the income has increased i.e. (income effect not constant).
 $\therefore$ To get the effect of P_x' and to keep the real income constant, P_y we draw a straight line $RS \parallel BI'$, its tangential to IC_0 at a single pt. Since $RS \parallel BI'$, P_x' is reflected and since it touches P_y the curve at IC_0 it implies the welfare is kept constant (there is no change to real income).

The construction of RS essentially means taking away some part of the 'nominal income' of the C.
 i.e. Nominal income reduce $\therefore$ welfare level is at IC_0 .

Thus the consumer substitutes away and reaches a point E'' .

$$E (M, P_x, P_y)$$

$$E' (M', P_x', P_y) \quad P_x' < P_x, M' < M.$$

$\therefore$ From E to E' , the movement has taken place along the ^{same} IC curve IC_0 implies the 'real income' side is constant.

Thus the movement from E to E'' is the substitution effect.

Income effect

Now keeping the price ratio constant (P_x'/P_y) the nominal income is increased, it implies welfare is increased as the Budget-line is shifted to BI' from RS thus, movement takes place from E'' to E' at IC_1 , the higher IC giving higher welfare, the P_x ratio has constant.

• Movement from E' to E'' shows income effect.

• Commodity X

$$\text{Price effect } (X_1 \text{ to } X_2) = \text{Sub effect } (X_1 \text{ to } \hat{X}) + \text{Income effect } (\hat{X} \text{ to } X_2)$$

• Commodity Y

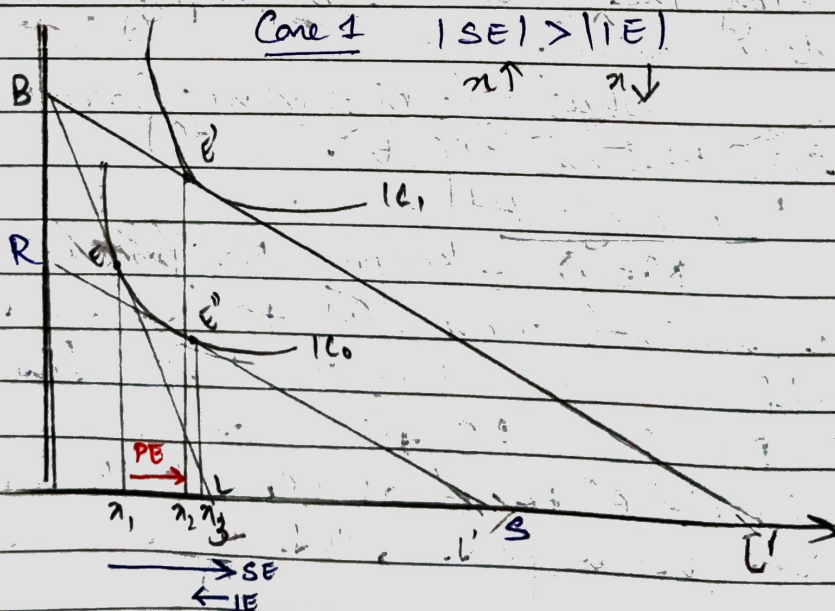
$$\text{Price effect } (Y_1 \text{ to } Y_2) = \text{Sub effect } \left(\begin{matrix} \text{value} \\ \text{negative} \end{matrix} (Y_1 \text{ to } \hat{Y}) \right) + \text{Income effect } (+ve) (\hat{Y} \text{ to } Y_2)$$

as consumption is reduced as it becomes relatively costlier

$\therefore |IE| > |SE|, |PE| > 0$ for commodity Y.

Now as $M \uparrow, x \uparrow$ and $y \uparrow \Rightarrow$ both x and y are 'normal goods'.

When X is inferior and $P_x \downarrow$



Substitution effect.

Welfare is kept constant via the construction of RS subject to conditions:

(a) it is $\parallel$ to BC' ($\frac{P_x'}{P_y}$)

(b) it touches IC_0 (welfare)

It essentially means reduction in nominal income.

Due to substitution effect, the consumer substitutes away from costlier y to cheaper x .

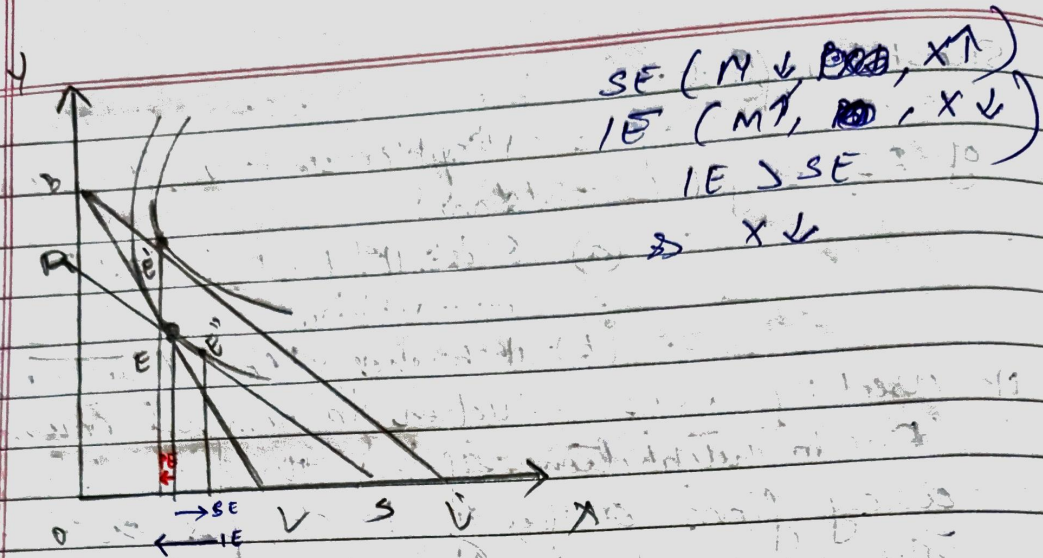
The movement is from E to E'' and the consumption of x increases from x_1 to x_3 .

Income effect

Keeping the price factor constant, the nominal income increases, causing a shift of Budget Line from RS to BC' . But since x is an inferior good, as income increases, consumption reduces, thus $\text{cons of } x \text{ reduce from } x_3 \text{ to } x_2$. Thus equilibrium moves from E'' to E .

Since substitution effect dominates income effect, the consumption of x has also increased.

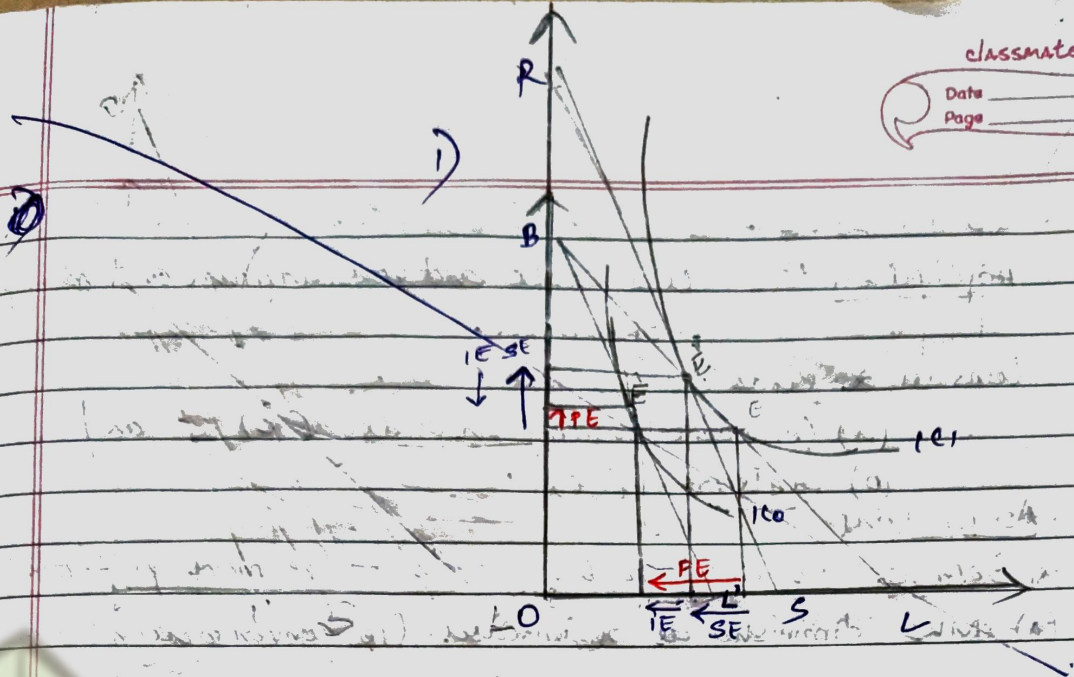
When x is inferior, and $P_x \downarrow$ (Giffen goods)
Case 2 $|SE| < |IE|$



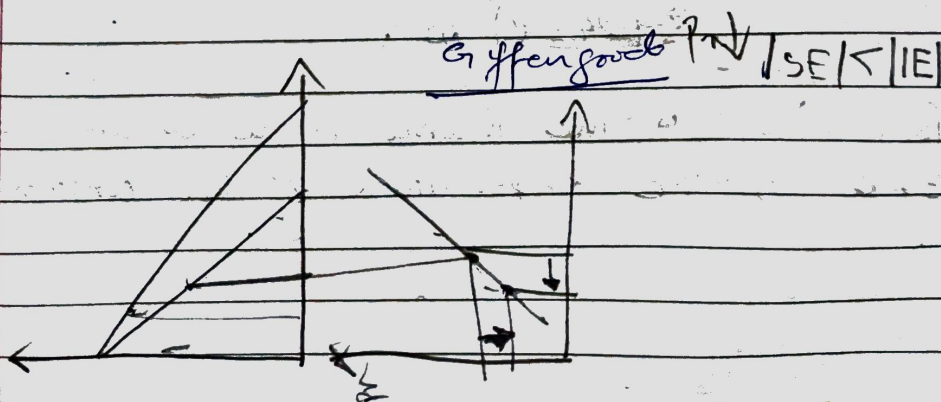
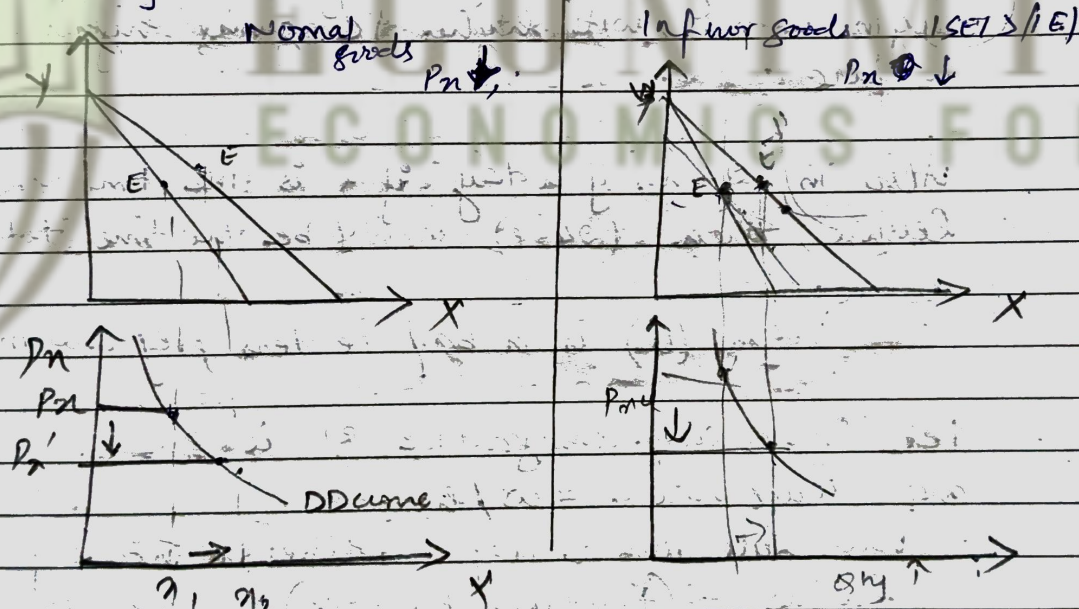
Diagrams for

- 1) When x is inferior, $P_x \uparrow$ & $|SE| > |IE|$
- 2) When x is inferior, $P_x \uparrow$ & $|SE| < |IE|$
- 3) When x is inferior, $P_y \uparrow$ & $|SE| > |IE|$
- 4) When x is inferior, $P_y \uparrow$ & $|SE| < |IE|$
- 5) When x is inferior, $P_y \downarrow$ & $|SE| > |IE|$
- 6) When x is inferior, $P_y \downarrow$ & $|SE| < |IE|$
- 7) - 10) When y is inferior, $P_x \uparrow$, $P_x \downarrow$, $P_y \uparrow$, $P_y \downarrow$
- 11) - 14) When y is inferior, $P_x \uparrow$, $P_x \downarrow$, $P_y \uparrow$, $P_y \downarrow$
- 15) When both are normal, $P_x \downarrow$
- 16) - 17) When both are normal, $P_y \uparrow$, $P_y \downarrow$

Pic will be done backside.



Deriving demand curve



25-01-2022.

Application :- Wage rate and Consumption and supply of labour.

Consider 2 goals:

- (a) Composite Consumption goods (c) and
- (b) leisure (l).

Assumptions

- (*) Both're assumed to be goods - (ie more pref. over less)
- (*) MRS diminishes as x increases (ie convex to origin curve).

The nature of IC map.

The IC map would be a collection of non intersecting, downward sloping convex to the origin curves, with higher IC giving higher welfare.

Also in 24 hrs of a day, if l is the time taken for leisure, then $(24-l)$ would be the time taken for work.

Work (w) is a bad ie less pref over more.

Let Price of comp. cons. good be $\text{₹}1$ ie $P_c = 1$.

and wage rate = $\text{₹}w/\text{hr}$.

$\therefore$ Wage rate when a person takes ' l ' hours of leisure = (time taken for work) $\times$ wage rate
 $= \text{₹} (24-l) w$.

$\text{₹} (24-l) w$ is the income of the consumer and $\text{₹} P_c \cdot c$ is the expenditure of the consumer.

Thus the budget line will be shown as:

$$P_c \cdot c = \overbrace{(24 - l)}^{\text{Exp. Income}} w$$

where, c and l are variables.

P_c and w are parameters

$l \geq 0$ (time can't be -ve)

$l \leq 24$ (max only 24h/day)

The equation of budget line is

$$P_c \cdot c = (24 - l)w$$

For x intercept, put $c = 0$

$$\Rightarrow l = 24$$

For y intercept, put $l = 0$

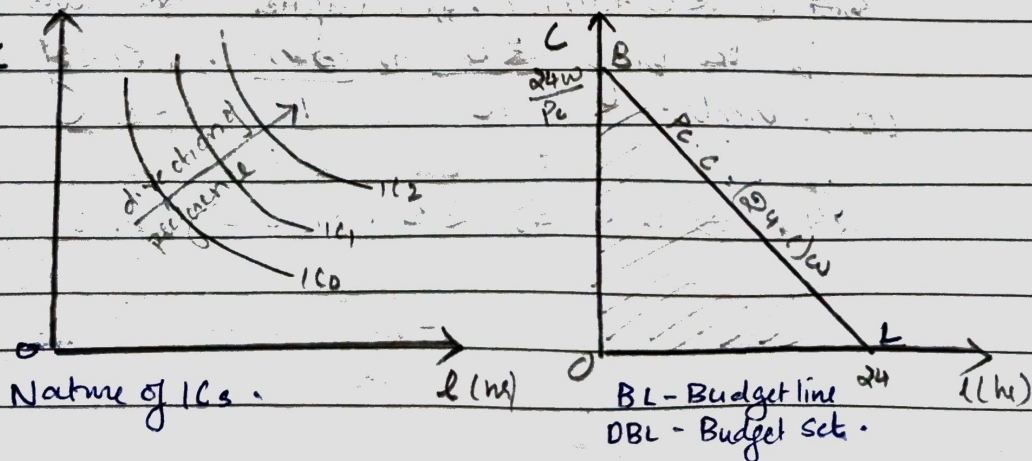
$$\Rightarrow c = \frac{24w}{P_c}$$

$$P_c \cdot c = (24 - l)w$$

$$c = \frac{24w}{P_c} - \frac{w}{P_c} \cdot l$$

$$\Rightarrow \text{slope} = -\frac{w}{P_c} \quad \text{Thus } |S| = \frac{w}{P_c}$$

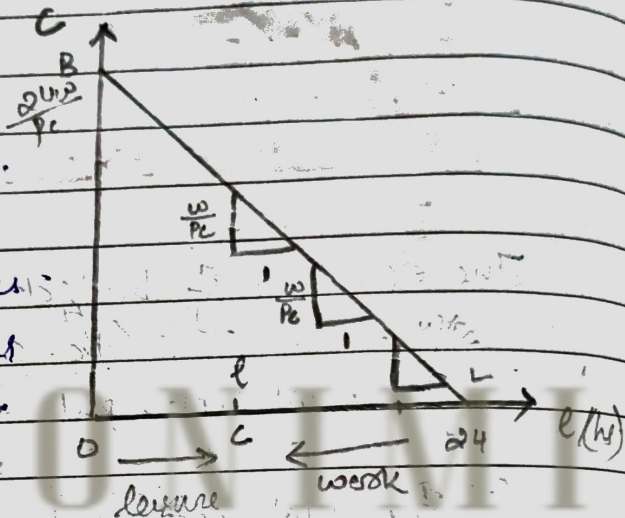
$\therefore$ Budget line is a straight downward sloping line with $|S| = \frac{w}{P_c}$ and abscissa and ordinate being $(24, 0)$ and $(0, \frac{24w}{P_c})$.



Thus BL is the budget line shown by the equation $P_c \cdot c = (24-l)w$.

The budget set OBL is shown by the inequality $P_c \cdot c \leq (24-l)w$.

Interpretation of the slope.



Both work and leisure can be reflected on the X axis as both work and labour are dependent variables.

Leisure is measured from

0 as origin to the right. Work is measured taking (24) as the origin.

Shown by OC

Suppose 'l' is number of hrs taken for leisure, then (24-l) is the time taken for work shown by CL.

Now if the consumer spends entire day without work, then 24 hrs would be leisure, and 0 hrs of work. 0 hrs of work implies $(0 \times w)$ of income and is ≥ 0 income. This implies the consumer is able to buy $\frac{\geq 0}{P_c}$ i.e. $\frac{\geq 0}{1}$ units of composite goods.

$24l \Rightarrow 0w \Rightarrow \geq 0 \text{ income} \Rightarrow 0 \text{ units of good.}$

Now if the consumer gives up 1 hr of leisure, then $l = 23$, $w = 1$.

$$\Rightarrow \text{Income} = \text{wage rate} \times \text{work time} \\ = w \times 1 \\ = \underline{\underline{\text{₹}w}}$$

If the consumer spends the entire income on consumption then $\frac{w}{P_c}$ amt of composite consumption goods can be P_c bought.

$$i.e. \quad l \downarrow \text{ to } 23 \quad l \Rightarrow 1w \Rightarrow \text{₹}w \times \text{income} \Rightarrow \frac{w}{P_c} \cdot P_c$$

$\frac{w}{P_c}$ is $|MRS_{lc}|$. How much of 'c' consumer is willing to give up for an add'l hr of leisure keeping the whole spendy entire income.

Now the budget line is straight line with a constant slope $\frac{w}{P_c}$. It implies for every 1 hr of leisure given up, $\frac{w}{P_c}$ amt of goods can be bought.

Suppose wage rate goes up, what happens to the budget line.

Budget line won't shift $\parallel^{el}$ $\because$ that would mean $l > 24$ which is wrong and also that the new $\parallel^{el}$ line $B'l'$ would have the same slope $\frac{w}{P_c}$ ($\parallel^{el}$ line have same slope). But here slope is $\frac{w'}{P_c}$ and ' w ' has increased to say w' , $w' > w$. Therefore slope has increased.

Thus the budget line swivels up from B i.e. it shifts from BL to $B'l'$. B' is $\left(\frac{24w'}{P_c} \right)$ and $|S| = \frac{w'}{P_c}$

as shown in the fig. (PTO)

The new budget line is shown by $B'L$.

For $B'L$

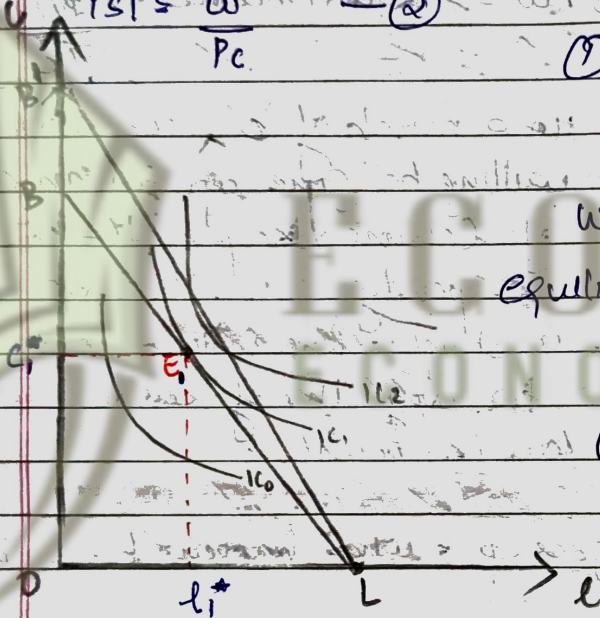
$$|S| = \frac{w'}{P_c} \quad \text{--- (1)}$$

For BL

$$|S| = \frac{w}{P_c} \quad \text{--- (2)}$$

$$(1) > (2)$$

When wage rate is w , equilibrium is at pt E_1 , where
 Labour = l^* hr
 work = $(24 - l^*)$ hr
 Comp. lous. good = C^*



Note :- The price of leisure is the opportunity cost of work that is foregone which is w .

$\therefore$ Price of leisure is also $w \Rightarrow P_l = w$
 and P_c is

when wage rate increases say w' , $w' > w$
 then, $P_l = w'$

This leisure becomes costlier.

Substitution effect

The consumer substitutes away from leisure and buy more of composite consumption good (moving from costlier l to cheaper food c).

$$|SE| \Rightarrow l \downarrow \quad (\text{reduce leisure})$$

Income effect

Under the assumption that leisure is a 'normal' good, when income rises and BBL is available now, the consumer would be induced to buy more of leisure.

$$|IE| = l \uparrow \quad (\text{more leisure})$$

Since $|SE|$ and $|IE|$ are in two directions, where will be the equilibrium and whether it'll increase l or not depends on the strength/magnitude of the effects.

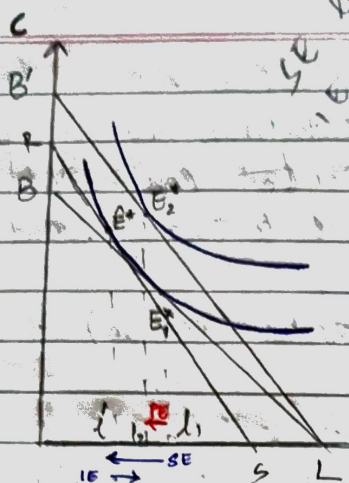
i.e. PE leads to $l \uparrow$ if $|IE| > |SE|$ and $l \downarrow$ if $|IE| < |SE|$.
2 cases.

31-01-2022

① when $|SE| > |IE|$

The substitution effect is shown by decrease in leisure ($\uparrow$ in work) from l_1 to $\hat{l}$ and the income effect is shown from $\hat{l}$ to l_2 .

Since substitution effect is the dominating effect, the price effect leads to decrease in leisure and composite consumption goods resulting to change in equilibrium from E_1^* to E_2^* where intermediate equlb is $\hat{E}$.



E_1^* - Initial equilibrium

E_2^* - Intermediate Equilibrium

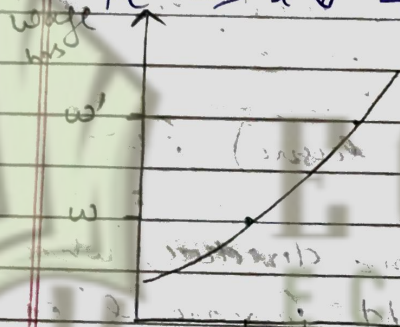
E_3^* - Final equilibrium

Substheff - l_1 to l'

Income effect - l' to l_2

Pnu effect - l_1 to l_2

PE $\Rightarrow l \downarrow \Rightarrow w \uparrow$

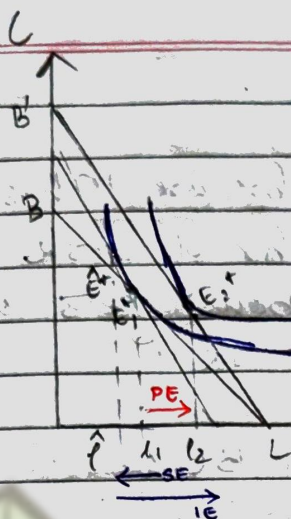


$l_1 - l_2 \Rightarrow$ leisure $\downarrow$
 $\Rightarrow$ work $\uparrow$
~~leisure $\uparrow$~~

From the above figure we can derive this diagram below which shows the wage hrs of labour supplied by household.

② When $|IE| > |SE|$

The substitution effect is shown by decrease in leisure (increase in work) from l_1 to l' . The income effect is shown by the movement of leisure hrs to the right i.e. increase from l' to l_2 where $l_2 > l_1$ since $|IE| > |SE|$. Therefore pnu effect is from l_1 to l_2 . Therefore final equilibrium will be to the right of E_1^* at E_2^* when the intermediate equilibrium is E_3^* .



E_1 - Initial equilibrium

E_+ - Int. equilibrium

E_2 - Final equilibrium

Substitution effect - l_1 to l_+

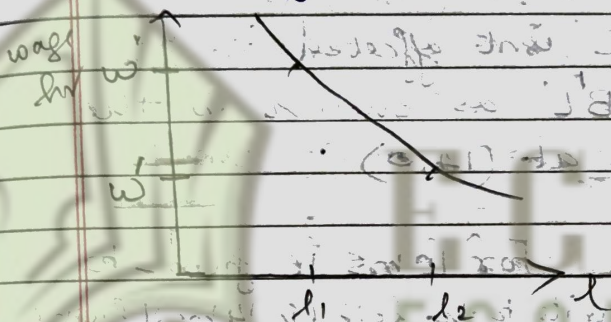
Income effect - l_+ to l_2

Price effect - l_1 to l_2

$PE \Rightarrow l \uparrow \Rightarrow w \downarrow$

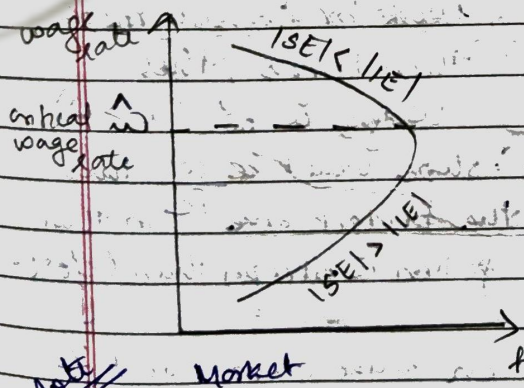
$l_1 - l_2 \Rightarrow \text{leisure} \uparrow$

$\Rightarrow \text{work} \downarrow$



The dominated income effect results in downward sloping supply schedule.

In general an individual labour supply curve is a backward bending curve,



M/w

Why at lower levels of wage, as wage rate $\uparrow$ $SE > IE$ and at high rate as wage rate $\uparrow$ $SE < IE$?

Note

Market Total Supply Curve of labour is horizontal summation of individual supply curve and would be generally a bayat upward sloping line that tends to bend back at extremely high wage rates.

{ $\uparrow$ $\rightarrow$ $\rightarrow$ $\rightarrow$ }

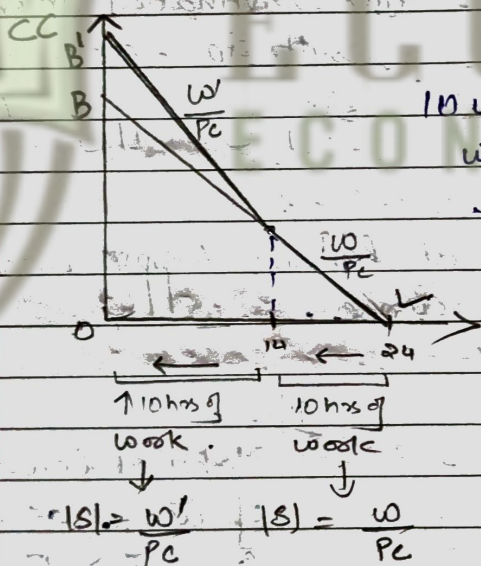
Another case

- Suppose:-
- ① The normal working hrs are 10 hrs.
 - ② For every additional hr of work above 10 hrs, labour gets w' ($w' > w$) i.e. overtime work.

What'd be the nature of IC and BL?

No change in IC as IC isn't affected.

Budget line will be $B'L'$ as shown in the figure with a kink at $(14, 0)$.



For 10 hrs i.e. from L to 10 units to the left (i.e. 14 hrs of leisure which is 14, 0) wage rate is w/hr .

$\therefore$ No change in initial budget line

To the left (14, 0) as we move more and more to the left,

work hr $\uparrow$ and y more than 10 hrs, this

wage is w' ($w' > w$)

$\therefore$ Slope would be w' thus the budget line P_c in this portion is steeper than before.

Q1 If the govt imposes tax on wage income at $t\%$. What happens to Budget line?

Q2 If the govt impose tax on wage at $t\%$, what happens to budget line?

Q3 If household gets non-labour income, what happens to budget line?

Application :- Interest rates, savings and consumption over periods

Suppose these two commodities (say fruits apple and orange) in two periods.

Composite Cons. good in period 0 is P_0 and
Composite Cons. good in period 1 is P_1 ,
where consumption is represented as C_0 and C_1 , respectively.

Both are goods and $MRS_{C_0, C_1} \downarrow$ as $C_0 \uparrow$.
Thus - there is no change in IC.
But in order to develop Budget line, more assumptions are required.

> 1 unit of com. cons. good in period 0 can be transformed into $(1+r)$ units of com. cons. good in period 1.
ie if you save 1 unit in P_0 then you yield $(1+r)$ units in P_1 .
ie $C_0 \downarrow$ by 1 $\Rightarrow C_1 \uparrow$ by $1+r$
 $C_0 \downarrow$ by 2 $\Rightarrow C_1 \uparrow$ by $2(1+r)$

where r is the rate of interest. It is assumed to be constant in P_0 and P_1 .

> The person earns only in P_0 i.e. w_0 . The person earns none in P_1 .

P_0 - earns (w_0) $\leftarrow$ consumes & saves.
 P_1 - no earning (lives off by consuming out of savings and its interest).

Total consumption cannot be represented as $C_1 + C_0$ as the goods in both periods can be different and hence can't be added together.

We can't frame quantities with different time periods. We have to make expenditure and ~~cons~~ income of P_1 w.r.t P_0 and vice versa.

→ P_1 w.r.t P_0 .

It is said if 1 unit of C_0 is saved $\Rightarrow (1+r)$ unit max of C_1 .

C_0 will be the expenditure on consumption in P_0 . Same amount of cons which is from savings of P_1 & rate of int. is consump. exp in P_1 .
ie C_1 in P_1 .

$\therefore$ Cons. exp. w.r.t P_0 will be $\frac{C_1}{1+r}$.

$\therefore$ Total expenditure of P_0 w.r.t $P_0 = C_0 + \frac{C_1}{1+r}$

Income earned in $P_0 = W_0$

Income earned in $P_1 = 0$

Total income w.r.t $P_0 = W_0 + 0$

$$\therefore W + 0 = C_0 + \frac{C_1}{1+r}$$

$W = C_0 + \frac{C_1}{1+r}$ is the equation of

budget line, with C_0, C_1 as variables and W and r as parameters.

$\Rightarrow P_0$ wrt P_1

10 $(1+r)$
9 $(1+r)$

Consumption in $P_1 = C_1$

Consumption in $P_0 = C_0$ $(1+r)$ times consumption in P_1 $\Rightarrow$ cost of C_1 in P_0 is $(1+r)$ unit of C_0 equal to say $(1+r)$ unit of C_0 in P_1

$\therefore$ Cons exp in P_0 wrt $P_1 = C_0(1+r)$

$\therefore$ Total exp wrt $P_1 = C_0(1+r) + C_1$

Income earned in $P_1 = W_1$

$\Rightarrow$ Income earned in P_0 wrt $P_1 = W_0(1+r)$

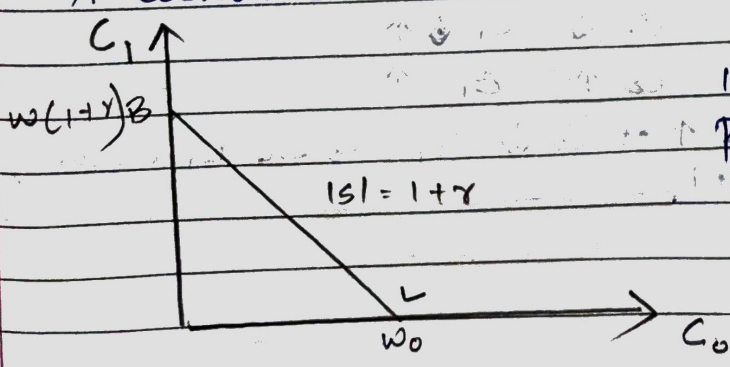
$\therefore$ Total income wrt $P_1 = W_0(1+r)$

$\therefore W_0(1+r) = C_0(1+r) + C_1$ is the equation of budget line

$-(1+r)$ is the slope which shows what will be the consumption in P_2 if a consumer gives C_0 amt of cons in P_0

$W_0 = C_0 + \frac{C_1}{1+r}$ is the eqn (*) This eqn can also be used

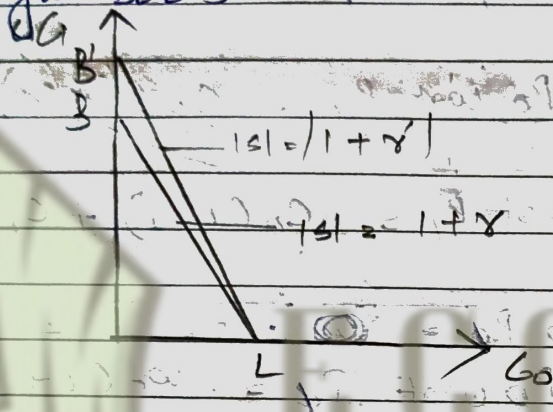
X coordinate is W_0 and Y coordinate is $W_0(1+r)$



$1+r$ is the relative price of C_1 cons in P_0 over cons in P_1

What if $r \uparrow$

Since r doesn't affect in P_0 . Thus consumption of C_0 is unaffected. But consumption of C_1 , which is in $P_1 \uparrow$. Thus budget line swivels up from BL to BL' .



01-02-2022

change in r

When $r \uparrow$

Substitution effect:

As $r \uparrow$, the com cons good in P_0 has become costlier i.e. C_0 become costlier and thus household shifts away from C_0 to C_1 by saving more in P_0 .

Income effect

The rise in r will lead to additional availability of more bundles of C_0 and C_1 . Thus real income increased thus both C_0 and C_1 will increase.

On short when $r \uparrow$

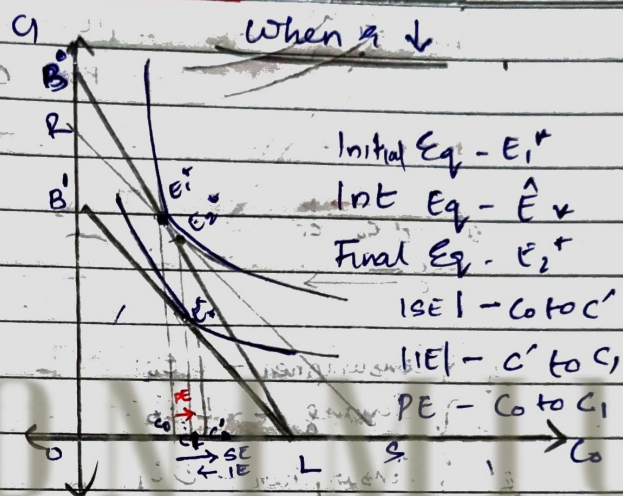
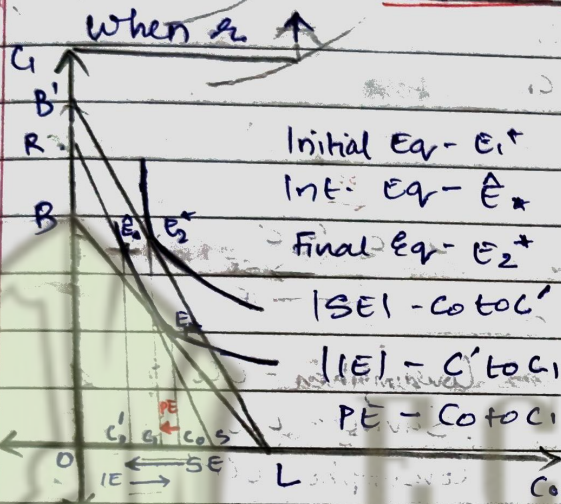
SE $\Rightarrow C_0 \downarrow, C_1 \uparrow$

IE $\Rightarrow C_0 \uparrow, C_1 \uparrow$

$\therefore$ PE $\Rightarrow C_0 \uparrow$ as $C_0 \downarrow$ depends on dominance of |SE| and |IE|.

R	C_0	C_1	SE - IE
↑	↓	↑	$ SE > IE $
↑	↑	↑	$ SE < IE $
↓	↑	↓	$ SE > IE $
↓	↓	↓	$ SE < IE $

When $|SE| > |IE|$



$r \uparrow$ { Consumption - OC_0
 Saving - LC_0

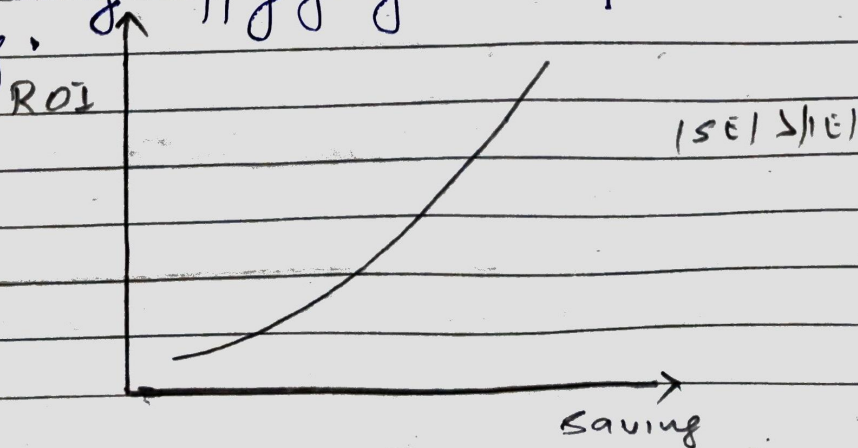
Consumption - OC_0 } r
 Saving - LC_0

$r' > r$ { Consumption - OC_1
 Saving - $LC_1(r)$

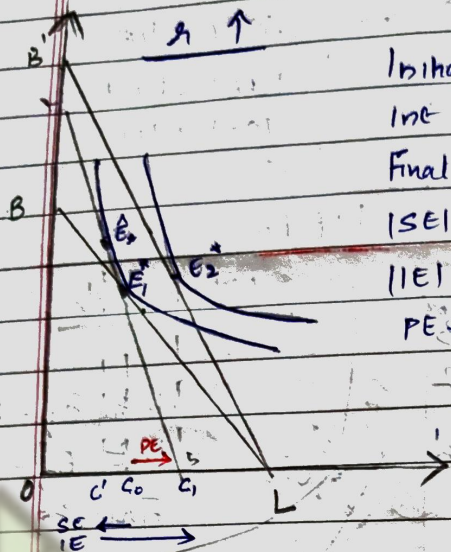
Consumption - OC_1 } r'
 Saving - LC_1 } $r' < r \downarrow$

∴ Savings is positively related to ~~income~~ ^{rate of interest}
 if $|SE| > |IE|$ ~~ceteris paribus~~

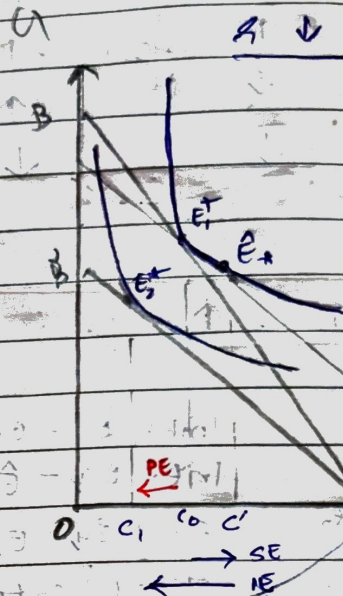
Thus individual saving supply fn of household would be upward sloping.



when $|SE| < |IE|$



Initial Eq - E_1
 Int Eq - E_2
 Final Eq - E_2
 $|SE| - C_0 \text{ to } C_1$
 $|IE| - C_1 \text{ to } C_2$
 $PE \rightarrow C_0 \text{ to } C_1$



Consumption - OC_0
 Saving - LC_0

Consumption - OC_1
 Saving - LC_1 (↓)

Consumption - OC_0
 Saving - LC_0

Consumption - OC_1
 Saving - LC_1 (↑)

Savings is negatively related to rate of interest if $|IE| > |SE|$ ceteris paribus.

Thus individual households ^{savings} supply would be a negative function of rate of interest.

