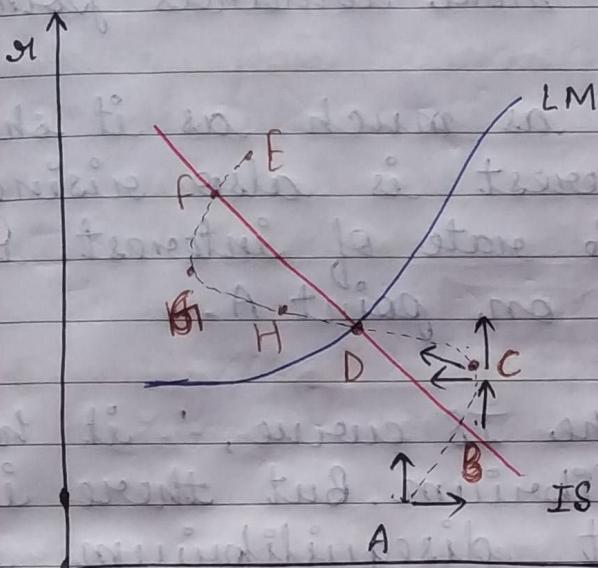


LM curve,  $M_d < M_s$ .

### \* From Disequilibrium to Equilibrium



- Point A is to the left of the IS curve & right of LM curve.

$$\therefore \cancel{I > S, Y < (C+I)}$$

- Also Money demand > Money supply.  
Demand > Supply, the economy is in the phase of prosperity.

- Income will have a tendency to rise because demand > supply. firms will produce more and as production will rise, income will rise.

- From A, there would be rightward shift.

- As money demand > money supply, the interest rate will rise & interest rate will fall when money demand < money supply.

- ∴ rate of interest ~~rate~~ will also rise. From A, there would be upwards shift.
- ∴ from A, it ∴ A will move towards point B.
- Income cannot rise as much as it should because, rate of interest is also rising.  
∴ Rise in income & rate of interest will create a net effect on point A.
- Point B is on the IS curve, ∴ it has goods market equilibrium. But there, is still money market disequilibrium, as money demand > money supply ∴ rate of interest will rise again & point B will move upwards towards C.
- Point C is towards right of both IS & LM curve ∵  $S > I$  or  $Y > C + I$ . i.e. demand of goods < supply of goods ∴ there is overproduction in the economy.
- ∴ Income will decrease but rate of interest will increase. ∴ Point C will move towards left & also upwards ∴ it will move towards the equilibrium point D.
- ∴ After number of iterations & adjustment of income & rate of interest, equilibrium point will be reached.

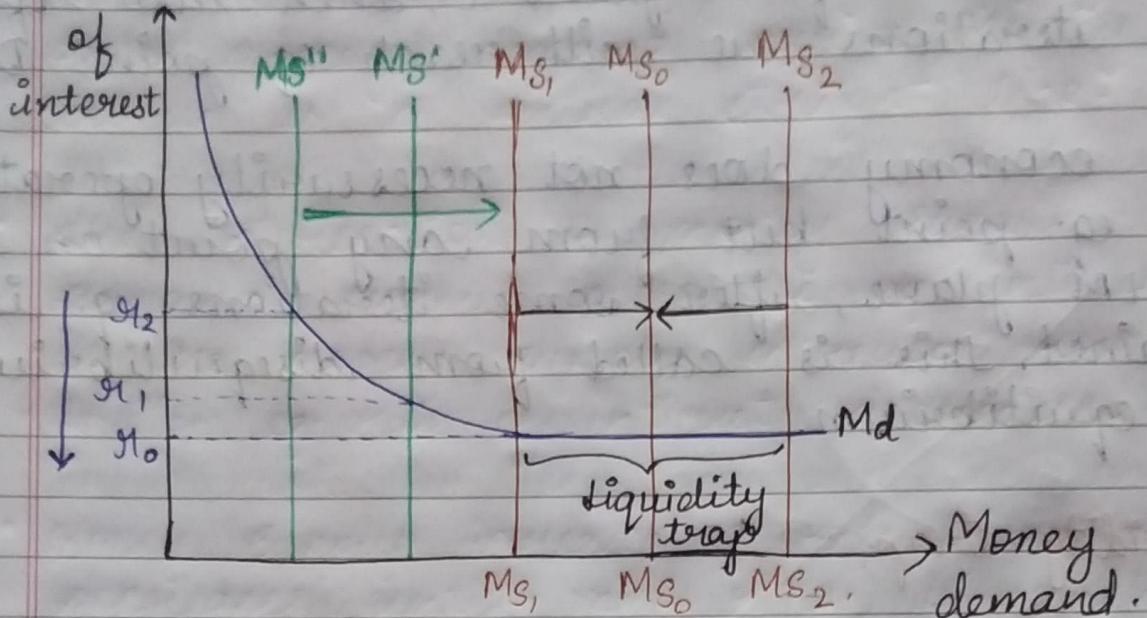
- If we start from point E, then also after some iterations we will reach eq. point D.
- Any economy does not necessarily operate on the eq. point but from any point on the IS-LM plane, after some iterations eq. is attained. This is called from disequilibrium to equilibrium.

### \* Liquidity Trap

- Liquidity trap refers to the situation in which an increase in money supply does not result in a fall in the interest rate but there is addition to the idle balances (interest elasticity for money becomes infinite).
- Speculative demand for money is an inverse function of rate of interest.
- As or decreases, speculative demand for money rises i.e. people prefer liquidity over illiquidity and vice-versa.

But as  $r_s$  reaches a minimum value,  $M_d$  will reach a constant value & will not rise further.

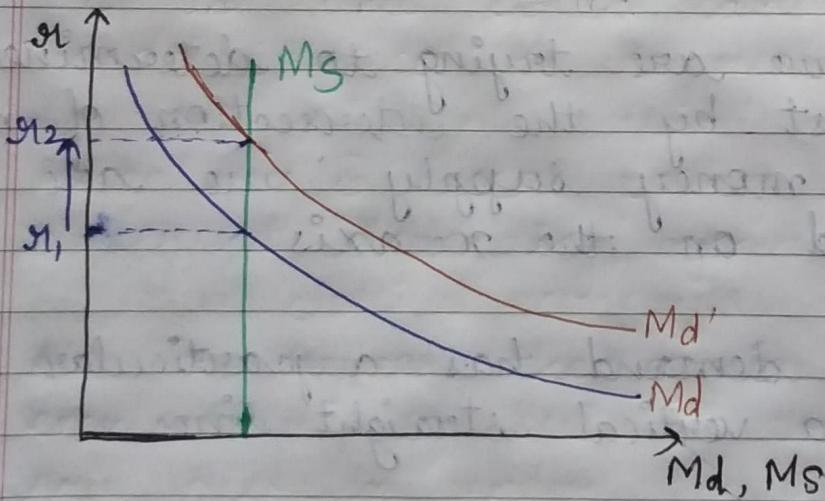
The rate  
of interest



- Keynes pointed out that during depression when rate of interest is very low, the demand for money (or liquidity preference curve) becomes completely elastic (horizontal) and the rate of interest cannot fall more.
- At the minimum rate of interest  $R_0$ , people will not hold bonds, they will only hold money as idle balances.
- As rate of interest keeps falling, bond price increases, ∴ people will keep more idle balance than holding bonds i.e. people will prefer liquidity over illiquidity.
- But the rate of interest doesn't go to zero, it goes to a minimum value & it doesn't fall below it.

- At this minimum rate of interest, as rate of interest can't go any down further, the speculative demand for money will become a horizontal straight line i.e. it will become infinitely elastic.
- At this rate of interest, people will prefer to hold the entire money as idle balances as in future the rate of interest will only rise. At this minimum  $i_1$ , whole money will be kept as idle balances as bond prices will be very high.
- We assume income  $\rightarrow$  to be given so that we get a certain value of transaction demand.
- In this case, we are trying to determine eq. rate of interest by the intersection of money demand and money supply : we are taking money demand on the x-axis.
- As transaction demand has a particular value  $\therefore$  it will be a vertical straight line.
- $\therefore$  The curve  $m_d$  consists of both transaction & speculative demand,  $m_d = m_{sp} + m_{to}$ . where we are assuming income to be given. money demand curve becomes a -vely sloped curve until rate of interest  $i_0$ .

- Now we superimpose money supply curve onto money demand curve. Money supply curve is a vertical straight line.
- The intersection of money supply and demand curve gives the eq. interest rate. As the money supply increases from  $M_s''$  to  $M_s'$ , eq. rate of interest decreases.
- Money Supply increases, eq. rate of interest, decreases until min.  $i_0$  ( $i_{10}$ ) is reached.
- If money demand increases with money supply unchanged, money demand curve will shift towards right. eq. rate of interest will increase.

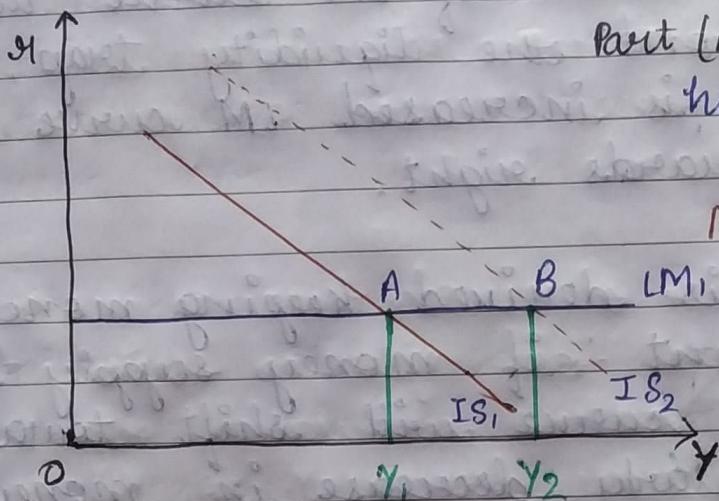


- But at  $i_0$  rate of interest, if money supply is increased then the eq.  $i$  remains unchanged. This is called the liquidity trap.

- In general when there is increase in money supply, rate of interest decreases and income tends to increase. But there is a lower limit for rate of interest.
- At the stage of liquidity trap, expansionary monetary policy fails as even if money supply is increased, rate of interest will not change. Income will not change. All the money will go to idle balances, all the change in money supply will be converted to transactionary money demand.
- Liquidity trap refers to the situation in which an increase in money supply does not result in a fall in the interest rate but there is addition to the idle balances (interest elasticity of demand for money becomes infinite).
- Under normal conditions, an increase in money supply results in a excess cash balance that further leads to an increase in bond price corresponding to the fall in interest rate.
- But when there is a situation of liquidity trap, individuals believe that bond price is too high and it will fall. Correspondingly, interest rates are too low, hence it will rise. They, therefore, believe that buying bonds would be

incur capital loss and as a result, they hold only money.

- This means an increase in money supply ~~merely~~ merely increases idle balances and leaves the interest rate unaffected.
- Money market solution to the economy is remote. In this situation i.e. income cannot be increased by money market ~~phenomena~~ phenomena, monetary policy would fail.
- Economic Fluctuations and Stabilization policies
- IS & LM curves can be different depending on the time period and also on which model (Classical or Keynesian) we are using.
- Monetary & fiscal policy can also be different depending upon different curves.
- A/c to ~~Keynes~~, the eq. is always full employment eq. but a/c to Keynes, the eq. can also be under employment eq.
- In order to attain full employment eq., stabilization policies for diff. economic fluctuations have to be applied & these policies depend upon the IS & LM curves.



Part (A) LM curve is a horizontal straight line.

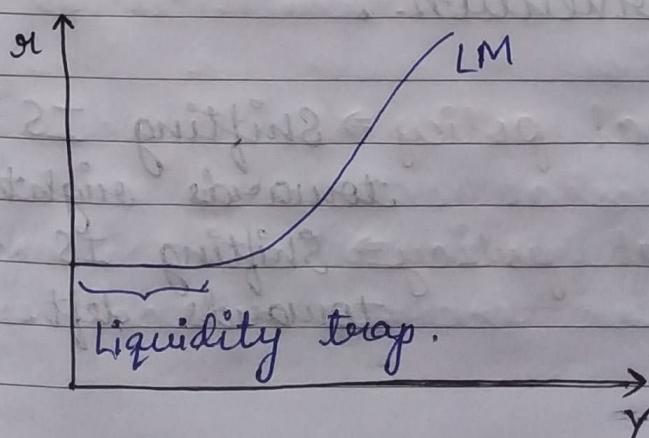
Monetary policy does not work.

- In this case, when liquidity trap is encountered LM curve becomes infinitely elastic i.e. a horizontal straight line.

$f = \infty$   
f is the slope coefficient of speculative money demand w.r.t. rate of interest & at liquidity trap, f becomes  $\infty$ .

$$\frac{L}{P} = eY - fr \quad (\text{Money demand}) \quad f = \infty.$$

- when money demand curve will become perfectly elastic, monetary policy will become completely ineffective. i.e. increasing money supply will not, ~~not rise~~ result in rise of income.



- From the derivation of LM curve, we can infer that beyond the liquidity trap, if money supply is increased LM curve ~~is~~ will shift towards right.
- If LM curve is derived keeping money supply constant : if money supply is increased, LM curve will shift towards right. And similarly, decrease in money supply will lead to leftward shift in LM curve.
- IS curve is derived keeping autonomous expenditure ( $A_0$ ) constant.  

$$A_0 = C_0 - bT_0 + I_0 + G_0$$

When  $A_0$  will change, IS curve will shift.  
 $\therefore$  If  $A_0$  increases, IS curve will shift ~~to~~ towards right & vice-versa.

Increasing govt. expenditure ( $G_0$ ) keeping tax ( $T_0$ ) unchanged or decreasing taxes ( $T_0$ ) keeping govt. expenditure unchanged will lead to increase in autonomous expenditure ( $A_0$ ). These measures are called fiscal measures on the part of the govt. And the phenomena is called fiscal intervention.

Expansionary fiscal policy  $\Rightarrow$  Shifting IS curve towards right.

Contractionary fiscal policy  $\Rightarrow$  Shifting IS curve towards left.

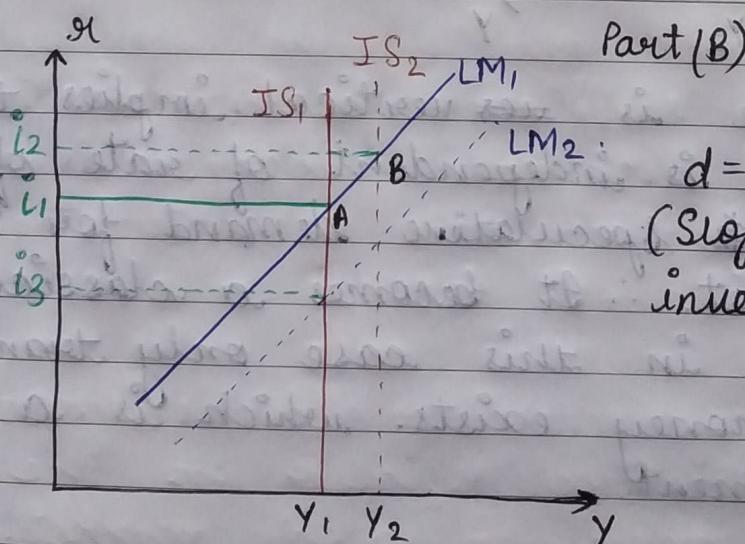
- Position of LM curve depends on monetary measures i.e. money supply.

$$Y = \frac{1}{e} \left( \frac{M_0}{P} \right) + \left( \frac{1}{e} \right) R_1$$

- Position of IS curve depends on fiscal measures ( $G_0$  &  $T_0$ ) i.e. autonomous expenditure.

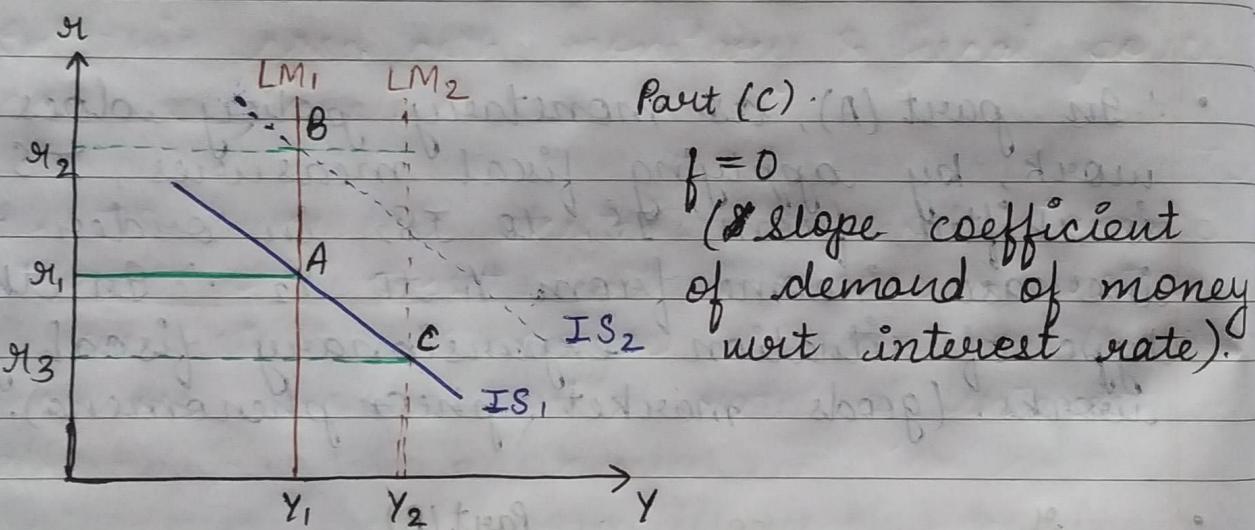
$$Y = KA_0 - dK R_1$$

- In part (A), as monetary policy does not work, by applying fiscal measures, IS curve is shifted from  $IS_1$  to  $IS_2$  in order to increase income from  $Y_1$  to  $Y_2$ .  $\therefore$  In this type of situation expansionary fiscal policy works. (goods market phe~~r~~ phenomena).



- IS curve becomes vertical when investment func<sup>n</sup> is independent of rate of interest. Slope coefficient of investment wrt  $r$  is 0.

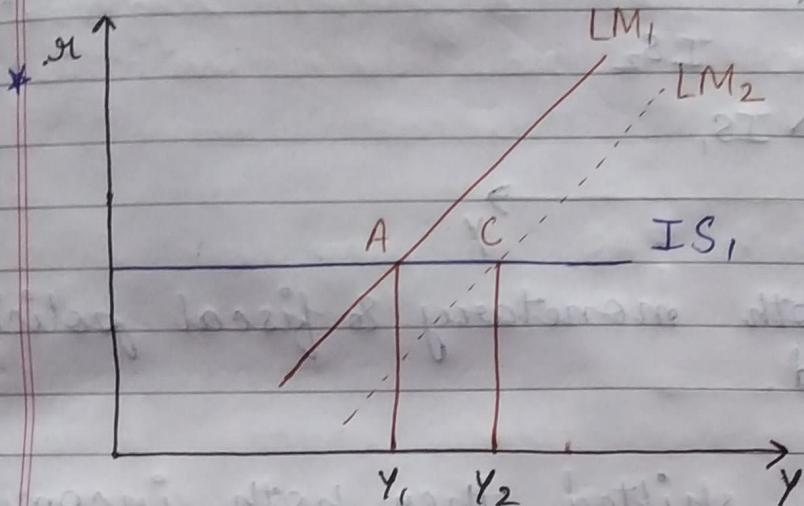
- ∴ In this case, increasing/decreasing money supply i.e. shifting LM curve will not affect the income, it will only result in change of  $r$ .
- ∴ In this case also, expansionary fiscal policy have to be applied such that IS curve will shift towards right and income will increase from  $y_1$  to  $y_2$ .



- More LM curve is ~~more~~ vertical implies that money demand is independent of rate of interest ( $r$ ) ∵ ~~it's~~ speculative demand for money does not exist. ∴ It becomes a classical LM curve as in this case only transaction demand for money exists which is a classical argument.
- In this case if fiscal policy is applied, shift of IS curve from  $IS_1$  to  $IS_2$  will not result in change in income ∵ fiscal policy is inapplicable.

- Expansionary monetary policy has to be applied to shift LM curve from  $LM_1$  to  $LM_2$  in order for income to rise from  $Y_1$  to  $Y_2$ .

Part (D)



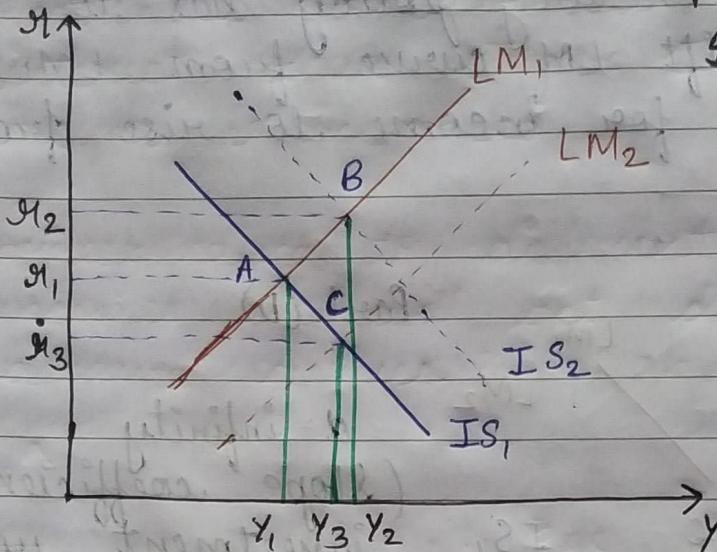
$d = \infty$ ,  
(slope coefficient of  
investment ~~w.r.t.~~ w.r.t.  
 $r$ ).

- IS curve is horizontal i.e. perfectly elastic ~~w.r.t.~~ w.r.t. rate of interest i.e. investment is highly sensitive to rate of interest.
- In this case also, ~~monet~~ fiscal policy is not applicable, expansionary monetary policy has to be applied to increase income from  $Y_1$  to  $Y_2$ .

$$Y = KA_0 - dKr$$

- ∴ IS curve cannot be shifted upwards or downwards.

## Part (E)

Intermediate  
situation

- In this case, both monetary & fiscal policies can be applied.
- If IS curve is shifted, then both income & rate of interest will increase & instead if we shift LM curve income will increase while rate of interest will fall.
- ∴ Intermediate sol<sup>n</sup> will be intersection of IS<sub>2</sub> & LM<sub>2</sub> such that income is higher but change in rate of interest will be very less.
- ∴ Stabilization process depends upon the type of fluctuation & also on the behaviour of money & goods market.

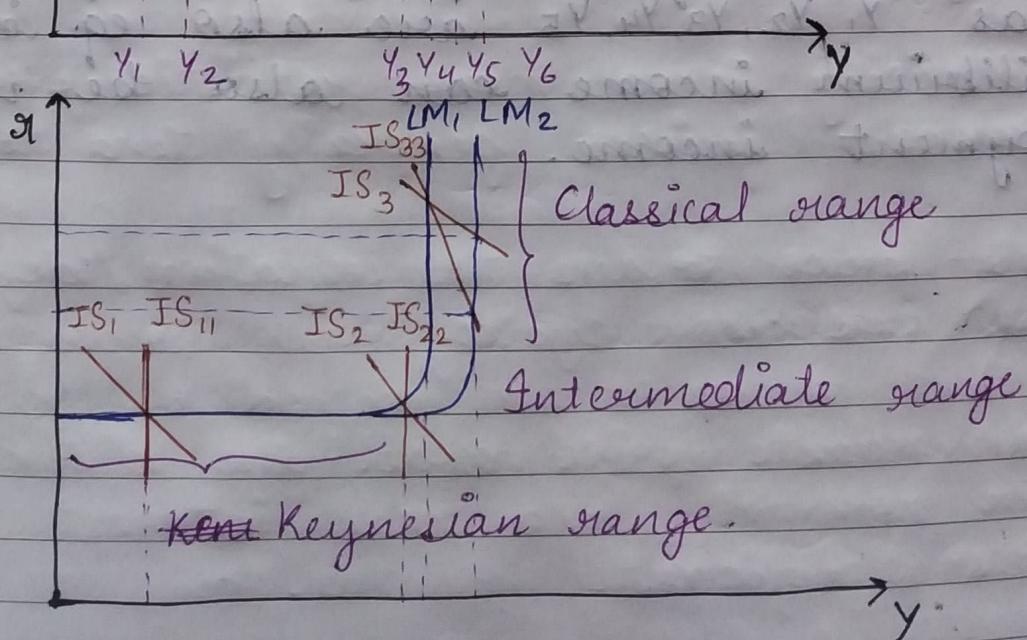
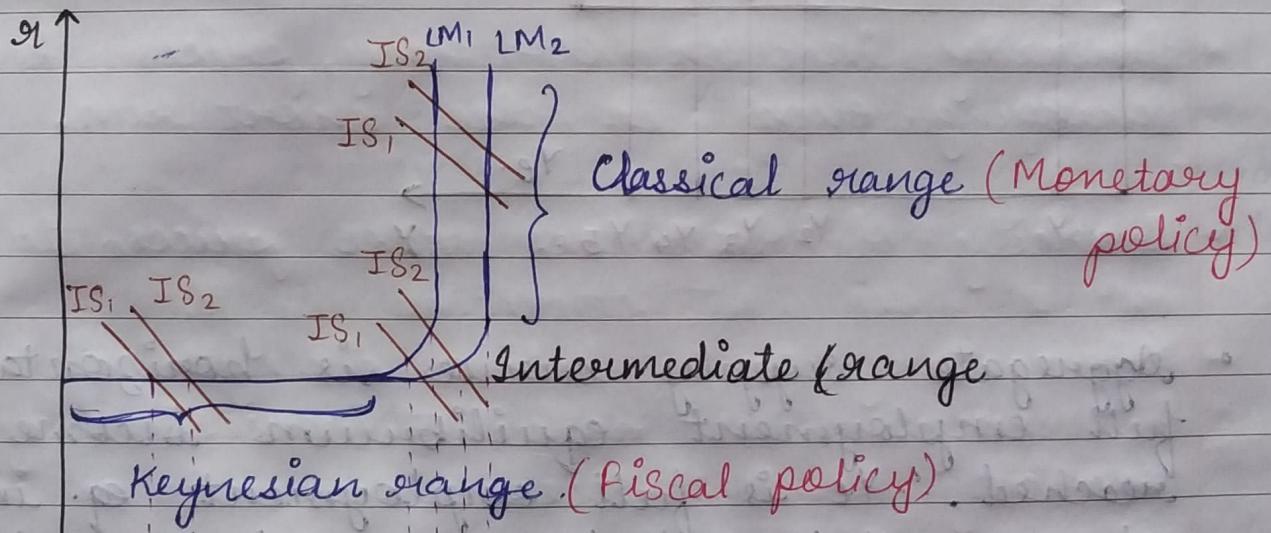
**Part (A):** Horizontal LM curve  
Fiscal policy.

Part (B): Vertical IS curve  
(Fiscal policy)

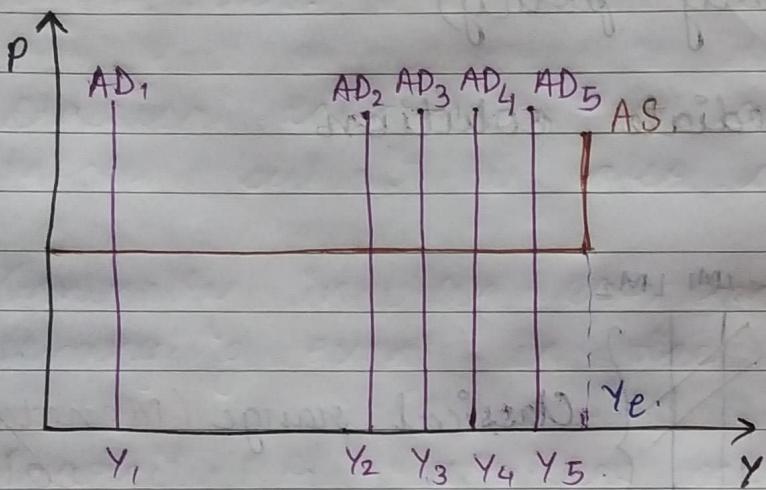
Part (C): Vertical LM curve  
(Monetary policy)

Part (D): Horizontal IS curve  
(Monetary policy)

Part (E): Intermediate solution



- Flatter IS curve realises higher rate of interest than steeper IS curve when income is increased.
- Corresponding to different equilibrium incomes, we will get different aggregate demand curves.



- Aggregate supply curve is horizontal until full employment equilibrium income is reached. ∴ Y<sub>e</sub> is full employment eq. income whereas Y<sub>1</sub>, Y<sub>2</sub>, Y<sub>3</sub>, Y<sub>4</sub>, Y<sub>5</sub> are also eq. incomes.  
∴ Equilibrium income can also be under-employment income.

## \* The Variable Price Model

- IS curve: Goods Market Equilibrium
- LM curve: Money Market Equilibrium
- IS-LM Model: Simultaneous determination of rate of interest and the real GDP.
- Alternate derivation of AD curve is the core of IS-LM curve.
- From IS-LM curve, eq. income is attained which can be used to determine money aggregate demand. As for a particular value of income, there is a corresponding value of aggregate demand.
- Aggregate supply curve is a horizontal straight line until full employment. eq. is reached.
- ∵ By intersection of the aggregate demand and supply, we get the fixed price.
- Keynesian fixed price model: Firms are assumed to supply any quantity of their goods at fixed price.
- However, it does not explain how aggregate price is determined.

- It is a static model. Expectation of future prices tend to have an impact on both AD and AS.
- Prices do not remain fixed in the real world.
- Fixed price is not tenable even in the short run.
- Classical economics is a variable price model but it is also a long run model.
- Generally in an economy, prices keep changing even in the short run.
- Scarcity of resources make prices to change.
- Prices vary on relative strength of demand & supply, it is ~~not~~ not necessarily scarcity of resource.
- But scarcity is a more realistic phenomena, prices generally tend to rise.
- Variable price ~~is~~ due to inflation / deflation and business cycles.

Under variable price model: the distinction between nominal and real interest rate becomes significant.

Real  $r = \text{Nominal } r + \text{expected inflation rate}$

- Distinction between nominal exchange rate and real exchange rate <sup>also</sup> becomes significant.
- Derivation of AD curve
- AD equation under IS-LM is derived as

$$Y = A_0 + \frac{d}{f} \left( \frac{M_0}{P} \right)$$

$$\frac{1}{k} + \frac{de}{f}$$

- $e$  &  $f$  are the slope coefficients of money demand func'.

$e \rightarrow$  net income

$f \rightarrow$  net rate of interest.

$$M_d = eY - f\alpha$$

- $d$  is the slope coefficient of investment demand func' net rate of interest.

- $A_0, d, e$  &  $f$  are the slope coefficients of the different demand func's corresponding to goods and money market.

$A_0 \rightarrow$  Aggregate ~~autonomous~~ autonomous expenditure

$M_0 \rightarrow$  Total Money Supply.

$K \rightarrow \text{Multiplier } \left( \frac{1}{1-b} \right)$

$P \rightarrow \text{price level.}$

- In this eq<sup>n</sup>, when price is considered fixed, when money supply rise (& monetary policy Y increases) & similarly when autonomous expenditure will rise (fiscal policy), Y will rise. But as aggregate demand curve is vertical  $\therefore$  change in  $A_0$  or  $M_0$  will lead to shift in AD curve.
- When P is considered fixed, the above eqn. shows the eq. income.
- Here if P is assumed to be variable, the eq<sup>n</sup> & does not determine eq. Y.
- It provides AD equation which gives the m<sup>n</sup> of real income and general price level at each combination of which the goods and money market are simultaneously in equilibrium.
- The IS-LM model is now incomplete as now it has one more endogenous variable (P) and that makes them exceed the number of independent variables.
- P & Y are inversely related. Hence, AD curve is negatively sloped.

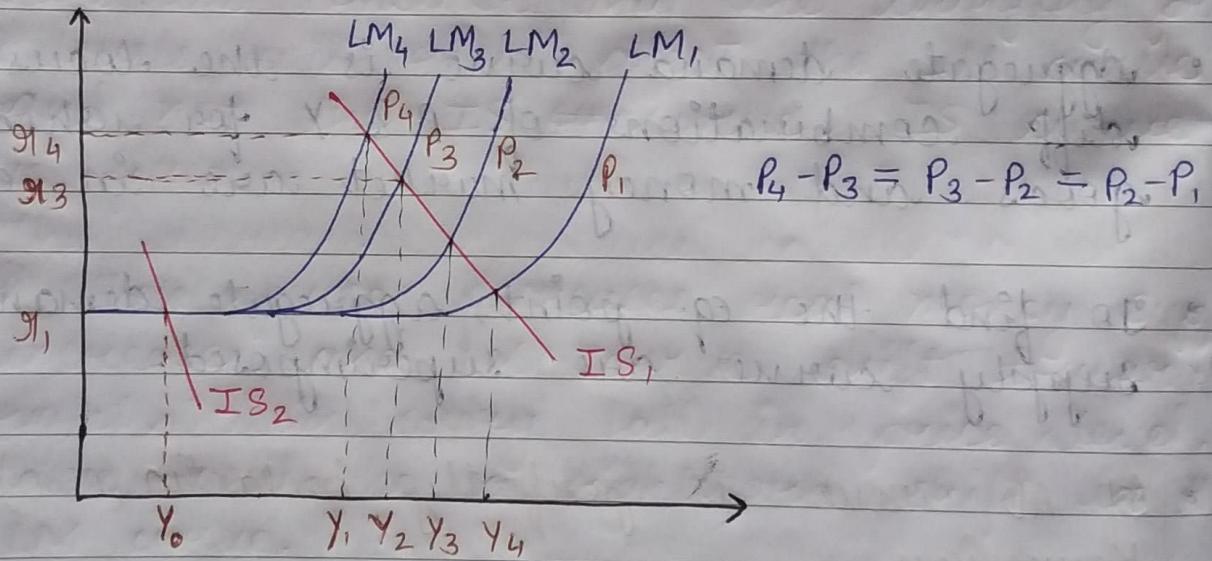
- From this eq<sup>n</sup>, now we will get aggregate demand curve.
- The demand ~~curve~~ law states that when general price level rises, its quantity demanded falls. ∴ the aggregate demand curve will be negatively sloped.
- Each point on the aggregate demand curve represents goods market & money market equilibrium. as the eqn. comes from IS & LM curve intersection. But now, we also have to determine eq. price level.
- Aggregate demand curve is the locus of diff. combinations of  $P$  &  $Y$  for which goods and money market are in eq.
- To find the eq. point, aggregate demand & supply curve are superimposed.
- If AD curve is perfectly inelastic ( $e=0$ ):  
Keynesian
  - Here, neither IS nor LM curve shifts with changes in the price level.
  - If total nominal spending increases or decreases proportionately with any rise or fall in the price level, the total real spending remains unchanged.  
(Fixed price model).

- If AD curve is less than perfectly elastic (downward sloping) (elasticity varies at each point).

Changes in price level lead to shifts in IS & LM curves: More demanded at lower prices and vice-versa. (Variable price).

- If AD curve is a rectangular hyperbola ( $e=1$ ): Classical (~~MP~~  $\rightarrow MV = PY$ )  
Aggregate supply curve is a vertical straight line.

### Derivation of the AD curve



- Every LM curve corresponds to a particular value of money ~~supply~~ demand.
- It corresponds to a particular value of  $(1/P)$  and in fixed price model,  $P$  was fixed,  $\therefore$  each LM curve corresponds to a particular value of money demand.

And to derive LM curve money supply becomes equal to money demand.

And in fixed price model, only way to increase money demand was to increase the nominal money supply value.

- In fixed price model, only way to increase real money supply is to increase the nominal value of money supply. And the increase in nominal value of money supply leads to shifting of LM curve.
- IS curve shifts under fiscal measures & LM curve shifts under monetary measures. And LM curve shifting can take place only via changing the nominal money supply in fixed price model.
- In this case prices tend to change. But price change is not a money market phenomena. Prices change a/c to demand and supply of goods in the goods market. An apex bank of a country can only regulate money supply of a country which is the monetary policy.
- But a/c to quantity theory of money  

$$MV = PY$$
 prices ~~st~~ can change due to change in money supply which makes it a monetary

phenomena.

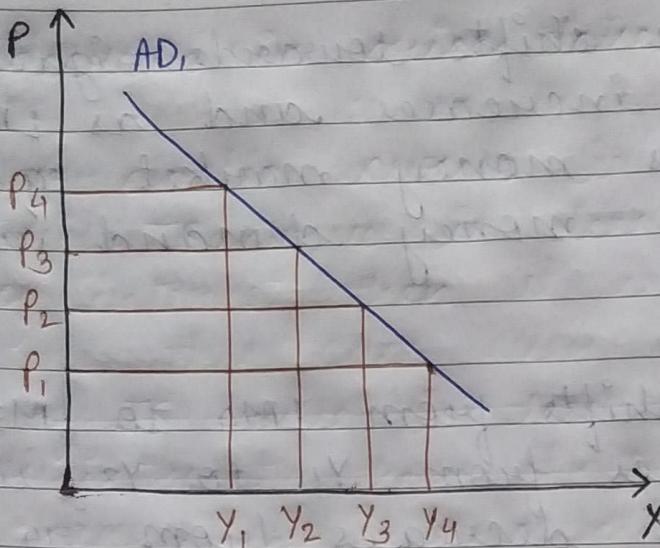
- ∵ change in price may not be necessarily due to change in money supply.
- Increasing nominal money supply keeping price level unchanged or decreasing price level keeping nominal money supply constant will lead to rise in real money supply.

$$\text{Real money supply} = \frac{M_s}{P}$$

- Here, we consider that the changing price levels will only affect the LM curve and not the IS ~~curve~~ curve. ∴ IS curve is fixed.
- When price decreases, real money supply increases and LM curve shift towards right. ∵ with every fall in price level, there will be a rightward shift in the LM curve.
- ∵ As price level falls from  $P_4$  to  $P_1$ , LM curve moves from  $LM_4$  to  $LM_1$ .
- As Price level falls from  $P_4$  to  $P_3$ , real money supply rises and gives rise to the new LM curve,  $LM_3$ .

- When LM curve shifts towards right, real money supply increases and as LM curve represents money market eq. : correspondingly money demand will increase.
- As LM curve shifts from  $LM_4$  to  $LM_3$ , eq. income increases from  $Y_4$  to  $Y_3$  while rate of interest decreases from  $i_4$  to  $i_3$ . as IS curve is fixed.
- With the fall in price level, apart from the liquidity trap range, at each interest, the Y value indicated by successive LMs are higher than the preceding ones.
- The successive fall in price is equal in value, but the LM curves move farther & further : if the distance b/w LM curves have to be kept same, the fall in price levels must decrease gradually.
- Also, as price is falling, income is rising and rate of interest is falling.
- whenever there is decrease in price level, there is an increase in income due to increase in demand but it is not direct, it happens through decrease in rate of interest.

Date / /



- As the price falls from  $P_4$  to  $P_1$ , aggregate demand increases  $\therefore$  AD curve is negatively sloped.
- \* Process of deriving Downward sloping AD curve.
  - The decrease in price causes a shift in the LM curve.
  - The adjustment of  $Y$  and  $a$  is not instantaneous.
  - Suppose price falls from  $P_4$  to  $P_3$ .  $LM_3$  becomes the new LM curve.
    - At the existing combination of  $Y_1$  &  $a_4$ , people like to hold more money than what they wish to hold as now this point is to the left of LM curve.

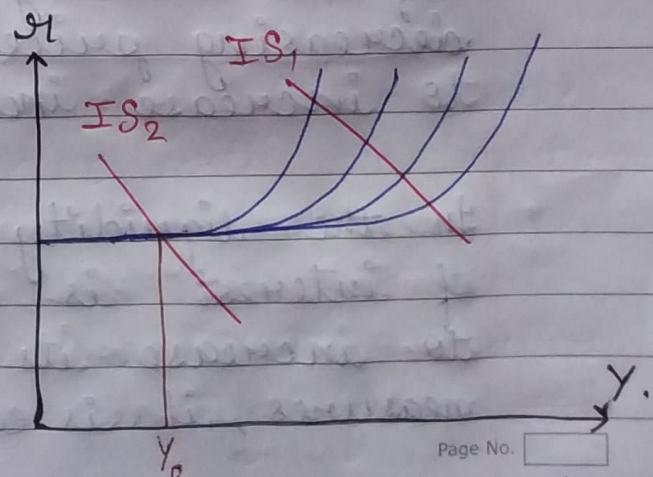
- The excess real balances spill over into purchase of bonds.
- This would bid up the bond prices and lower the interest rate.
- With lower  $r_1$ , investment will rise leading to increase in total demand for goods.
- Once the adjustment is complete, the increase in real money supply due to decrease in price ceases to be an excess supply.
- A fall in  $r_1$  to  $r_3$  and rise in  $Y$  to  $Y_2$  tend to increase  $M_d$  by just the amount equal to the increase in  $M_s$ .
- Any other combinations of  $y$  and  $r_1$  on  $LM_3$  provides eq. in money market but not in goods market. To have simultaneous eq. in both money and goods market, the combination should be  $y_2$  and  $r_3$ .
- Elasticity of the IS curve and AD.
- How much of an increase in the amount of goods demanded will occur with the rightward shift in the LM curve?
- Less elastic the IS curve is, the smaller will be increase in AD resulting from the

decrease in price level.

- Less elastic curve is more steeper it is.  
∴ if IS curve is less elastic to rate of interest, then it is more steep.
- If IS curve is less sensitive to rate of interest, then it is steeper. and if I (Investment) is less sensitive to rate of interest, then IS curve is steeper & if I is more sensitive to rate of interest then IS curve is flatter (more elastic).
- Income will increase more than proportionally with decrease in price if IS curve is flatter & it will increase less than proportionally with decrease in price if IS curve is steeper.
- ∴ The elasticity of IS curve which depends on the elasticity of investment curve determines how much the income will increase with the decrease in price level.
- If IS curve is perfectly inelastic,  $e_{IS} = 0$ , then AD curve is vertical straight line,  $e_{AD} = 0$ . IS curve becomes a vertical straight line when investment func<sup>n</sup> is interest insensitive i.e. slope coefficient

of investment w.r.t rate of interest is zero. In this case, the fall in price will lead to fall in rate of interest rate but this will not affect investment value. income will not change. ∵ In this case, fall in price have no effect on income. AD curve is a vertical straight line.

- If the economy slows down, then fall in price can be a solution because it leads to increase in demand via interest rate effect.
- But if investment is insensitive to the rate of interest then change in price will not have any effect on income/demand, ∵ in this AD curve is perfectly inelastic.
- AD curve is -vely sloped only when IS curve is -vely sloped i.e. Investment curve is -vely sloped otherwise interest rate effect is not functional.



- The slope of  $IS_1$  &  $IS_2$  curves is same, but  $IS_2$  curve passes through the liquidity trap region so interest rate remains same even when price level falls.
- In this case, even when price level will fall, interest rate cannot fall any further : it will not lead to any change in investment, there will not be any change in income/demand. AD curve will be perfectly inelastic or a vertical straight line.
- At this stage, there is no scope for the demand to rise even when there is a fall in price level.
- Fall in price level will cause real money supply to rise, but the whole increased money supply will go to idle balances as the interest rate in the economy is very low.
- If the country is in liquidity trap, then decreasing price level is not the solution to increase income/demand.

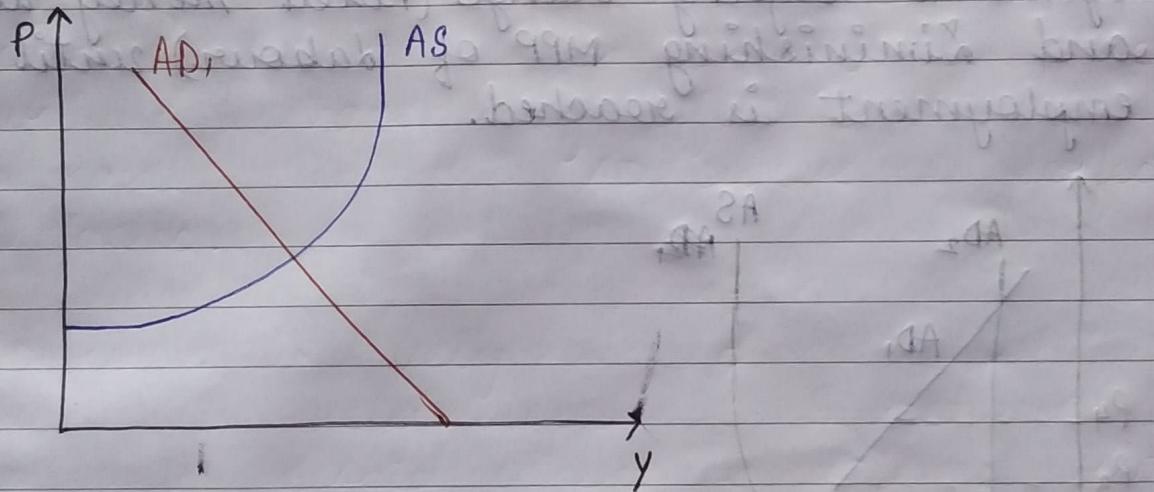
In the liquidity trap situation, when rate of interest is very low, and govt. needs to increase its spending ~~so~~ a/c to fiscal measures, it is easier for govt. to do

borrowing & spending.

- In special case, even if IS curve is not perfectly inelastic, still  $\epsilon_{AD} = 0$  if IS curve is in the Keynesian range. Decline in  $P$  does not lead to shift in LM. There is no fall in or below the liquidity trap.

### • Equilibrium Price & Output

- Once an AD curve is derived, its intersection with AS curve will determine the eq. price and output.



AS curve:

Classical framework: Vertical straight line.  
(Perfectly inelastic)

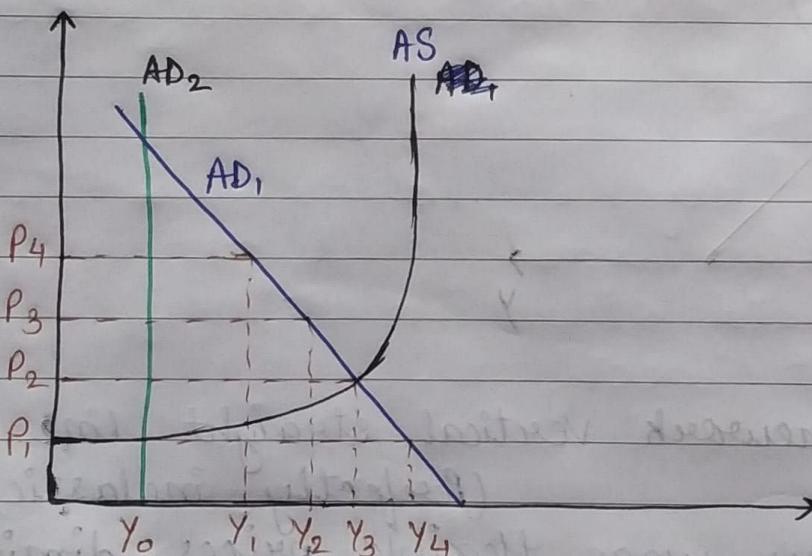
Flexible money wage, flexible prices, diminishing MPP<sub>i</sub>.

Keynesian framework: Horizontal straight line until full employment is reached & then vertical straight line.

Money wage rigidity, constant returns to

scale, fixed price.

- Intermediate case: aggregate supply curve is upward sloped until full employment is reached at which it is a vertical straight line.  
In this case, we consider Money wage rigidity, diminishing  $MPP_L$ , rigidity.
- There are two such points shown earlier ( $P_1$  and  $Y_0$ ,  $P_2$  and  $Y_3$ ).
- Here AS curve is assumed to have an upward sloping range (fixed money wage and diminishing  $MPP$  of labour) until full employment is reached.



- When money wage is fixed & there is diminishing  $MPP_L$ , then we get upward sloping AS curve. In this case, the profit seeking producers will only supply more

when the price rises.

- Upward sloping AS curve: Money wage fixity and diminishing MPP.

However,

- Equilibrium below full employment is the rule.
- However, full employment equilibrium can be attained if there is a sufficiently large ~~the~~ rightward shift in IS curve to cause AD curve to shift to the level where it intersects AS curve at the full employment level.
- IS curve will shift towards right when there is fiscal intervention i.e. autonomous expenditure ( $A_0$ ) must rise.