Can be derived

IS-LM

What is IS curve?

IS curve is the diagrametic tool built-up by Hicks and Hansen, which shows all the combinations of income and rate of interest that keep the product market in equilibrium in the sense that the planned investment + government purchases equals planned savings + tax revenue at that level of income.

Let us consider,

$i = i(r)$: Planned investment

g : Government purchase

$s = s[y - t(y)]$: Planned saving

t : tax revenue.

Then, $i + g = s + t$ represents the IS schedule. It can be expressed in the form,

$$y = c[y - t(y)] + g + i(r)$$

{ value $i' < 0$, $0 < c' < 1$, $t' > 0$ } + the slope $s' > 0$. <0

Interpretation of

To interprete the slope of IS curve let us differentiate above equation totally, considering the value at 'g' as given.

$$dy = c'(dy - t'dy) + dg + i'dr$$

$$dy = c'(1 - t')dy + dg + i'dr$$

or $dy = c'(1-t')\,dy + i'\,dr$

or $[1-c'(1-t')]\,dy = i'\,dr$ Since $dy=0$

or $\frac{dy}{dr} = \frac{i'}{1-c'(1-t')}$

Here $i' < 0$

$0 < t' < 1$

$\Rightarrow 0 < (1-t') < 1$

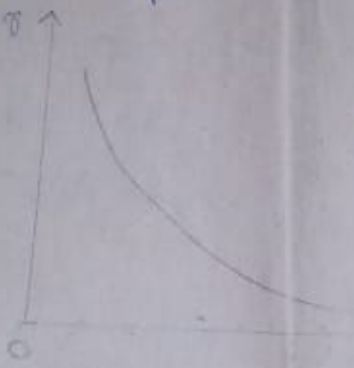
Again $0 < c' < 1$

$0 < [c'(1-t')] < 1$

$0 < [1-c'(1-t')] < 1$

$\therefore \frac{dy}{dr} < 0$

Thus the IS curve has the following shape



$r\uparrow \Rightarrow i\downarrow$ as $i' < 0$

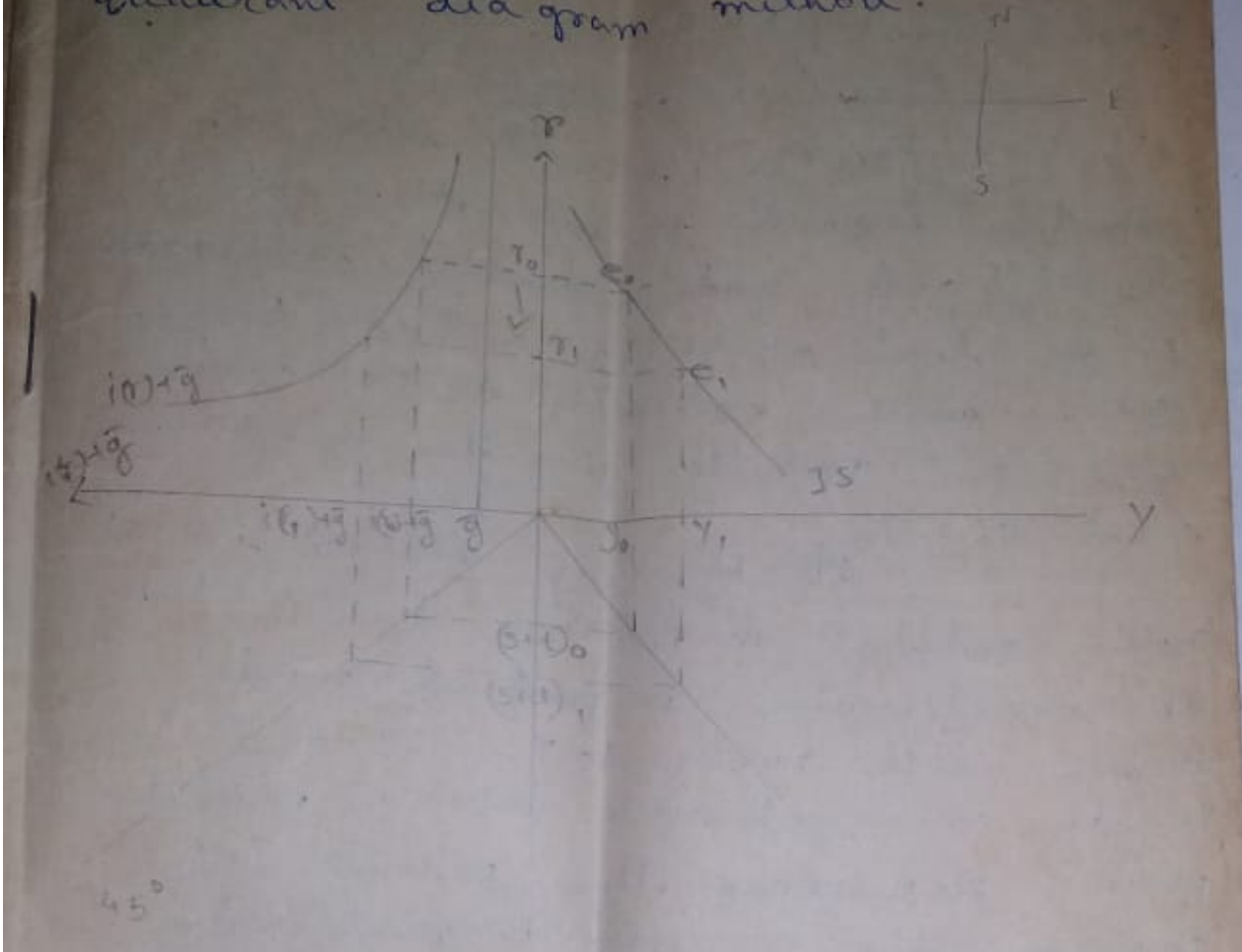
$\Rightarrow$ agg. dd $\downarrow \Rightarrow Y\downarrow$

logic. So, the above relation ensures the negative slope of IS curve. Because a higher level of interest rate reduces investment spending thereby reducing aggregate demand and thus finally the equilibrium level of income equilibrium.

Derivation Of IS curve

The IS schedule i.e market equili-

briating interest rate and income combination can be derived in several ways. Here we will opt the four quadrant diagram method.



In the north-west quadrant of the above figure $[i(\bar{0})+\bar{g}]$ curve gives the planned investment (as a decreasing function of interest rate) + a certain constant amount of govt. purchase. This curve has a slope $i' < 0$. In the south-east quadrant we draw a line showing planned savings and tax as an increasing function of income. In the south-west quadrant we have used a geometric trick by

drawing a 45° line that ensures the equilibrium condition in product market:

Planned investment + Govt. purchase = Planned saving + tax

For an interest rate r_0, effective demand in product market is $[i(r_0)+\bar{g}]$ and product market equilibrium ding level of saving and tax becomes (S+t). which corresponds to the income level Y_0. It will give the equilibrium point e_0.

If by any reason interest rate reduces to r_1 then to maintain the equilibrium in product market income will raise to Y_1. It will result an equilibrium point e_1 in [r-Y] plane. Repeating this process and joining the successive equilibrium points in (r-Y) plane the IS schedule will be obtained.

Due to fall in interest rate, investment demand will be raised. It will boost-up production and hence income in next period. People will save more since saving is an increasing function of income. Ultimately the product market will be in equilibrium.

Shift of I
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$i(r)+\bar{g}$

$[i(r)+\bar{g}]$

45° line

$y = c(y-t(y)) + i$

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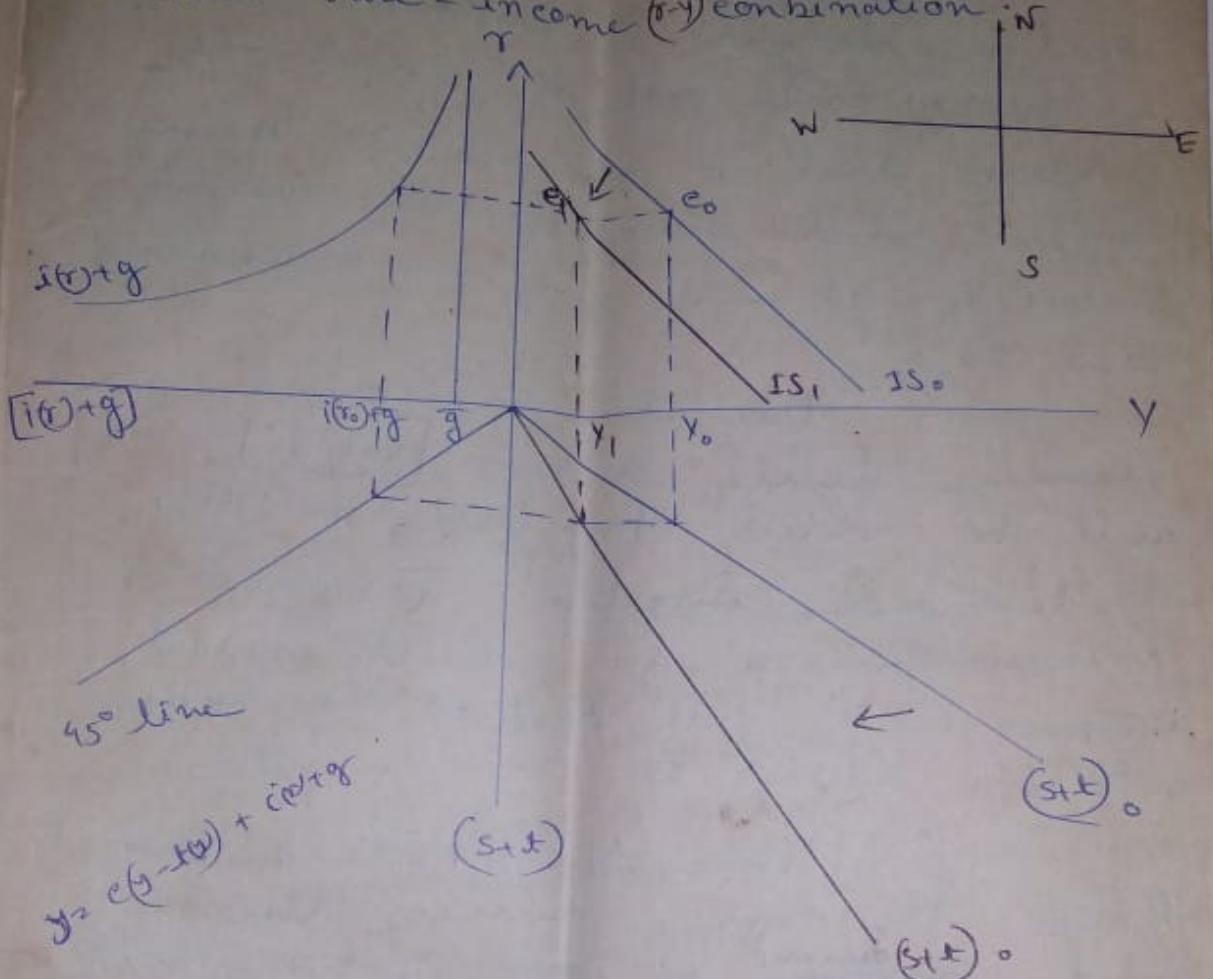
... of IS curve due to change in savings + tax :-

The IS schedule is the locus of product market equilibriating interest rate - income (r-y) combination.



In the north-west quadrant of the above figure [i(r)+g] curve gives the planned investment (as a decreasing function of interest rate) + a certain constant amount of govt. purchase. This curve has a slope i'(r). In south east quadrant we draw a line showing planned savings and tax as an increasing function of income. In the south-west quadrant we have used a line that ensures

the equilibrium condition in product market:

Planned investment + Govt. Purchase = Planned saving + tax.

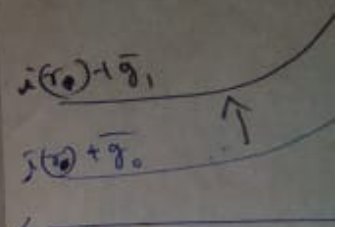
Let, for an interest rate r_0, effective demand in product market is $[i(r_0)+\bar{g}]$ and product market equilibrating level of savings + tax becomes $(s+t)_0$, which corresponds the level of income Y_0. It will give the equilibrium point e_0.

Due to an increase in desire to save [(s+t) function] will be rated from $(s+t)_0$ to $(s+t)_1$ in downward direction. To maintain an equilibrium in product market, income will fall to Y_1 at the same rate of interest r_0.

Thus, the increase in desire to save, reduces the total demand at any given interest rate. The IS curve will shift to leftward, giving a lower equilibrium income for any given interest rate.

Shift of IS curve due to change in constant amount of govt. purchases.

The IS schedule is the locus of product market equilibrating interest rate - income combination.



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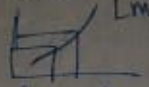
Since $R' > 0$ and $l' < 0$, $\frac{dr}{dY} > 0$

Hence LM curve is positively sloped.



Logic:- Due to increase in rate of interest speculative demand for money reduces as ($l' < 0$). With a fixed ~~real~~ level of real money balance the remaining part of the money demand function that is the transaction demand for money will raise to establish equilibrium in money market. Such increase in transaction demand is caused by an increase in income. So rate of interest and income are positively related to ensure money market equilibrium and hence LM curve is positively sloped.

Derivation of LM curve:—

LM schedule is the locus of all combinations of rate of interest and income each of which ensures equilibrium in money market, with a given money supply and a given price level. Here we will opt the four-quadrant diagram method:

We denote transaction demand for money by $R(Y)$, which $R' > 0$ and speculative demand for money by $l(r)$ where $l'(r) < 0$.

In the south-east quadrant of the figure, the line $R(Y)$ gives

rate income will increase from Y_0 to Y_1 to maintain the product market equilibrium. It will result a shift of the equilibrium point from e_0 to e_1.

Thus the IS curve will shift rightward or outward giving a higher equilibrium income, with a given rate of interest r_0.

LM CURVE

What is LM curve?

LM schedule is the locus of all combinations of rate interest and income each of which ensures equilibrium in money market, with a given money supply and a given price level.

We denote transaction demand for money by $k(Y)$, where $k' > 0$ and speculative demand for money by $l(r)$, where $l' < 0$. Equating the money demand function to the exogenously fixed real money supply $\left(\frac{M}{P}\right)$, we get,

$$\frac{M}{P} = k(Y) + l(r)$$

This relationship gives the LM schedule.

To interprete the slope of the LM schedule we differentiate the above equation totally.

$$0 = l' dr + k' dy$$

$$\Rightarrow -l' dr = k' dy$$

$$\Rightarrow \frac{dr}{dy} = -\frac{k'}{l'}$$

Since $k' >$

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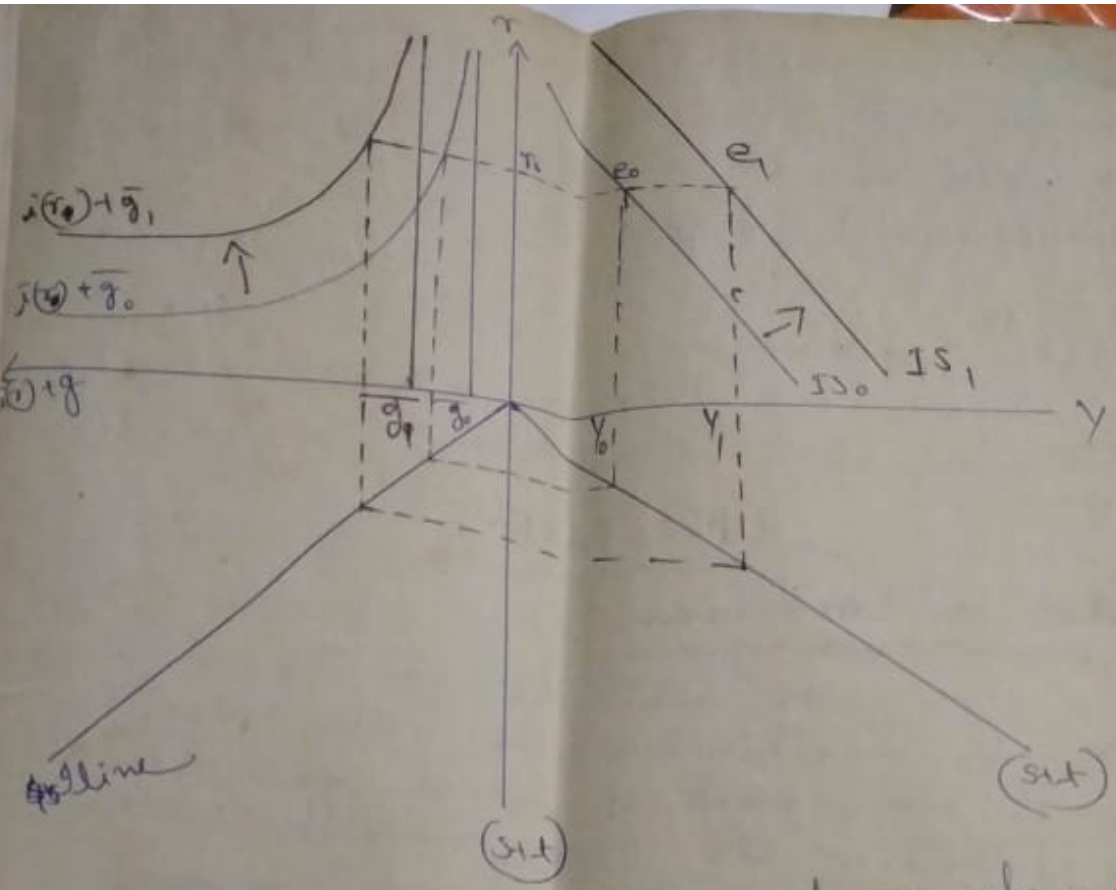


In the north-west quadrant of the above figure $[\bar{i}(r)+\bar{g}]$ curve gives the planned investment (as a decreasing function of interest rate) + a certain constant amount of govt. purchase. This curve has a slope $i' < 0$. In the south-east quadrant we draw a line showing planned savings and tax as an increasing function of income. In the south-west quadrant we have used a geometric trick by drawing a 45° line that ensures the equilibrium condition in product market.

Planned investment + Govt. purchase = Planned saving + tax.

Dual Due to an increase in govt. purchases at some given interest

transaction demand as an increasing function of income measured downward.

The north-west quadrant represents the speculative demand for money as a decreasing function of interest rate.

In the south-west quadrant we have used another geometric 'trick' which ensures the money market equilibrium condition, $\frac{M}{P} = k(Y) + l(r)$, i,e, equating total supply of money to the total demand for money;

This time we draw a line between the transaction demand axis and speculative demand axis at an angle 45° to each axis. Any point on this 45° line gives a transaction demand + speculative demand that just ~~demand~~ add up to total money supply.

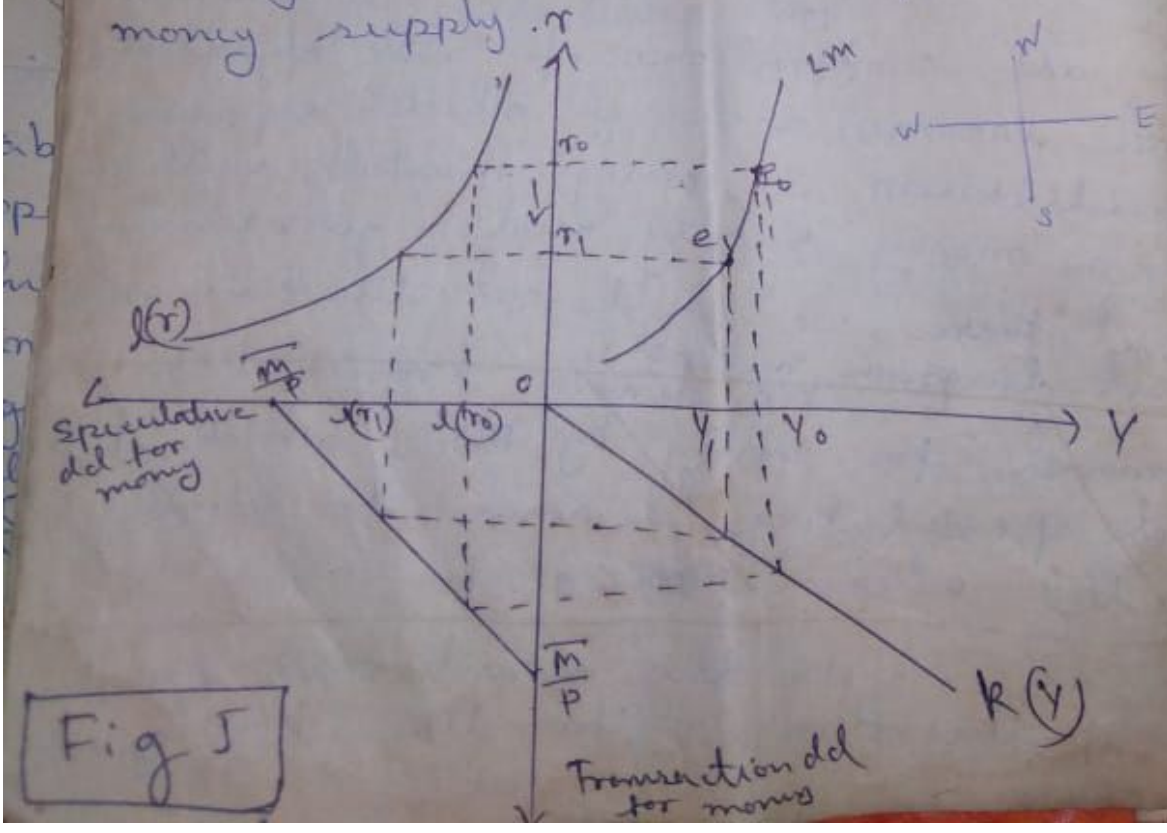


Fig J

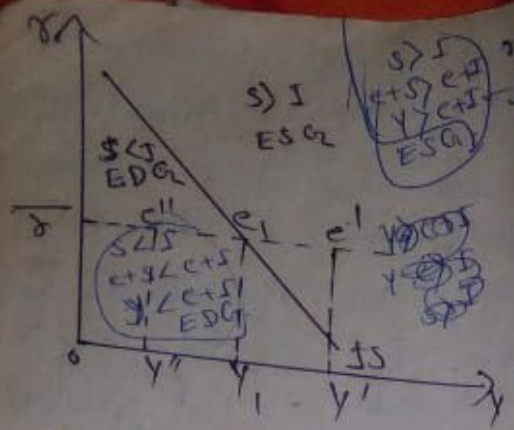
In the north-east quadrant of figure I they (r, Y) pairs maintain the money market in equilibrium. At given level of income Y_0, transaction demand for money can be measured from the k(Y) function. By following the line drawn in south-west quadrant the corresponding money market equilibriating level of speculative demand is also measured. This level of speculative demand shows interest rate r_0 maintaining the money market in equilibrium (at co) with income Y_0. In this way, starting from another income level Y_0 from Y_1 we can end-up with another money market equilibrium point e_1. Joining such successive equilibrium points we drive the LM ~~curve~~ schedule.

Stability of IS-LM equilibrium:

IS-LM equilibrium point occurs where IS curve and LM curve intersects ~~t~~ each other. Now to examine the stability at this equilibrium point let us consider first the case when economy deviates from the IS curve.

If the economy deviates right to IS, i.e., level of income at some given ~~level of interest~~ interest

IS ⇒ $i(Y)+\bar{g} = s+t$; To the right of IS ⇒ ~~interest~~ y is higher at some given level of income ⇒ $y\uparrow \Rightarrow s(Y)+t\uparrow > i(Y)+g \Rightarrow s > i$



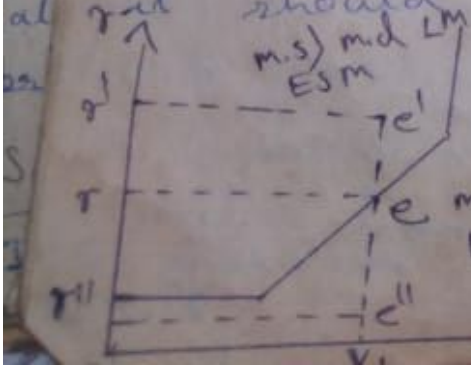
rate becomes higher than what it should be to maintain product market in equilibrium. That is savings become higher than investments. In other words, supply of income is greater than demand for income. In this situation producers cut their production and gradually move towards the IS curve.

Similarly, if the system moves left to the IS curve, their occurs excess demand for income which stimulates the producer to raise their production and the system moves towards the IS curve.

LM curve ⇒ at $y = y_1$ & $r = r_1$, $r \uparrow \Rightarrow l(r) \downarrow$

$\frac{M}{P} = l(Y) + L(r) \Rightarrow \frac{M}{P} > l(Y) + L(r) \Rightarrow ESM$

Next let us consider the case when economy deviates from LM curve. Also it is consider a disequilibrium condition in money market at $Y = Y_1$ when $r = r'$. That is economy is above the LM curve. Here the interest rate is higher than the level of what it should be to maintain money market equilibrium.



Corresponding speculative demand for money is less

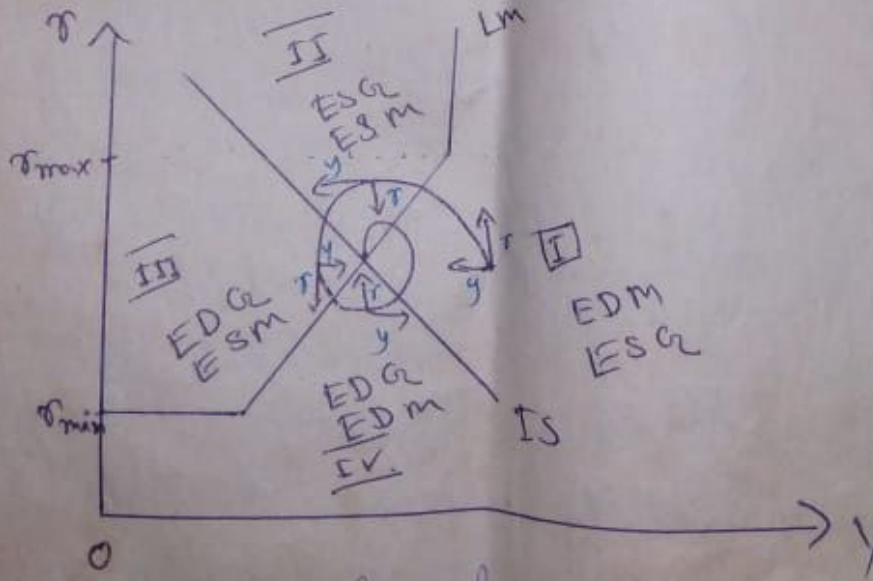
lastly, level of income also fall fall

IS-LM Equilibrium:-

Thus at $Y = Y_1$ and $r = r'$, there occur excess demand for bonds, following which bond price goes up and rate of interest starts to fall

It is continues, interest rate r' reaches to the level r, i.e, economy reaches to LM schedule. If the economy would go below the LM schedule there would occur excess demand in money market, in other words excess supply of bonds following which bond price would fall and rate of interest would rise until economy comes back to LM-curve.

Thus the product market force or income can be represented horizontally and the money market force or interest rate can be shown vertically in same figure.



We divide the surrounding area of intersection point between

money as a decreasing function of interest rate.

In the south-west quadrant we have used another geometric 'trick' which ensures the money market equilibrium condition, $\frac{M}{P} = k(Y) + l(r)$, i.e. equating total demand for money to the total supply of money.

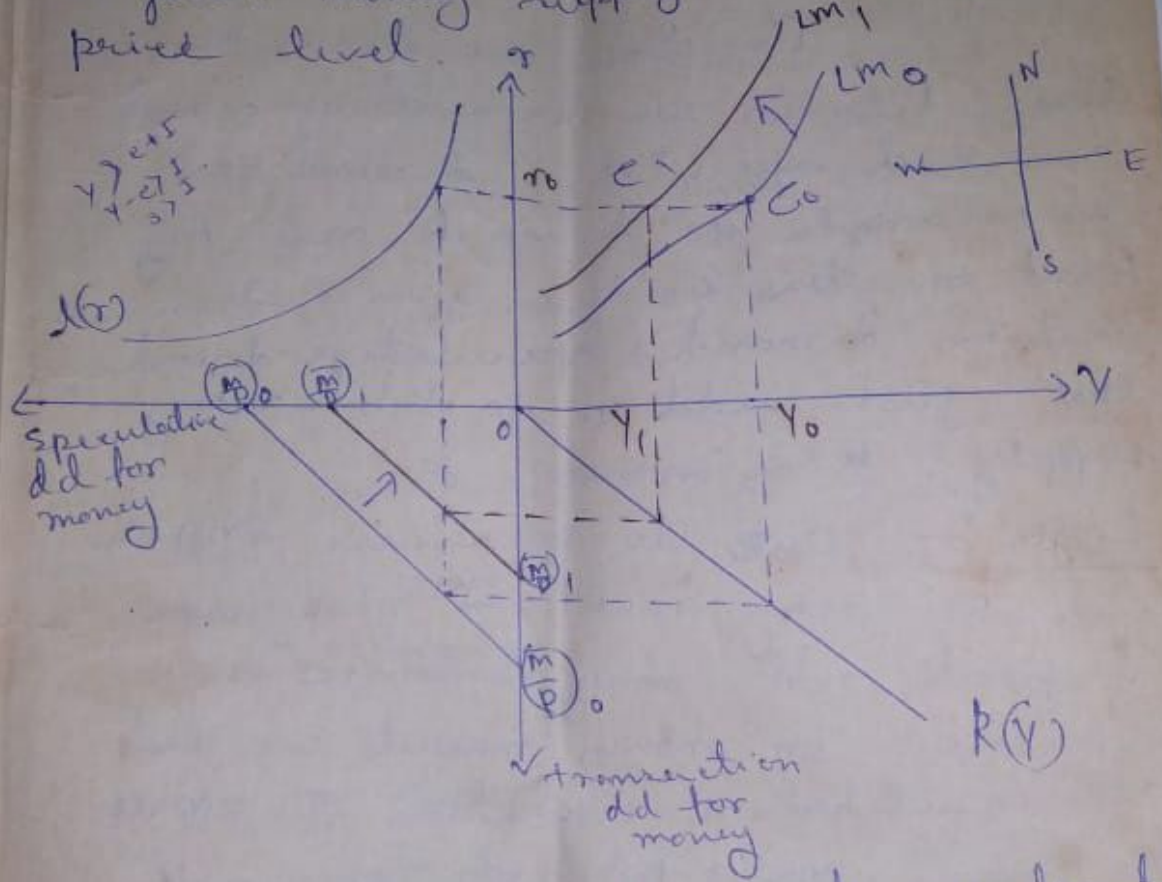
This time we draw a line between the transaction demand axis and speculative demand axis at an angle 45° to each axis. Any point on this 45° line gives a transaction demand + speculative demand that just add up to total money supply.

Logic :- Due to increase in price level in money market, since money supply is fixed real money balance will decrease. In money market we know the equilibrium condition $\frac{M}{P} = k(Y) + l(r)$, So here agg supply of money will less than agg demand for money. So there is excess dd in money mkt. As a result rate of interest will increase and investors will invest less. Effective dd will fall and production also fall and

than its actual level of speculative dd for money required for equilibrating level. /* [illegible]

Shift of LM curve due to change in real money supply:-

LM curve is the locus of all combinations of rate of interest and income each of which ensures equilibrium in money market, with a given money supply and a given price level.



In the south-east quadrant of the diagram of the above figure, the line K(Y) ~~from~~ gives transaction demand as an increasing function of income measured downward.

The north-east quadrant represents the speculative demand for

IS-LM curve in four zones.

Zone I — Excess supply of income and excess demand for money

Zone II — Excess supply of income, Excess supply of money

Zone III — Excess demand for income, Excess supply of money

Zone IV — Excess demand for income, Excess demand for money.

Let the economy initially be situated in zone I. In this zone due to the resultant forces as shown in figure above, on product market and money market economy moves anticlockwise and gradually reaches to LM. There money market is in equilibrium, but still economy is out of IS schedule. In zone II again the resultant force occurs and the economy reaches to IS.

In this way the anti-clockwise movement continues and the divergence from equilibrium point gradually diminishes and the economy ultimately reaches to the equilibrium point. So IS-LM equilibrium is a stable equilibrium.