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IS-LM Model
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Goods and Money Markets

Links between Goods and Money Markets:-

By **Goods Market**, we mean all the buying and selling of goods and services.

By **Money Market**, we mean the interaction between demand for money (M_d) and the supply of money (M_s) (the size of the money stock) as set by the Federal Reserve working through the banking system.

A. The goods market determines income, which depends on planned investment (I_p). Planned investment in turn depends on the interest rate (r) (which is determined in the money market).

B. The money market determines the interest rate where $M_d = M_s$. The demand for money in the money market is affected by income (which is determined in the goods market).

Thus:

If something changes in goods markets and affects Y , this in turn will affect M_d and hence affect r .

If something changes in money markets and affects r , this in turn will affect I_p , and hence affect Y .

The links between these two markets are:

There is a link between investment and interest rate.

Investment is a negative function of rate of interest i.e., $I = I(r)$ where as r is determined in the money market. Thus, money market influences goods market.

Another link is between income and demand for money.

Demand for money (keeping interest rate constant) depends on income where as income is determined in the goods market. Thus, goods market influences money market.

These two links can be shown in the following form:

Goods Market	Money Market
Y(income)=C+I (aggregate output) Or S=I	Demand for money(Md)=Supply of money(Ms)
Determines Y	Determines r
I depends on r	Md depends on Y

Goods Market Equilibrium:

The Derivation of the IS Curve:-

The goods market is in equilibrium when aggregate demand (C+I) is equal to income (Y) and planned Investment (I) is equal to planned saving (S) which mean equilibrium in Product market Requires.

$$Y=C+I$$

$$S = I$$

Equilibrium between $S = I$ is influenced by consumption, saving and investment function.

Following equations explains goods market equilibrium

Consumption function $C = C(Y)$ (+ve function of income)

Investment function $I = I(r)$ (-ve function of rate of interest)

Equilibrium situation is $Y = C(Y) + I(r)$

From saving investment approach, following equilibrium is obtained at

Saving function $S = S(Y)$ (+ve function of Income)

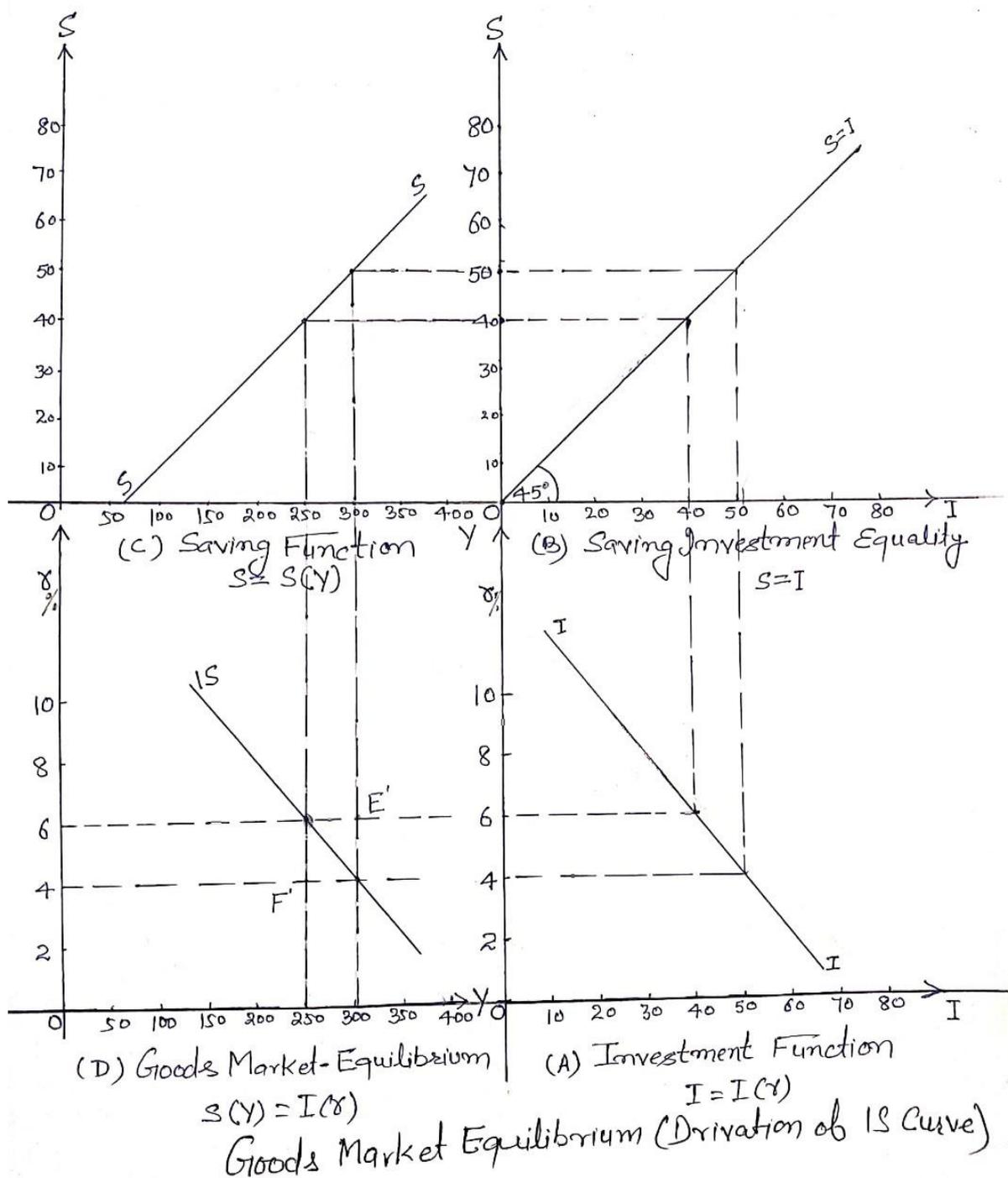
Investment function $I = I(r)$

Equilibrium situation is $S(Y) = I(r)$

Above sets of equations have been graphically presented in below figure.

In this figure

Part A provides investment spending schedule. It indicates that investment spending is a negative function of rate of interest. If rate of interest rises, investment falls and vice versa.



Part B shows planned investment is equal to planned savings which is expressed by 45° angle line starting from the point of origin. Planned investment is measured along X-axis and planned saving along Y-axis.

Part C showing saving function that savings varies directly with income

Part D showing IS curve i.e goods market equilibrium.

Let us consider that interest rate is 6% in Part A of the figure. It shows investment is Rs. 40 per unit. In part B to justify equality between S and I, saving should be equal to Rs. 40 as shown along Y-axis. In part C saving will be Rs. 40 only at the level of income Rs. 250. Thereafter, bringing together Y of Rs.250 from part C and R of 6% from part A yield one combination of Y and r at which $S=I$.

Let us consider linear rate of interest 4 % then investment in Part A will increase to Rs. 50 which yield an income level of Rs.300 in part C. Therefore Y of Rs. 300 and r of 4% is another combination of IS curve. Likewise, we can trace out other combinations also. If we connect all these points we get IS curve.

There is not a single level of income at which $S=I$ but separate level for each separate rate of interest rate. Higher will be the r, lower will be income level at which $S=I$. It implies that higher r signifies low I. Lower I through multiplier effect means a low Y. Alternatively low Y means low S. Goods market requires $S=I$. Low S means low I. A low I is because of higher r. Every combination on IS curve are equally possible equilibrium combination of Y and r in goods market.

Identifying every equilibrium combination does not imply that actual combination in every period will be one and same. There may be disequilibrium in products market.

Let us consider actual combination of Y Rs. 300 and r is 6% as shown by point E' in part D of the figure. At the level of income Rs. 300. S will equal to I only at the rate of interest 4%. Given income level of Rs. 300 signifies at an rate of interest 4%, S must exceed I as I will be smaller at higher than 4% rate of interest but S will be unchanged S depend on Y which remains unchanged of Rs. 300. Combination of $Y=300$ and $r=6\%$ is also disequilibrium from another angle that is at $r=6\%$, S will equal to I only at an income level of Rs. 250. So at available combination of Y & r (at point E') S must be greater than I as S will be more at the income level of Rs 300, but I will remain same. I depends on r which is here unchanged at 6%. Any point on right of IS curve shows disequilibrium i.e. S is more than I and Y is more than $C+I$.

Similarly, any point on left of IS curve also shows disequilibrium where $I>S$ and $C+I >Y$. Alternately, aggregate spending on the product is more than aggregate output of the goods.

Money Market Equilibrium

The derivation of LM curve:

The term money market equilibrium implies equality between supply and demand for money.

According to the opinion of Keynes, demand for money for transaction and precautionary motive is direct function of the level of income alone i.e.

$$M_t = k(Y)$$

Demand for money for speculative motive is inverse function of interest rate alone i.e

$$M_{sp} = h(r)$$

Total demand for money is

$$M_d = M_t + M_{sp} = k(Y) + h(r)$$

Supply of money M_s is thus exogenously determined. It may be written as

$$M_s = M_d$$

Where, M_d = nominal stock of money determined by the monetary authority.

It provides three equations to cover up money market:

Demand for money $M_d = k(Y) + h(r)$

Supply of money $M_s = M_d$

Equilibrium condition $M_d = M_s$

Below figure express the money market equilibrium

Part A indicates speculative demand for money as negative function of r .

Part B shows that total amount of money supply is Rs. 100 all of which will be held for transactions or speculative purpose. Point along the line shows possible ways of money supply will be divided between M_t and M_{sp} .

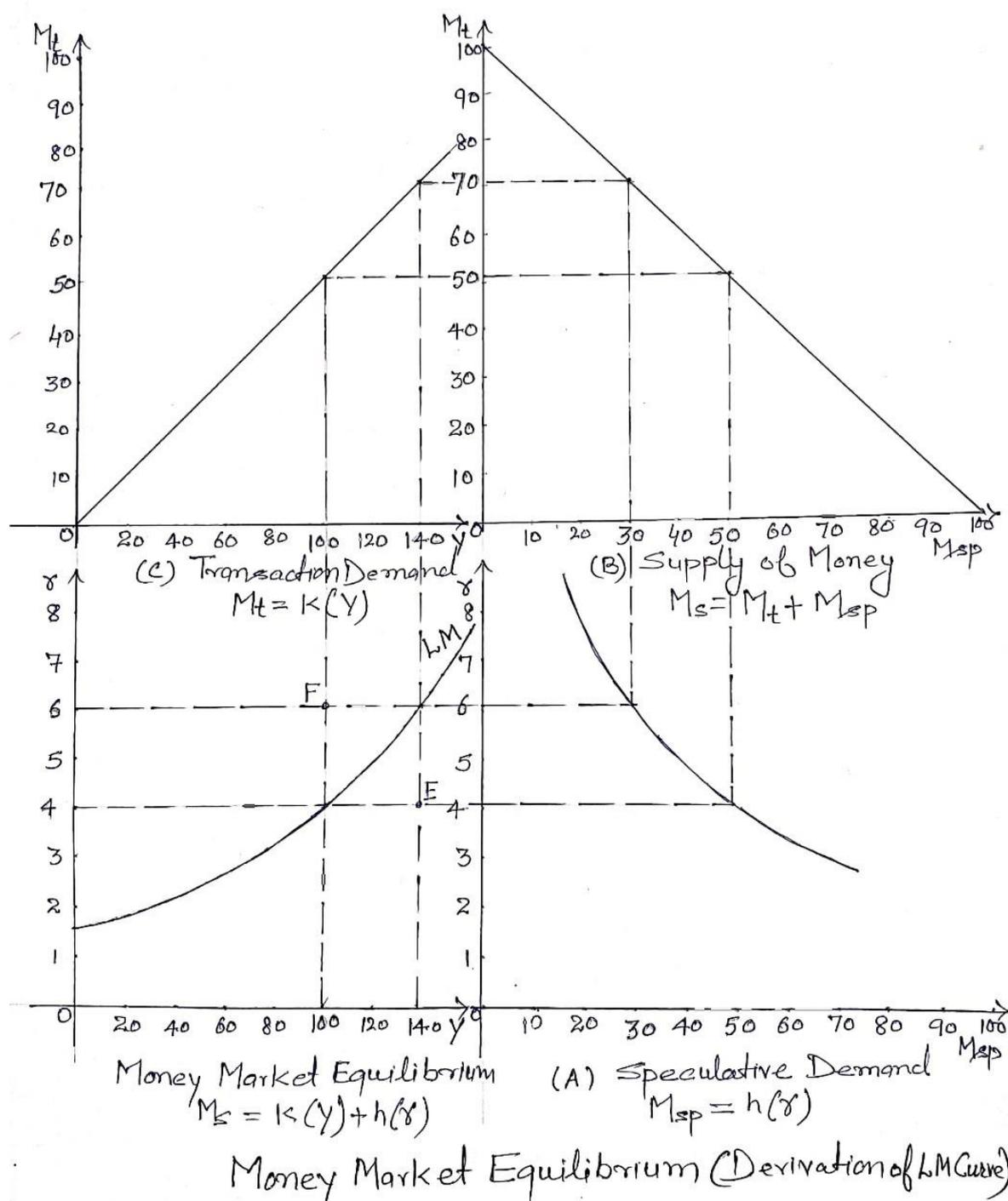
Part C indicates quantity of money required for transaction purpose which shows that at every level of income, consumption $C = 1/2$ (50%) Y

Part D shows LM curve

Let us consider

In Part A, at 6% interest rate at which public will hold only Rs 30 for speculative demand.

In part B, by subtracting Rs. 30 of speculative demand from total money supply of Rs. 100, balance of Rs. 70 for transaction and precautionary motive, amounts consistent with income level of Rs 140 in Part C.



Part D links Y of Rs. 140 from Part C and r of 6% from part A yields one combination of Y and r at which $M_d = M_s$, while there is equilibrium in money market. If we consider lower interest rate of 4%, in that situation Part A shows speculative demand of Rs 50 and Part B shows transaction balance of Rs 50 which is against the income level of Rs 100 as shown in Part C. It provides another combination of Y and r with Rs. 100 and 5% at which $M_d = M_s$

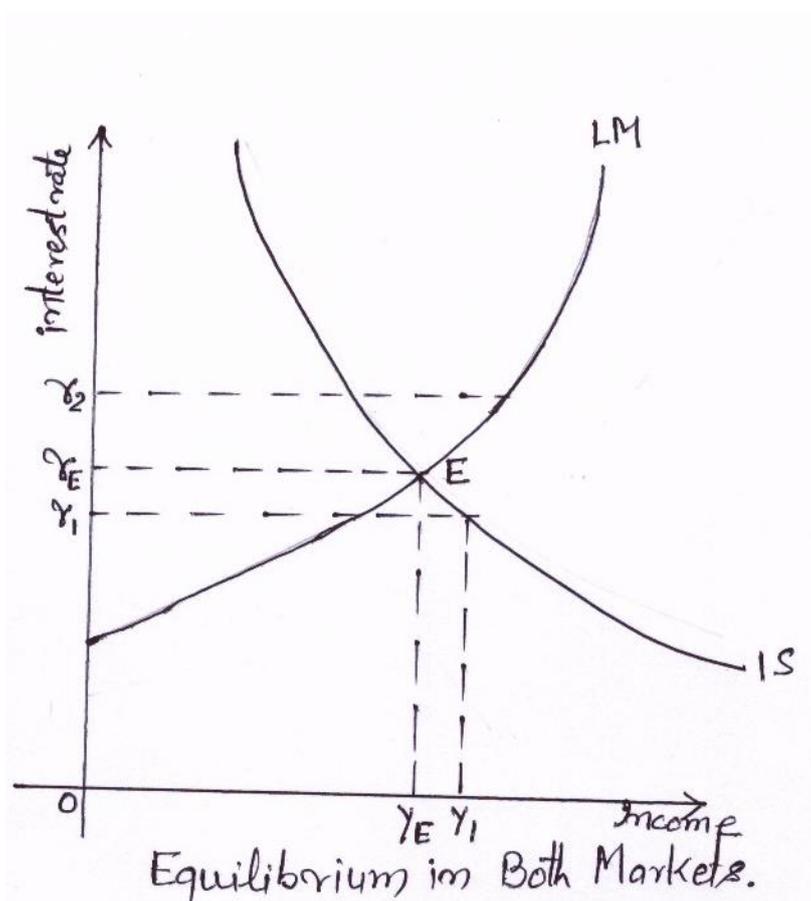
In Part D, all such combinations are determined and LM curve is drawn. Shape of LM curve is sloping upward to right.

There may also be disequilibrium in money market. For instance if we consider combination of Y of Rs. 140 and r of 4% at point E where $M_d = M_s$. If the level of income of Rs. 140 where $M_t =$ Rs. 70 with r of 4% where $M_{sp} = 50$ is combined, in that case M_d (Rs 70 + Rs 50) $> M_s$ which shows disequilibrium in the money market.

Similarly, point F shows disequilibrium condition. At this point, $M_s > M_d$ indicating other possibilities of disequilibrium.

Simultaneous Equilibrium in Goods and Money Market

The General Equilibrium in terms of IS and LM curves is shown in below figure where both the curves are plotted on the same axes, the equilibrium level of income, Y_E , and the equilibrium interest rate, r_e , are determined simultaneously. This is known as the synthesis of monetary analysis and income analysis or macroeconomic general equilibrium. Point E is the (only) point of general equilibrium for both the markets. Point E is a stable equilibrium point.



To demonstrate stability, let us consider $r_1 - Y_1$ combination. Since this combination is on the IS curve, the product market is in equilibrium while money market is not. At this combination, there is an excess demand for money ($M_d > M_s$). To meet this excess demand, people will go on selling bonds. This will depress bond prices and raise interest. As interest rate increases, there are repercussions in the product market.

Now, following an increase in interest rate, investment declines and, as a consequence, income declines. So, interest rate and national income will go on changing until point E is reached, if the equilibrium is to be a stable one. This occurs only at r_e and Y_E .

Similarly, any $r - Y$ combination above r_e (say, Or_2) will exhibit equilibrium in the money market, but disequilibrium in the product market. Now, product market will experience a deficiency in aggregate demand.

This causes income to decline. As income declines, there are repercussions in the money market. Now, demand for money will decline as income declines. So, rate of interest must decline. If the equilibrium is stable, r and Y tend to change until point E is reached. Thus, E is a stable equilibrium point. One thing should be borne in mind—to have stability in equilibrium, the slope of the IS curve must be less than that of the LM curve.

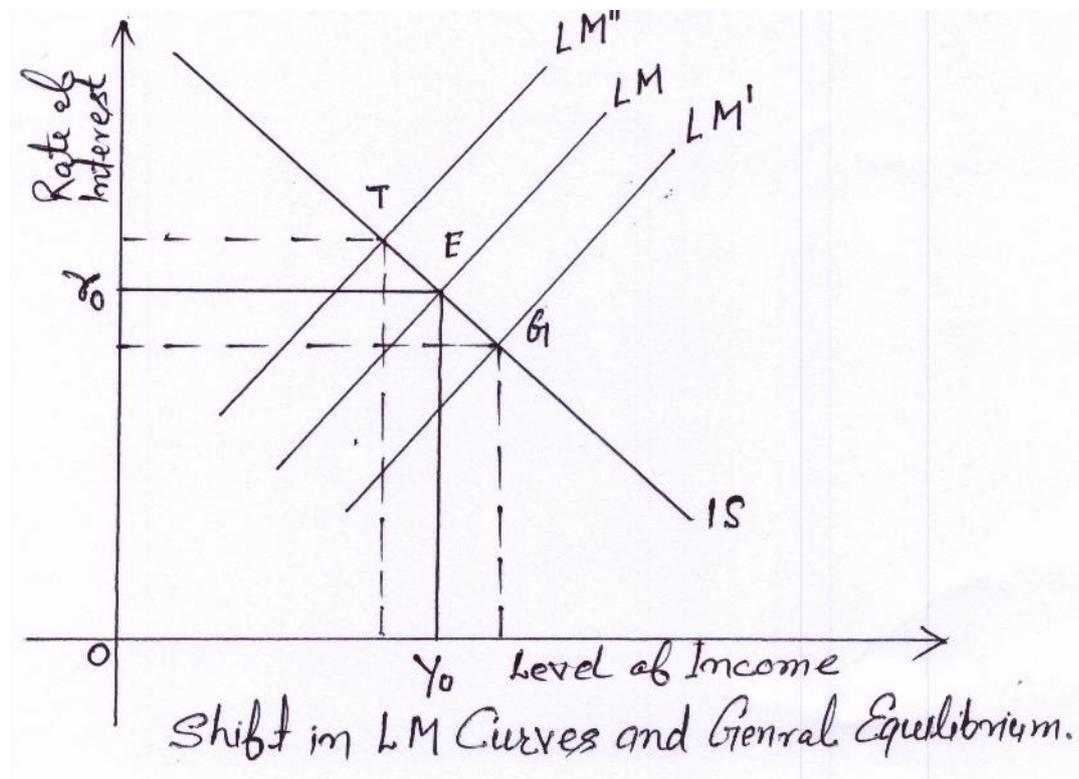
Shifts in IS and LM Curves and General Equilibrium

The shifts in IS and LM functions can bring about changes in the equilibrium rate of interest and level of income. The IS function can shift on account of changes in investment, saving, taxes and government spending. The LM function can shift because of the change in Money Supply and Money Demand (liquidity preference). The change in equilibrium may also be caused by the simultaneous changes in both IS and LM function. Lets us see how shifts in IS and LM curves effect the equilibrium r and Y

Shift in LM Curves and General Equilibrium:

Let us first consider that if the supply of money is increased by the action of the Central Bank. Given the liquidity preference schedule, with the increase in the supply of money, more money will be available for speculative motive at a given level of income which will cause the interest rate to fall.

As a result, LM curve shifts to the right to the position LM' , and with IS schedule remaining unchanged, new equilibrium is at point G corresponding to which rate of interest is lower and level of income greater than at E.

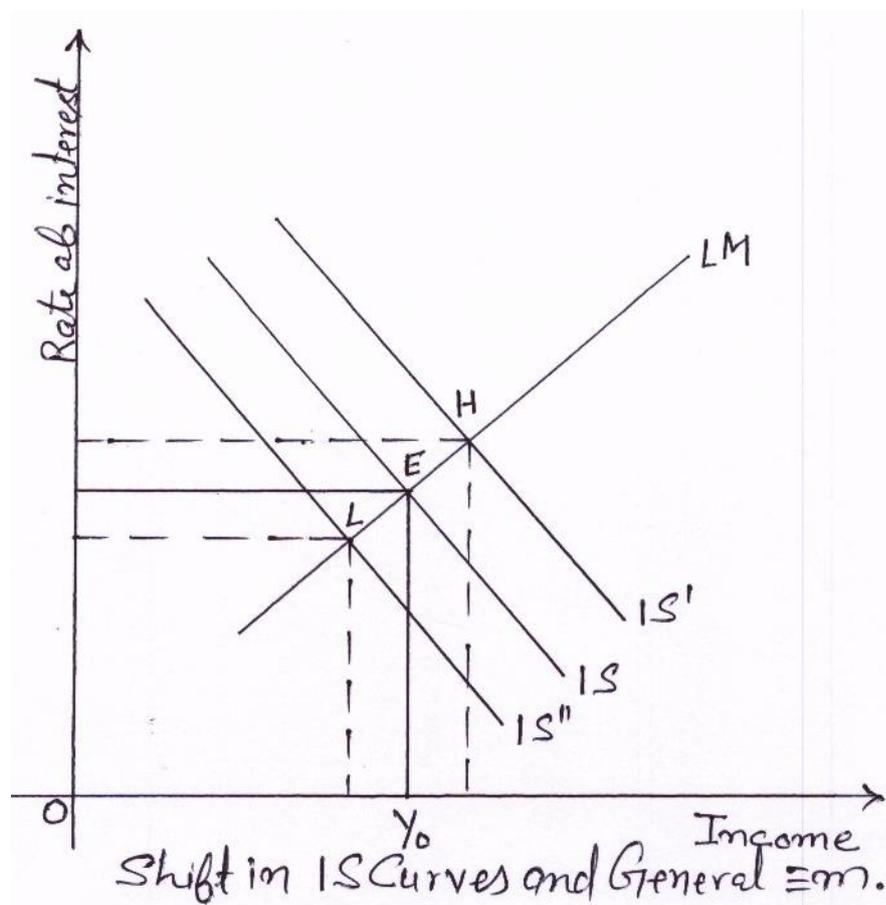


Now, suppose that Central Bank of the country takes steps to reduce the supply of money. With the reduction in the supply of money, less money will be available for speculative motive at each level of income and, as a result, the LM curve will shift to the left of E, and the IS curve remaining unchanged, in the new equilibrium position (as shown by point T in Fig.) the rate of interest will be higher and the level of income smaller than before.

Shift in IS Curves and General Equilibrium

Let us consider what happens to the rate of interest when desire to save (propensity to consume) changes. When people's desire to save falls, that is, when propensity to consume rises, the aggregate demand curve will shift upward and, therefore, level of national income will rise at each rate of interest.

As a result, the IS curve shifts rightward to IS' . With LM curve remaining unchanged, the new equilibrium position will be established at H corresponding to which rate of interest



as well as level of income will be greater than at E. Thus, a fall in the desire to save has led to the increase in both rate of interest and level of income.

On the other hand, if the desire to save rises, (propensity to consume falls), aggregate demand curve will shift downward which will cause the level of national income to fall for each rate of interest and as a result the IS curve will shift to the left.

With this, and LM curve remaining unchanged, the new equilibrium position will be reached to the left of E, say at point L (as shown in Fig.) corresponding to which both rate of interest and level of national income will be smaller than at E.