UNIT 11- IS-LM MODEL

UNIT STRUCTURE

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11.1 LEARNING OBJECTIVES

After going through this unit, you will be able to:

- discuss the term 'IS' and 'LM' in the context of goods market and money market equilibrium
- derive the IS curve from investment-saving equality along with rate of interest and level of income
- describe the shift of IS curve
- derive the LM curve from the equality of money demand and money supply along with rate of interest and level of income
- describe the shift of the LM curve
- explain the interaction between IS and LM curves.

11.2 INTRODUCTION

In the earlier unit, we have discussed about investment function and MEC. From that unit you have already known about the relationship between rate of interest and investment. In this unit we will deal with the investment-saving (IS) function and money demand –money supply (LM) function and their derivation with the help of rate of interest and level of Income. We shall also discuss the slope and shift of IS-LM and the General equilibrium of IS-LM Model.

The level of national income in simple Keynesian Model is determined by Goods market equilibrium and the rate of interest is determined by money market equilibrium. The Goods or real market is in a state of equilibrium when saving and investment are equal or Aggregate demand for goods just equals the Aggregate Supply. The Interaction between saving and Investment in Goods market is reflected in IS curve. Again Equilibrium in money market implies the equality between demand for money and supply of money. The interactions between them are reflected in LM curve.

11.3 IS CURVE

As we have already stated, IS curve reflects the interaction between saving and investment in the goods market. The term IS is the shorthand expression of the equality of Investment-Saving which represents the goods market equilibrium . IS curve is the locus of all the combinations of rate of interest and level of income at which saving and investment are equal. In other words, IS Curve is a curve which explains the relationship between a family of saving schedule and investment schedule.

11.3.1 Derivation of IS Curve

In the derivation of IS curve, we seek to find out the equilibrium level of national income as determined by equilibrium in Goods market by a level of investment determined by a given rate of interest. Thus, IS curve relates different equilibrium levels of national income with various rate of interest. As we know that saving is a

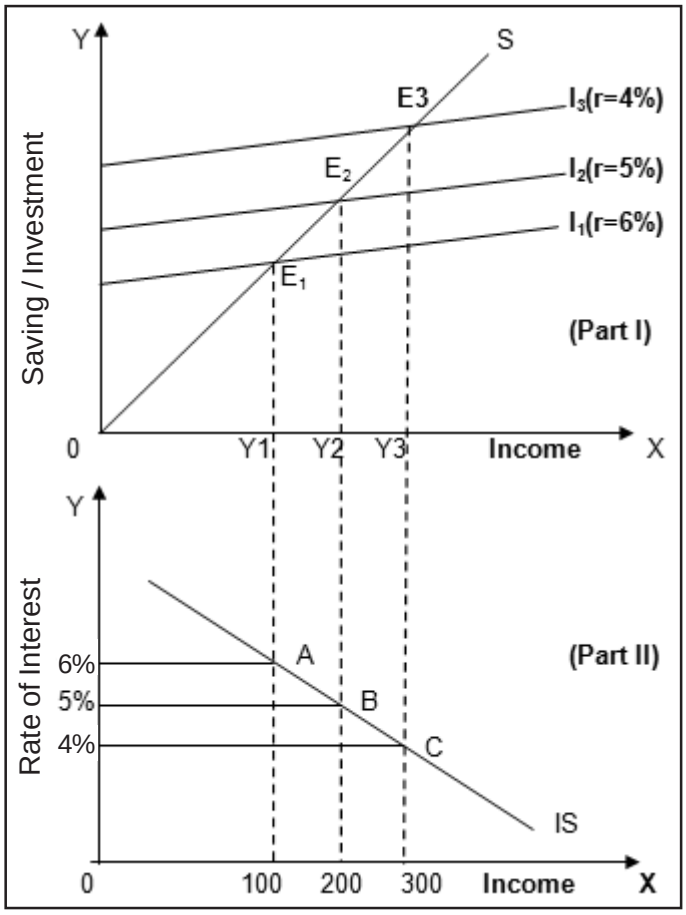
direct function of level of income and investment is a decreasing function of rate of interest.

i.e. S=f(Y) and I=f(r)

Thus, the goods market is in equilibrium when S=I at different levels of income and rate of interest which is reflected in IS curve. Thus IS curve shows all the combinations of rate of interest and level of income at which saving is equal to investment. It is also known as goods market or real market equilibrium.

The derivation of IS curve is depicted in Figure 11.1.

Figure 11.1: Derivation of IS Curve



In Part- I of the above figure, OS represent the Saving curve which shows saving as an increasing function of income. I_1, I_2 and I_3 represent the investment curve. Let us assume that at different rate of interest i.e. at 4% , 5% and 6%, the level of income is 100 crores, 200 crores and 300 crores respectively.

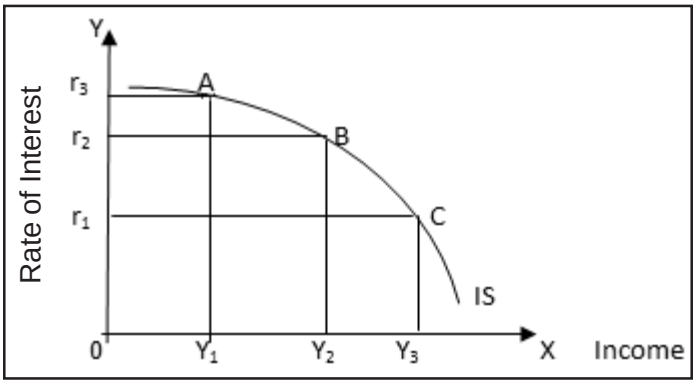
Now at 5% interest rate, saving-investment equality establishes at point E_2 where level of income is $0y_2$. If the rate of interest is reduced to 4%, the investment curve will shift upward to I_3 and the new equilibrium point is established at point E_3 where level of income is $0Y_3$. Similarly when interest rate rises to 6%, the investment curve will shift downward to $I_{1.}$ Now a new equilibrium point is established at point E_1 where level of income is $0Y_{1.}$

In Part II of the above figure, IS curve is derived by making the level of income at various interest rates. Each point on the IS curve represents a level of income at which S=I at various interest rate. Thus by connecting the corresponding point of $E_{1,}$ $E_2$and E_3 i.e. A, B,C we have the IS curve. Thus IS curve slopes downward from left to the right because as interest rate falls, investment increases and thus income increases.

11.3.2 Slope of IS Curve

As seen above, a lower rate of interest is associated with higher level of national income and vice versa. This makes the IS curve to slope downward, which relates the level of income with rate of interest. The IS curve may be flat or steep depending on the sensitiveness of investment to changes in the rate of interest. If investment is very sensitive to the rate of interest, then IS curve will be very flat. Again if investment is not very sensitive to the rate of interest, then IS curve will be relatively steep. This is shown in Fig 11.2

Figure 11.2: Slope of IS Curve



In Figure 11.2, segment AB of IS curve is flat because a small fall in the rate of interest from r_1 to r_2 leads to a proportionately large change in income from Y_1 to Y_2. Again BC segment of IS curve is relatively steep, as a large fall in rate of interest from r_2 to r_3 leads to smaller change in income from Y_2 to Y_3. Any further fall in the rate of interest from r_3 will lead to no change in income because IS curve is vertical in that range. It is interest elastic.

The slope of the IS curve basically depends on two factors, viz., elasticy of investment curve and the size of the multiplier. If the size of the multiplier is large, income is more sensitive to changes in interest rate and thus the IS curve becomes flatter. On the other hand, smaller the value of multiplier, the smaller will be increase in the level of income given the investment caused by a given fall in the rate of interest. Thus in case of smaller size of multiplier IS curve will be more steep. Again, higher the investment elasticity, flatter will be the IS curve and lower is the elasticities, steeper will be the IS curve.

11.3.3 Shift of IS Curve

The position of IS curve depends upon the magnitude of investment and saving. The IS curve will have a shift to right if the investment function increases or saving function decreases. Such a shift can be possible if there are more and more inventions, discoveries, technological and other innovations and if there are better expectations of profit.

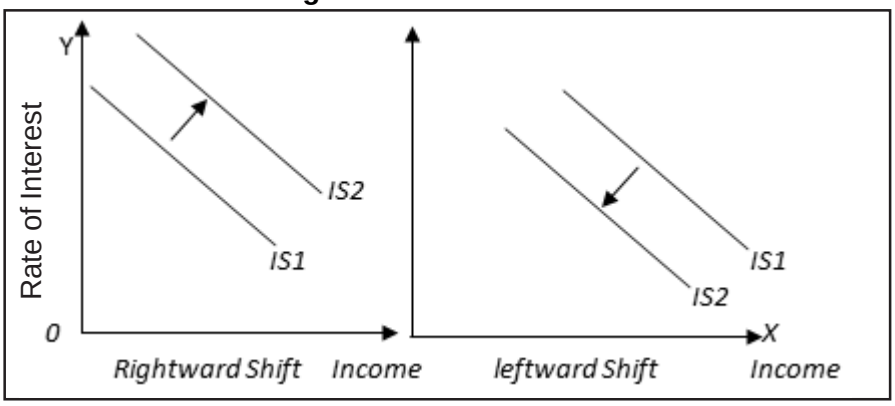
Similarly, the IS function is likely to shift to the left when saving function increases or investment function decreases. This shift in the IS function may be caused by changes in ***fiscal policy***. An expansionary fiscal policy will shift the IS curve to the right, and a contractionary fiscal policy will shift to the left.

The shift of IS function has been shown in the Figure 11.3.



Fiscal policy is the means by which a government adjusts its spending level and tax rate to influence a nation's economy. The changes in fiscal policy includes govt. spending, taxes etc.

Figure 11.3: Shift of IS curve





LET US KNOW

We should know about the term Goods Market, Saving & Investment. By goods market, we mean all the buying & selling of goods & services. The goods market determines income which depends on planned investment. Planned investment in turn depends on the interest rate.

In a Keynesian sense saving is whatever left over after income is spent on consumption of goods & services. Again investment is what is spent on goods & services that are not consumed but are durable.



CHECK YOUR PROGRESS

Q 1: State whether the following statements are True (T) or False (F):

(i) IS is the shorthand expression of saving & income. (T/F)

(ii) The IS curve shift to the left due to the changes in fiscal policies. (T/F)

Q 2: Define IS curve. Why does the IS curve slope downward? (Answer in about 40 words)

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Q 3: Write about the factors responsible for the slope of IS curve. (Answer in about 40 words)

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11.4 LM CURVE

As we have already stated, LM curve reflects the interaction between demand for and supply of money in money market. In the term LM, 'L' denotes money demand and 'M' denotes money supply. Thus in equilibrium in money market L=M or $M_d=M_s$.

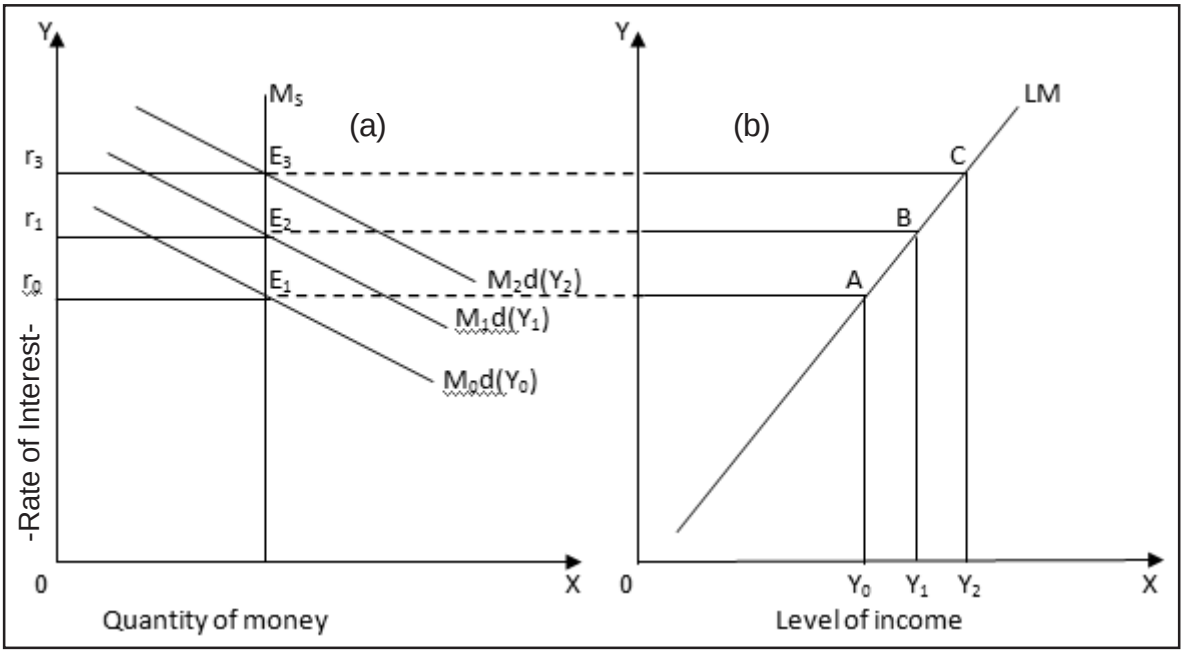
The demand for money $L=L_t+L_S$,where L_t is the transaction demand for money which is a direct function of level of income, i.e. $L_t=f(Y)$. Again L_s is the speculative demand for money which is a decreasing function of the rate of interest, i.e. $L_s=f(r)$. Thus in money market equilibrium $M= L_t(Y) + L_s(r)$.

11.4.1 Derivation of LM Curve

The LM curve can be derived from the Keynesian theory from its analysis of money market equilibrium. The LM curve shows all the combinations of interest rate and levels of income at which the demand for and supply of money are equal. In other words, the LM schedule shows the combinations of interest rate and levels of income where the demand for money and supply of money are equal such that the money market is in equilibrium.

The LM tells what the various rate of interest (given the quantity of money and the family of demand curve for money) at different levels of income. But money demand curve alone cannot tell us what exactly the rate of interest will be. This has been explained with the help of Figure 11.4.

Figure 11.4: Derivation of LM Curve



In Figure 11.4(a) and (b) we have derived the LM curve from a family of demand curve for money. As income increases, money demand curve shift upward and therefore the rate of interest rises which equates the supply of money with demand for money.

In Figure 11.4(a) a family of demand curve is shown by M_0d, M_1d and M_2d at income levels Y_0,Y_1 and Y_2.These curve together with the perfectly inelastic money supply curve M_S give us the LM curve.

If the level of income is Y_0, the demand for money (M_0d) equals to supply of money at interest rate r_0. At Y_1 income level, the demand for money (M_1d) and supply of money are equal at r_1 rate of interest. Similarly at Y_2 income level, the demand for money (M_2d) is equal to supply of money at interest rate r_2. The Supply of money, the demand for money and the rate of interest provide data for LM curve as shown in Figure 11.4(b). Thus joining the corresponding points of E_1, E_2, and E_3, i.e. A,B and C we get the LM curve. This curve relates different income levels to various interest rates.

11.4.2 Slope of LM Curve

The slope of LM curve depends on two factors, viz., the responsiveness of demand for money to the change in income, and the responsiveness of demand for money to the change in rate of interest.

In Figure 11.4 (b), it can be noticed that the LM curve slopes upward to the right. This is because with higher level of income, demand curve for money (M) is higher , which in turn leads to higher rate of interest. This implies that rate of interest varies directly with income. There are two factors on which the slope of LM curve depends, first, the responsiveness of demand for money to the changes in income. The greater the extent to which demand for money for transaction motive increases with the increase in income, the higher the rise in the rate of interest and consequently steeper the LM curve.

The second factor which determines the slope of the LM curve is the elasticity or responsiveness of demand for money to the changes in the rate of interest. The lower the elasticity of demand for money for speculative motive with respect to the changes in the rate of interest, steeper will be the LM curve. On the other hand, if the elasticity of money demand to the changes in the rate of interest is high, the LM will be flatter or less steep.

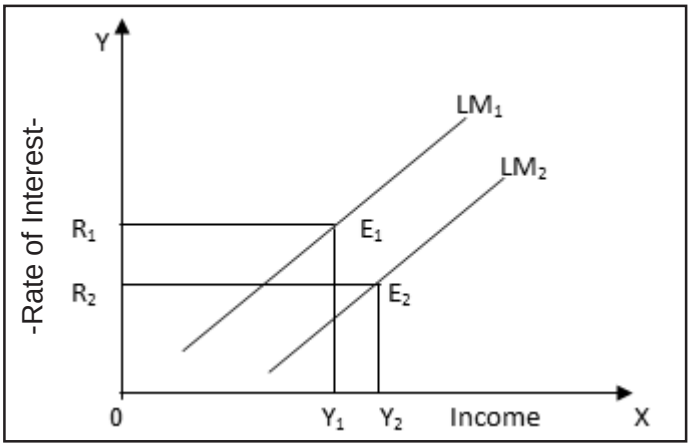
11.4.3 Shift LM Curve

The shift in the LM curve is brought about by the variations in the supply of money and the shift in money demand function. LM curve will shift to the right, if the supply of money is increased or the supply of money function shift to the right or alternatively, if the money demand function shift to the left.

A decrease in the demand for money means a reduction in the quantity of balance demanded at each level of income and interest rate. Such a decrease in the demand for money balance

creates an excess of the money supplied over money demanded. This is equivalent to an increase in money supply in the economy which has the effect of shifting LM curve to the right. This is depicted in the following Figure 11.5**.**

Figure 11.5: Shift of LM Curve



With the rise in the money supply the LM curve shifts to the right as LM_2 which moves the economy to a new equilibrium point E_2 . The increase in the money supply brings down the interest rate to R_2 in the money market. This, in turn , increases investment thereby raising the level of income to Y_2.

On the other hand, a decrease in the money supply or an increase in the demand for money will shift the LM curve to the left such that a new equilibrium is established at a higher interest rate and lower income level. This can be shown by assuming LM_2 as the original curve.



LET US KNOW

We Should Know about the essential features of LM curve:

- The LM curve is a schedule that describes the combinations of rate of interest and level of income at which money market is in equilibrium
- The LM curve slopes upward to the right.
- The LM curve is flatter if the interest elasticity of demand for the

money is high, on the contrary, the LM curve is steep if the interest elasticity of demand for the money is low.

- The LM curve shifts to the right when the stock of money supply is increased and it shifts to the left if the stock of money supply is reduced.
- The LM curve shifts to the left if there is an increase in the money demand function which raises the quantity of money demanded at a given interest rate and income level. On the other hand , the LM curve shifts to the right if there is an decrease in the money demand function which lowers the quantity of money demanded at a given interest rate and income level.



CHECK YOUR PROGRESS

Q 4: State whether the following statements are True (T) or False (F).

(i) LM curve is derived from the intersection between demand for money and supply of money. (T/F).

(ii) LM Curve slopes downward. (T/F).

Q 5: Mention the factors that determines the slope of LM curve. (Answer in about 40 words)

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Q 6: Define LM curve. Write three characteristics of LM curve. (Answer in about 40 words)

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11.5 INTERSECTION IS-LM CURVE : GENERAL EQUILIBRIUM

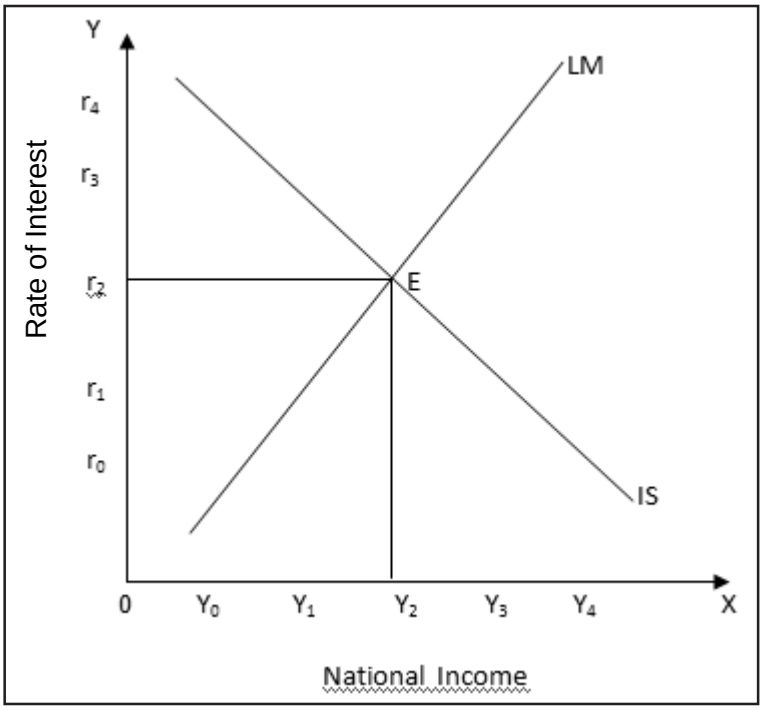
The goods market or real market equilibrium gives us the IS curve that depicts various combinations of income and rate of interest at which saving and investment are in equilibrium. Similarly, the money market equilibrium gives such combinations of rate of interest and income which brings demand for money and supply of money in equality. If there is a simultaneous equilibrium in both the markets, the entire system can be considered in equilibrium. This can be possible if:

(i) the saving and investment are in equilibrium (S=I), and

(ii)the demand for money is equal to the supply of money (MD=MS)

The IS and LM curves relate the two variables: (a) income and (b) the rate of interest. Income and the rate of interest are therefore determined together at the point of intersection of these two curves, i.e., E in Figure 11.6. The equilibrium rate of interest, thus determined is $0r_2$ and the level of income is $0y_2$. At this point, income and the rate of interest stand in relation to each other.

Figure 11.6: General Equilibrium





LET US KNOW

The IS-LM curve model is based on: (1) the investment-demand function, (2) the consumption function, (3) the money demand function, and (4) the quantity of money. We see, therefore, that according to IS-LM curve model both the real factors, namely, saving and investment, productivity of capital and propensity to consume and save, and the monetary factors, that is, the demand for money and supply of money play a part in the joint determination of the rate of interest and the level of income. Any changes in these factors will cause a shift in IS or LM curve and will therefore change the equilibrium levels of the rate of interest and income.



CHECK YOUR PROGRESS

Q 7: State whether the following statements are True (F) or False (F).

(a) General equilibrium exists when there is simultaneous equilibrium in both money market and capital market.

(b) General equilibrium is that point where both IS and LM curve intersect each other.

Q 8: What are factors on which the IS-LM curve model is based on? (Answer in about 30 words).

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11.6 LET US SUM UP

- The level of national income in simple Keynesian Model is determined by Goods market equilibrium and the rate of interest is determined by money market equilibrium.

- The Goods or real market is in a state of equilibrium when saving and investment are equal or Aggregate demand for goods just equals the Aggregate Supply
- IS curve is the locus of all the combinations of rate of interest and level of income at which saving and investment are equal.
- Saving is a direct function of level of income and investment is a decreasing function of rate of interest.

  i.e. S=f(Y) and I=f(r)
- IS curve slopes downward from left to the right because as interest rate falls, investment increases and thus income increases.
- The IS curve may be flat or steep depending on the sensitiveness of investment to changes in the rate of interest. If investment is very sensitive to the rate of interest, then IS curve will be very flat. Again if investment is not very sensitive to the rate of interest, then IS curve will be relatively steep.
- The shape of IS curve also depends on the size of multiplier. If the size of the multiplier is large, income is more sensitive to changes in interest rate and thus the IS curve becomes flatter. On the other hand smaller the value of multiplier, the smaller will be increase in the level of income given the investment caused by a given fall in the rate of interest. Thus in case of smaller size of multiplier IS curve will be more steep.
- The position of IS curve depends upon the magnitude of investment and saving.
- The IS curve will have a shift to right if the investment function increases or saving function decreases.
- The IS function is likely to shift to the left when saving function increases or investment function decreases. This shift in the IS function may be caused by changes in *fiscal policy*
- The LM curve shows all the combinations of interest rate and levels of income at which the demand for and supply of money are equal.
- The LM Curve slopes upward to the right. This is because with higher level of income, demand curve for money(M^d) is higher , which in turn leads to higher rate of interest.

- There are two factors on which the slope of LM curve depends, first, the responsiveness of demand for money to the changes in income, and the second factor the responsiveness of demand for money to the change in interest rate.
- The shifts in the LM curve are brought about by the variations in the supply of money and the shift in money demand function.
- The intersection of IS and LM implies the equality between goods market and money market.
- The IS-LM curve model is based on: (1) the investment-demand function, (2) the consumption function, (3) the money demand function, and (4) the quantity of money



11.7 FURTHER READING

1) Ajuja, H.L. (2007). *Macroeconomics: Theory and Policy*. New Delhi: S.Chand & Co.

2) Rana, K.C. & Verma, K.N. (2009). *Macroeconomic Analysis*. Jalandhar: Vishal Publications.

3) Shapiro, E. (2013). *Macroeconomic Analysis*. New Delhi: Galgotia Publications Pvt. Ltd..

11.8 ANSWERS TO CHECK YOUR PROGRESS

Ans to Q No 1: (i) False (ii) True

Ans to Q No 2: IS curve is the locus of all the combinations of rate of interest and level of income at which saving and investment are equal. IS curve slopes downward from left to the right because as interest rate falls, investment increases and thus income increases.

Ans to Q No 3: Slope of IS curve mainly depends on two factors:

(a) Elasticity of investment curve, and (b) Size of the multiplier.

The IS curve may be flat or steep depending on the sensitiveness of investment to changes in the rate of interest. If investment is very sensitive to the rate of interest, then IS curve will be very flat and vice-versa. . If the size of the multiplier is large, income is more sensitive to changes in interest rate and thus the IS curve becomes flatter and vice-versa.

Ans to Q No 4: (i) True (ii) False

Ans to Q No 5: There are two factors on which the slope of LM curve depends, first, the responsiveness of demand for money to the changes in income. The greater the extent to which demand for money for transaction motive increases with the increase in income, the higher the rise in the rate of interest and consequently steeper the LM curve. The second factor which determined the slope of the LM curve is the elasticity or responsiveness of demand for money to the changes in the rate of interest.

Ans to Q No 6: The LM curve shows all the combinations of interest rate and levels of income at which the demand for and supply of money are equal.

The three characteristics of LM curve are as follows-

(i) The LM curve is a schedule that describes the combinations of rate of interest and level of income at which money market is in equilibrium

(ii) The LM curve slopes upward to the right

(iii) The LM curve is flatter if the interest elasticity of demand for the money is high, on the contrary, the LM curve is steep if the interest elasticity of demand for the money is low.

Ans to Q No 7: (a) True (b) True

Ans to Q No 8: The IS-LM curve model is based on: (1) the investment-demand function, (2) the consumption function, (3) the money demand function, and (4) the quantity of money.



11.9 MODEL QUESTIONS

A) Short Questions (Answer each question in about 150 words)

Q 1: Discuss the slope and shift of IS curve .

Q 2: Explain the slope and shift of LM curve

Q 3: Discuss the determination of general equilibrium.

B) Essay-type Questions (Answer each question in about 300-500 words)

Q 1: Define IS curve. Explain how can you derive the IS curve from the goods market.

Q 2: Define LM curve. Explain how can derive the LM curve from the money market.

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