BECC-134

PRINCIPLES OF MACROECONOMICS - II

School of Social Sciences
Indira Gandhi National Open University
Maidan Garhi, New Delhi-110068

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COURSE PREPARATION TEAM

Block/ Unit Title		Unit Writer
Block 1	**IS-LM Analysis**	
Unit 1	Equilibrium in the Real Sector	Dr. Nidhi Tewathia, Assistant Professor, Gargi College, University of Delhi
Unit 2	Equilibrium in the Monetary Sector	
Unit 3	Neoclassical Synthesis	
Block 2	**GDP and Price Level in Short-Run and Long-Run**	
Unit 4	Aggregate Demand	Prof. Kaustuva Barik, IGNOU and Dr. Nidhi Tewathia, Assistant Professor, Gargi College, University of Delhi
Unit 5	Aggregate Supply	
Unit 6	Equilibrium Output and Prices	
Block 3	**Inflation and Unemployment**	
Unit 7	Inflation: Concept, Types and Measurement	Dr. Gurleen Kaur, Assistant Professor, Sri Guru Govind Singh College of Commerce, University of Delhi
Unit 8	Causes and Effects of Inflation	
Unit 9	Phillips Curve	Prof. Kaustuva Barik, IGNOU
Block 4	**Balance of Payments and Exchange Rate**	
Unit 10	Balance of Payments	Dr. Archi Bhatia, Associate Professor, Central University of Himachal Pradesh
Unit 11	Exchange Rate Determination	

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CONTENTS

COURSE INTRODUCTION

Macroeconomics is a branch of economics that deals with the behaviour of aggregate variables such as output, income, money supply, saving, investment, exports and imports at the economy level. We need to study macroeconomics, separately from microeconomics, as the behaviour of the aggregates could be more complex than that of the components. Larger issues such as economic growth, inflation, unemployment, public debt and balance of payments could be studied only at the macroeconomic level. Thus macroeconomics helps us in three aspects, viz., (i) understanding the relationship among aggregate economic variables, (ii) evaluating the performance of the economy, and (iii) formulation of economic policy.

You will study macroeconomics through a set of two courses, viz., BECC 133: Principles of Macroeconomics – I, and BECC 134: Principles of Macroeconomics – II. The present course, second one of the set, is divided into four blocks.

Block 1 titled, **IS-LM Analysis**, consists of three Units. Unit 1 titled, 'Equilibrium in the Real Sector' deals with the equilibrium in the real sector of the economy. It derives the IS curve and brings out the factors that influence the curve. Unit 2 is on 'equilibrium in the monetary sector' of an economy. In this Unit we derive the LM curve, and discuss the factors that determine the shape and position of the LM curve. In Unit 3 we put both the IS and LM curves together so that there is equilibrium in both real and monetary sectors the economy.

Block 2 is about **GDP and Price Level in Short-Run and Long-Run**. There are three Units in this Block. Unit 4 titled, Aggregate Demand, begins with derivation of aggregate demand curve from the IS-LM analysis. Subsequently, it outlines the factors that influence the aggregate demand curve. Unit 5 on Aggregate Supply brings out the Classical and Keynesian views on the shape and position of the aggregate supply curve. Unit 6 discusses about the interaction between aggregate demand and aggregate supply curves in short run and long run. It highlights the impact of contrast between both the schools of thought. Subsequently it deals with the Keynesian model of income determination.

Block 3 titled, **Inflation and Unemployment**, consists of three Units. In Unit 7 we deal with the concept, types and measurement of inflation. In Unit 8 we bring out the causes and effects of inflation. The last unit of the block, Unit 9, establishes a relationship between inflation and unemployment, and analyses the policy options before the government.

Block 4 titled, **Balance of Payments and Exchange Rate**, comprises two Units. In Unit 10 we define the various accounts and establish the identities under balance of payments. Unit 11 titled, Exchange Rate Determination, introduces the learners to various exchange rate regimes. It also discusses concepts such as nominal and real exchange rates, and purchasing power parity (PPP).

UNIT 1 EQUILIBRIUM IN THE REAL SECTOR*

Structure

1.0 OBJECTIVES

After going through this Unit, you should be in a position to

- explain how equilibrium in the goods market is achieved;
- explain the relationship between interest rate and investment;
- discuss the aggregate demand in relation to the interest rate;
- derive the IS curve with the help of aggregate demand and interest rate;
- interpret the slope of the IS curve; and
- explain the position of the IS curve and the factors affecting its position.

1.1 INTRODUCTION

In BECC 133, Unit 9 we learnt that equilibrium rate of interest is determined by the demand for and supply of money in the economy. In BECC 133, Unit 5 we learnt that equilibrium output is realized at the level where aggregate demand equals aggregate supply (of goods and services). The classical economists believed in duality of the real and monetary sectors of the economy and an increase in money supply results in proportionate increase in prices, as output cannot be increased (see BECC 133, Unit 4). According to Keynes, however, there is underemployment of resources in an economy and an increase in money supply results in a decline in interest.

A decrease in interest rate results in an increase in investment, which in turn results in an increase in output through investment multiplier. Thus monetary variables have an impact on real economic variables.

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The goods and money markets are interrelated – interest rate influences investment which influences output. Similarly, growth in output influences demand for investment which in turn affects interest rate. Thus studying goods market and money market separately does not give us a correct picture of the economy. For economic stability in the economy, there should be equilibrium in both goods market (equilibrium output) and in money market (equilibrium interest rate). In view of this economists such as J R Hicks (1904-1989) and Alvin Hansen (1887 – 1975) tried to combine the equilibrium in both goods and money markets.

1.2 GOODS MARKETS

Goods market is the one where aggregate demand and aggregate supply interact with each other and equilibrium level of income and output are determined. In the Keynesian model we saw that equilibrium output is realized when saving and investment are equal. A limitation of that model, however, was that the effect of interest rate on saving and investment was ignored.

Goods market equilibrium can be described through the IS curve (IS stands for Investment - Saving) which shows all the positions where investment and saving in the economy are equal. In Unit 11, we considered investment to be autonomous or fixed for simplicity. In reality however investment is not fully exogenous.

As you saw in Unit 6 of BECC 133, equilibrium level of output is given by

$$Y_0 = \frac{\bar{A}}{1 - c + ct}$$

where two determinants of equilibrium income are $\bar{A}$ and marginal propensity to consume (c). Higher *mpc* means higher output level and vice-versa.

1.2.1 Interest Rate and Investment

To have a complete picture, we introduce interest rate as a determinant of investment. Thus investment is not exogenously given; it is endogenously determined. We note that investment is lower when the rate of interest is high and *vice versa*. Generally, the firms borrow to invest. When interest rate is high, borrowing cost will increase, which will lower profits of the firms. On the other hand, if rate of interest is low, borrowing cost will be relatively lower and firms will borrow more. Thus, if the rate of interest is high, firms borrow less, which results in lower investment. On a similar logic, if the rate of interest is low, firms will borrow more, which would result in higher investment. Thus we assume that rate of interest and investments are inversely related. The investment spending function can be written as

$I = \bar{I} - b\,i$ where $b > 0$ …(1.1)

i = rate of interest

b = responsiveness of investment to interest rate

$\bar{I}$ = autonomous investment spending

In equation (1.1) we assume that investment consists of two components: (i) an autonomous component which does not depend upon the rate of interest; and (ii) an endogenous component which is influenced by the rate of interest. There are certain types of investments which are mandatory (such as repairs, maintenance, etc.). In Units 10 and 11 we assumed that investment is fixed, or autonomous, or exogenously given. In this Unit we relax this assumption and assume that certain types of investment are carried out for expansion of production capacity, and with a profit motive. The investment function given at equation (1.1) states that lower interest rate means higher investment. The investment function is shown in Fig. 1.1.

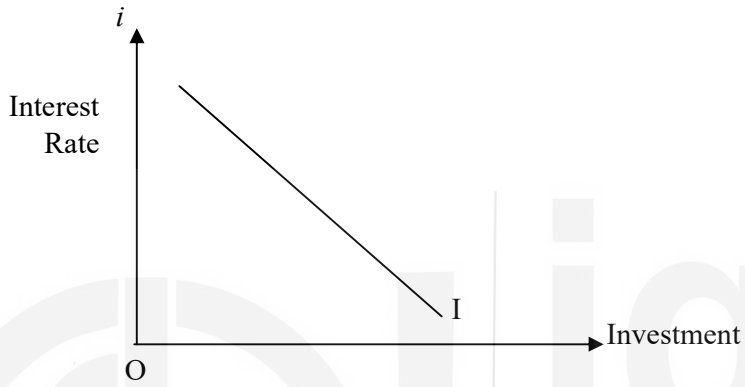

Fig. 1.1: Investment Function

The position of the investment curve is dependent on the slope of the investment function, i.e., b and the level of autonomous investment, $\bar{I}$. The intercept of the investment curve will depend on $\bar{I}$, while its slope will depend on b. If investment is highly responsive (value of 'b' is larger), the investment curve will be flatter (see Fig. 1.2).

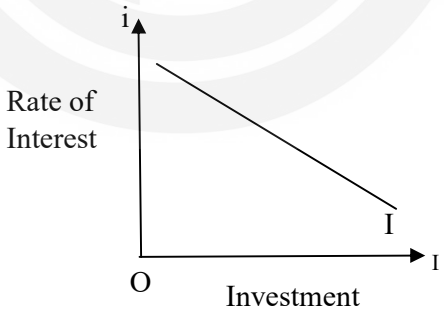

Fig. 1.2: Higher Responsive Investment

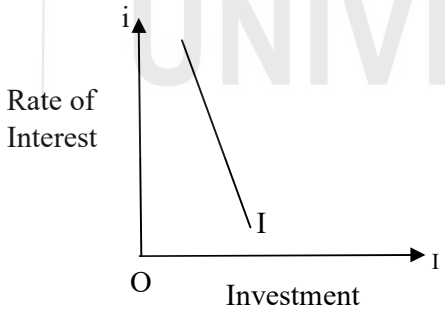

Fig. 1.3: Lower Responsive Investment

In this case, a small decrease in the rate of interest will result in a large increase in investment (see Fig. 1.3). On the other hand, if the responsiveness of investment to a change in the rate of interest is low (value of 'b' is relatively small), the investment curve will be steeper. A change in the level of autonomous investment ($\bar{I}$) will result in a parallel shift in the investment curve (see Fig. 1.4). If $\bar{I}$ is higher, the investment curve will shift rightwards (from I to I′).

It means that for each rate of interest, more is invested. Similarly, a lower level of $\bar{I}$ would indicate a leftward shift in the investment curve (from I to I").

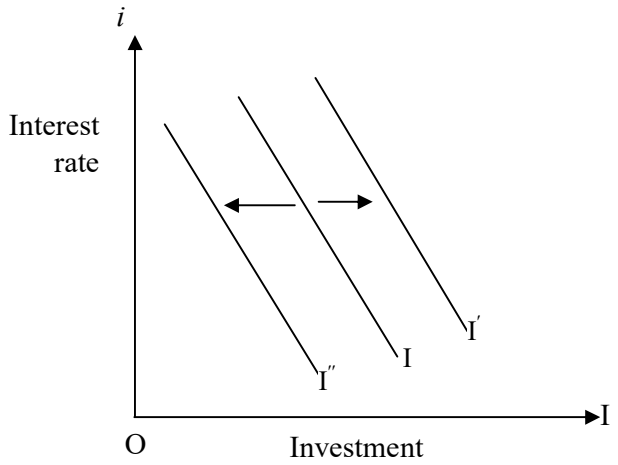

Fig. 1.4: Shift in Investment Curve

1.2.2 Aggregate Demand and the Interest rate

We have seen that investment is influenced by the rate of interest. Since investment has changed its form (it is not considered to be fixed anymore), it will have an impact on the aggregate demand (AD) curve.

$$AD = C + I + \bar{G}$$

$$AD = \bar{C} + c\overline{TR} + c(1 - t)Y + \bar{I} - bi + \bar{G}$$

$$AD = \bar{A} + \bar{c}\,Y - bi \qquad \ldots(1.2)$$

where $\bar{c} = c(1 - t)$ (see Unit 11 for derivation of this)

and $\bar{A} = c\overline{TR} + \bar{I} + \bar{G}$

An increase in the rate of interest rate results in a decrease in AD, while level of income is considered to be given. As pointed out earlier, $\bar{A}$ is not affected by the increase in the rate of interest. In Fig. 1.5 we describe the effect of change in interest rate on AD curve. At a given rate of interest *i*, the term 'bi' becomes a constant and hence the vertical intercept of AD curve is ($\bar{A}$ – bi).

In Fig. 1.5, we measure AD on the y-axis and output on the x-axis. In the diagram, we depict the impact of a shift in the AD curve on equilibrium output. Initially let the aggregate demand curve be $AD_1 = \bar{A} + cY - b\,i_1$ when the rate of interest is i_1. Here the intercept of the AD curve is $(\bar{A} - bi_1)$. The equilibrium is at point E_1 and equilibrium output is Y_1.

Suppose there is a *decrease* in the rate of interest from i_1 to i_2. The intercept of the AD curve will be $\bar{A} - bi_2$. Notice that $\bar{A} - bi_2$ will be larger than $\bar{A} - bi_1$, because we are subtracting a smaller quantity from $\bar{A}$. Thus there will be an upward shift in the AD curve from AD_1 to AD_2 (see Fig. 1.5).

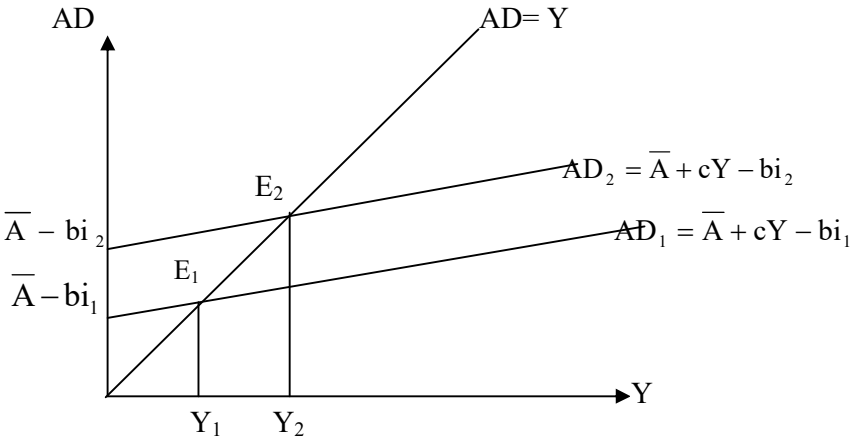

Fig. 1.5: Interest Rate and AD

If you see logically, a decrease in interest rate will lead to an increase in investment. An increase in investment will lead to an increase in aggregate demand. Thus the upward shift in the AD curve due to decrease in interest rate is valid. As per Fig. 1.5, initial equilibrium was at E_1 and equilibrium output level was Y_1. Because of the shift in the aggregate demand curve, the new equilibrium occurs at E_2 and the equilibrium level of output is Y_2.

Check Your Progress 1

1) Draw an investment curve when the investment is not autonomous and justify its shape.

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2) In what way the investment curve is affected when the sensitivity of investment to the interest rate increases?

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3) Explain the impact of a change in the interest rate on the AD curve and the resulting equilibrium.

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1.3 DERIVATION OF THE IS CURVE

We continue with Fig. 1.5 for derivation of the IS curve. The ground work is already done in the previous section where we learnt that the AD curve shifts due to change in the interest rate. Further, there is a change in equilibrium output in response to change in the AD curve. Thus, in Fig. 1.5, we have various combinations of interest rate and equilibrium output levels. If we plot such combinations in a diagram, we get the IS curve. As we observed in Fig. 1.5, when the rate of interest decreased from i_1 to i_2, the equilibrium level of output increased from Y_1 to Y_2. Thus we find that interest rate and equilibrium output are negatively related. The IS curve is shown in Fig. 1.6. You should note that on each and every point of the IS curve the real sector of the economy is in equilibrium.

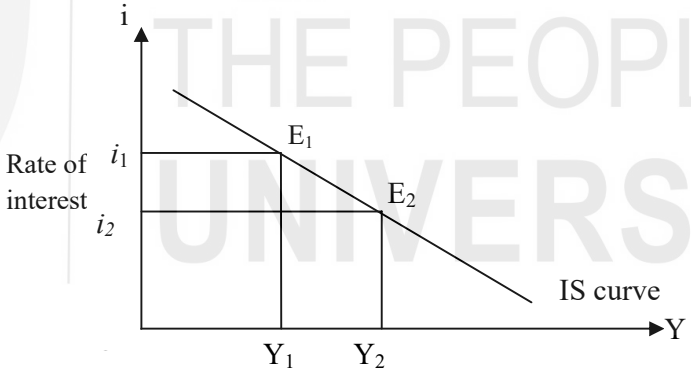

Fig 1.6: IS Curve

All the points on the IS curve represent the goods market equilibrium because this curve is made up of those combinations of rate of interest and output where savings is equal to investment (or, its equivalent, aggregate demand is equal to aggregate supply). Fig. 1.6 shows that the IS curve is downward sloping.

Another issue to discuss is the points which are not on the IS curve. Any such point indicates that there is disequilibrium in the goods market.

Point 'c' and 'd' in Fig. 1.7, for example, show disequilibrium in the real sector, while points 'a' and 'b' show equilibrium in the goods market.

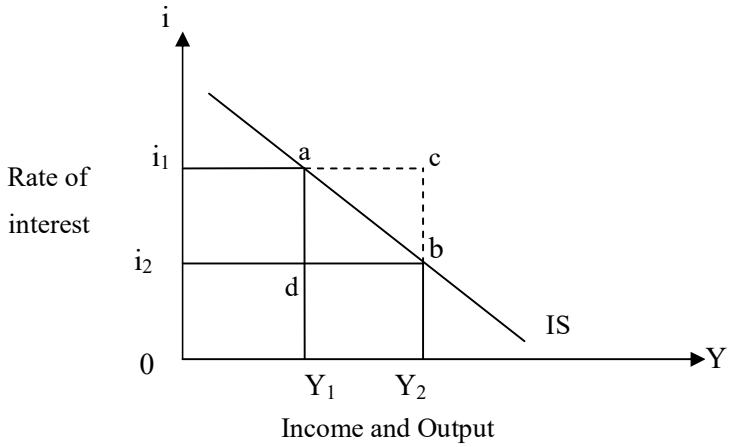

Fig 1.7: Points off the IS Curve

At point 'd' in Fig. 1.7, income is at Y_1 but the rate of interest is at i_2. At lower rate of interest, demand for investment will increase. Such increase in demand for investment will push the rate of interest upward. So, at point 'd' there is excess demand for goods. We can generalize that at any point below and to the left of the IS curve, there is excess demand for goods.

At point 'c' in Fig. 1.7, interest rate is i_1 while output is Y_2 . You should observe that the equilibrium rate of interest corresponding to Y_2 level of output is i_2 (equilibrium point on the IS curve is 'b') which is lower than i_1. Thus there is a tendency for interest rate to decline. An implication of the above is that there is excess supply in the market. We can generalize that any point which is above and to the right of the IS curve, indicates excess supply of goods.

1.3.1 Slope of the IS Curve

Let us derive the equation for the IS curve by using the goods market equilibrium condition. We know that equilibrium is achieved when Y = AD. Substituting the value of AD from equation (1.2), we obtain

$$Y = \bar{A} + \bar{c}\,Y - bi$$

$$\text{Or, } Y - \bar{c}\,Y = \bar{A} - bi$$

$$\text{Or, } (1 - \bar{c})Y = \bar{A} - bi$$

$$\text{Or, } Y = \frac{1}{(1-\bar{c})}(\bar{A} - bi)$$

$$\text{Or, } Y = \alpha_G(\bar{A} - bi) \qquad \ldots(1.3)$$

where $\alpha_G = \frac{1}{1-\bar{c}} = \frac{1}{1-c+c}$ is the multiplier in the presence of the government sector and $\bar{c} = c(1 - t)$.

Equation (1.3) above is the IS equation. The slope of the IS curve is defined as the rate of change in income due to change in interest rate. The slope of the IS curve is given by $\frac{\Delta Y}{\Delta i}$, where Δ represents a small change in a variable. The slope of the IS curve is $(-)b.\,\alpha_G$.

Those of you who are familiar with differential calculus, can see that we take derivative of (1.3) to find the slope of the IS curve. Thus, $\frac{dY}{di} = -\,b.\,\alpha_G$. The slope being negative reinforces the fact that Y and *i* are negatively related. The steepness of the curve depends on the two factors, viz., b and α_G. Recall that b represents the sensitivity of investment to changes in the interest rate, and α_G represents the value of the multiplier in the presence of the government sector.

Suppose there is certain decrease in interest rate and b is relatively large (responsiveness of investment to interest rate is high). It implies that the equilibrium income will change by a large amount through a large upward shift in the AD curve. This will produce a flatter IS curve. On the other hand, when b is relatively small, responsiveness of investment to interest rate is low. This leads to a steeper IS curve.

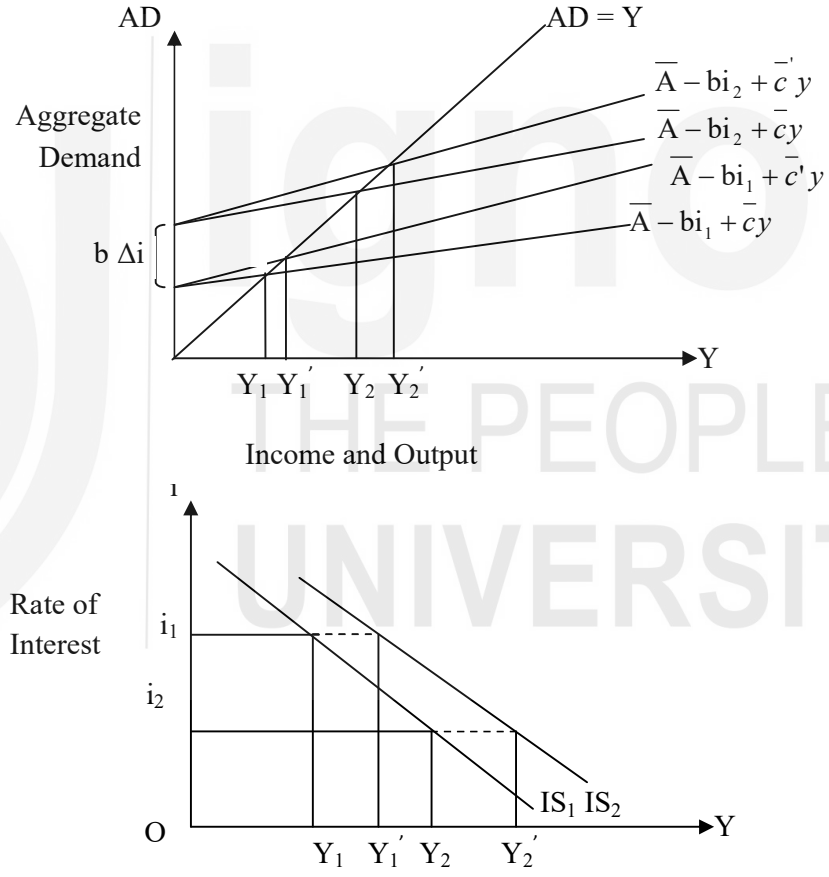

Fig 1.8: Multiplier and IS Curve

In Fig. 1.8 we present the effect of the multiplier (α_G) on the IS curve. We know that α_G depends on the marginal propensity to consume, $\bar{c}$.

Let us consider two different values of mpc, such that $\bar{c}' > \bar{c}$. We know that $\bar{c}'$ will produce a steeper AD curve (since $\bar{c}'$ represents the slope AD curve). We consider a decrease in the interest rate by an amount Δi (from i_1 to i_2 such that $i_2 < i_1$), and see the impact of the change in interest rate on equilibrium income in

both the cases. When interest rate decreases by Δi, the AD curve shifts upward by $g\Delta i$.

In Fig. 1.8, AD_1 is represented by the equation with mpc $\bar{c}$ and AD_2 is represented by the equation with mpc $\bar{c}'$ where $\bar{c}' > \bar{c}$. When interest rate decreases from i_1 to i_2 (such that $i_2 < i_1$), we observe parallel shifts in both AD_1 and AD_2, by the same amount. As a result of the shift in the AD curve, the equilibrium point changes and equilibrium output shifts from Y_1 to Y_2 in the case of AD_1 and from Y_1' to Y_2' in the case AD_2. Notice that the change in interest rate is the same, in both the cases. However, the horizontal distance between and Y_2' and Y_1' is more as compared to the distance between Y_2 and Y_1. Thus the change in output is larger in case the AD curve is steeper (and the mpc is higher).

We plot the combinations of interest rate and equilibrium output in the lower panel of Fig. 1.8, to obtain the IS curve. We see in the lower panel of Fig. 1.8 that the IS_2 curve turns out to be flatter which is corresponding to the higher $\bar{c}$ or $\bar{c}'$. We can say that higher $\bar{c}$ leads to higher α_G, and therefore a larger increase in the equilibrium level of income and output.

1.3.2 Position of the IS Curve

In the previous sub-section we discussed about the slope of the IS curve. Now let us look into the position of the IS curve. In other words, we should be in a position to identify the factors that determine the position of the IS curve. Let us once again look at the IS equation.

$$Y = \alpha_G(\bar{A} - bi)$$

We already know that α_G and b are responsible for the slope of the IS curve. This leaves us with $\bar{A}$ which plays an important role in the IS curve formation. In case $\bar{A}$ shifts, it leads to a shift in AD curve and hence shows an impact on the position of the IS curve. Fig. 1.9 shows how this process takes place. The upper panel of Fig. 1.9 shows the impact of change in autonomous spending $(\bar{A})$ on the AD curve. For a given rate of interest i_1, equilibrium level of income and output shifts from Y_1 to Y_2 due to $\Delta\bar{A}$.

Now, in the lower panel of Fig. 1.9, at the same interest rate (i_1), we have equilibrium a higher level of output (Y_2). This shows that the shift in IS_1 to IS_2 is as a result of $\Delta\bar{A}$. We have a new goods market equilibrium, i.e., (i_1,Y_2) instead of the old one (i_1,Y_1).

The next question is, what is the magnitude of the shift in the IS curve? The shift in the equilibrium level of income and output can be easily calculated with the help of the multiplier. $\Delta Y = \alpha_G . \Delta\bar{A}$

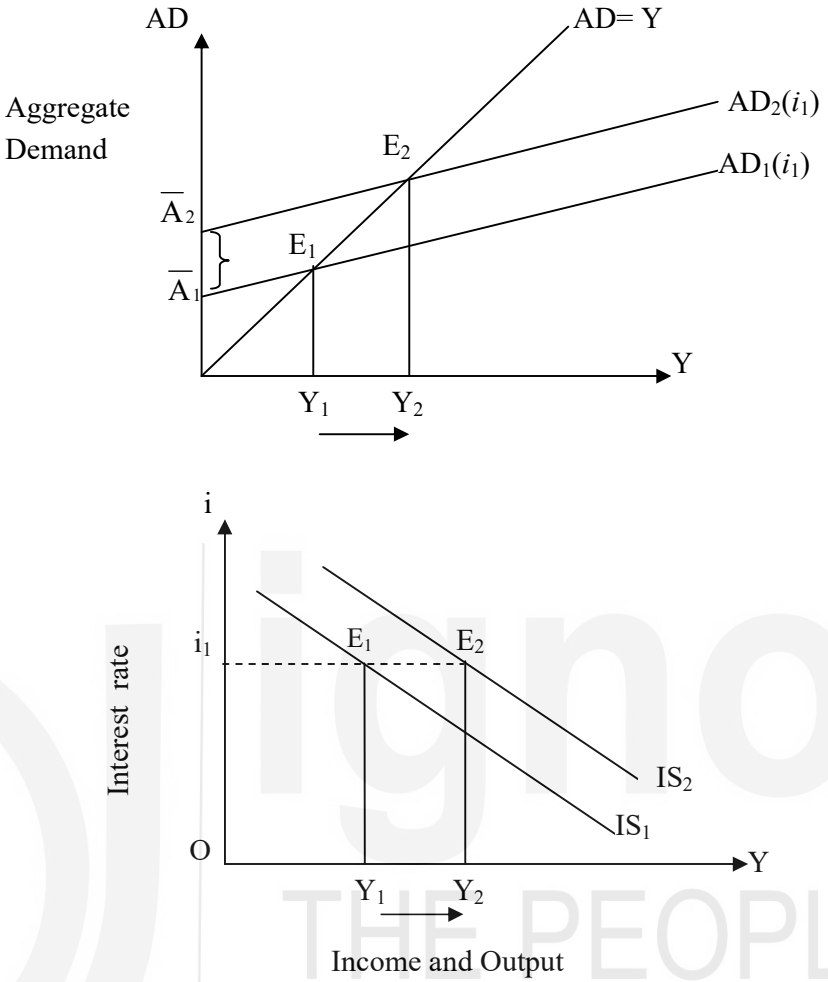

Fig 1.9: Shift in IS Curve

The change in equilibrium output is equal to the multiplier times the change in $\overline{A}$. The components of $\overline{A}$ are equally responsible for the shifts in the IS curve. Let us look at these components,

$$\overline{A} = c\overline{TR} + \overline{T} + \overline{G} + \overline{C}$$

In case the government spending decreases, the AD curve will experience a parallel shift downwards and this will decrease the level of income. It leads to a leftward shift in the IS curve. Similarly, if $\overline{I}$, $\overline{TR}$ and $\overline{C}$ decrease, the IS curve will shift leftwards.

Check Your Progress 2

1) Derive the IS Curve with the help of the Keynesian Cross.

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2) Which are the factors that determine the slope of the IS Curve?

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3) Identify the factors that affect the position of an IS Curve.

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1.4 LET US SUM UP

In this unit, we explained the role of interest rate in determining the investment level. We dropped the assumption that the investment is fixed, autonomous or exogenous. As the investment gets affected due to interest rate, the aggregate demand and the equilibrium output experience a change. This process of change in interest rate and its impact on equilibrium level of income and output helps us to derive the IS curve. All the points on the IS curve show the goods market equilibrium and all the points off the IS curve show disequilibrium. The slope of the IS curve is dependent upon the sensitivity of the investment to the interest rate (b) and the multiplier (α_G). The position of the IS curve is determined by the autonomous spending, $\overline{A}$.

1.5 ANSWERS/HINTS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress 1

1) Refer to Sub-Section 1.2.1 and Fig. 1.1
2) It becomes flatter.
3) Refer to Sub-section 1.2.2.

Check Your Progress 2

1) Refer to the Fig. 1.5 and Fig. 1.6.
2) Refer to Sub-Section 1.3.1.
3) Refer to Sub-Section 1.3.2.

UNIT 2 EQUILIBRIUM IN THE MONETARY SECTOR*

Structure

2.0 OBJECTIVES

After going through this Unit, you should be in a position to

- explain nominal and real demand for money;
- derive the LM curve with the help of demand for and supply of money;
- explain the slope of the LM curve and the factors affecting it; and
- explain the position of the LM curve and the factors affecting it.

2.1 INTRODUCTION

In the previous Unit we discussed about the equilibrium in the goods market. Knowledge of the goods market and its equilibrium alone however is not sufficient to understand how the economy works. The money market or the assets market is equally important.

The assets market affects the level of income and output. As you might have observed, large volume of trading occurs every day in the assets market. For simplicity, we group all the assets into two categories, viz., a) money (cash in hand), and b) interest-bearing assets such as bonds. A bond is a promise to pay an agreed amount of money to its holder at some future date. For example, suppose a borrower (usually the government or a corporate firm) borrows Rs.100 in the form of a bond. She promises to pay Rs.4 each year to the lender (who actually owns the bond) and will repay Rs.100 to the lender at a future specified date, say after 2 years. The interest rate is 4 per cent per year. Wealth of an individual is allocated between various types of assets. If an individual decides to have more

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number of bonds, she will receive more amount of interest income accordingly. Holding more money grants her liquidity and she can make transactions to purchase anything she wants. In the case of bonds, her liquidity is compromised. Such decisions are called portfolio decisions. The total wealth of an individual would either be held in the form of money or in the form of bonds. In other words, the wealth of an individual should add up to the money held in different types of assets.

State of the economy depends on both goods market and assets market, and there is an important link between the two. The complete picture emerges only after we study both goods and assets markets. In the present Unit we will be largely discussing about money, bonds, stocks, houses, etc., as forms of wealth. In Unit 14 we will combine both the goods and the assets markets to find out equilibrium rate of interest and equilibrium level of output.

2.2 REAL AND NOMINAL DEMANDS

Let us begin with the distinction between 'the nominal demand for money' and 'the real demand for money'. Nominal demand for money is the amount of money (in India, for example, the number of rupees) demanded by an individual. The real demand for money is also the demand for money but in terms of the number of units of goods that money will buy. This real demand is equal to the nominal demand for money divided by the price level. For example, nominal demand for money (also called *Nominal Wealth*, WN) is Rs.500, and the price level is Rs.5. Then the real demand for money will be equal to 100 units of goods (= 500/5). It is important to note that if the nominal demand for money and the price level doubles, then the real demand for money remains unchanged. Real demand for money is also known as 'demand for real money balances' or *real balances*. Real bond holdings will be equal to the sum of money and the bond holding divided by the price level. Real financial wealth of an individual should be equal to the sum of demand for real balances (L), and real bond holdings (BH). Also, another way to look at the real financial wealth is the nominal wealth (WN) divided by the price level (P).

Thus,

$$L + BH = \frac{WN}{P} \qquad \ldots(2.1)$$

Decision of holding more real balances would mean a decision to hold less real wealth in the form of bonds. It means, if we consider the money market only, we can have understanding on the assets market.

If the money market is in equilibrium, the bond market will also be in equilibrium because real wealth is distributed in these two markets only.

The real financial wealth available at a given time, in an economy, will be the sum of the real money balances and the available real bonds. So, the total financial wealth will be equal to:

$$\frac{WN}{P} = \frac{M}{P} + SB \qquad \ldots(2.2)$$

where M is the stock of nominal money balances, SB is the real value of the supply of bonds and P is the price level.

The amount of real wealth an individual wish to hold should be equal to the amount of real wealth available in the economy. We equate (2.1) and (2.2) to obtain

$$L + BH = \frac{M}{P} + SB$$

$$\text{Or,} \quad \left(L - \frac{M}{P}\right) + (BH - SB) = 0 \qquad \ldots(2.3)$$

If the demand for real balances (L) is equal to the existing stock of the real balances, we find that $\left(L - \frac{M}{P}\right) = 0$. This leads to the interesting observation, i.e., BH should be equal to SB. If the real money demand is equal to the real money supply, then the demand for real bonds should be equal to the supply of real bonds. Now, let us consider a situation where the money market is not in equilibrium, and see its implications for the asset market. Suppose real money demand is more than real money supply. Given the wealth budget constraint given at equation (2.3), the excess demand in the money market (i.e., $L > \frac{M}{P}$) there needs to be neutralized by excess supply in the bond market (i.e., BH < SB). With this behaviour, we reinforce the fact that studying only the money market would help us in comprehending the bond market also.

2.3 DEMAND FOR AND SUPPLY OF MONEY

Individuals require money to make transactions such as purchase of goods and services. At a given time, people will hold some cash in hand which is known as 'money balances'. The amount of physical units that money can buy, tells us the 'real balances' an individual demands at that point of time. If the price level rises, an individual will require more (nominal) money balances to keep continuing to afford the same amount of goods and services.

The decision of how much money to be held as nominal balance or in the form of cash is dependent on the income or real income of an individual and the interest rate on various assets available for investment. The cost of holding money is nothing but the foregone interest rate on the assets in which the investor could have invested. Higher interest rate increases the cost of holding money. Individuals make transfers from money to bonds whenever their money holdings become large. But if an individual holds her majority of wealth in the form of bonds, then she needs to be ready for the inconvenience which low level of liquidity brings.

We can say that at high levels of income, an individual demands more of money (means more liquidity) and at high rate of interest, the individual demands more bonds (means less money or less liquidity).

Keeping the above in view, we can write the money demand function as

$$L = kY - h\,i \qquad k, h > 0 \qquad \ldots(2.4)$$

where k is the sensitivity of money demand to the level of income (Y) and h is the sensitivity of money demand to the interest rate (i). An increase in the income by Re.1 increases the real money demand (L) by Rs. k. An increase in the interest rate by 1 per cent decreases the real money demand by Rs. h. The quantity demanded is a decreasing function of the rate of interest and increasing function of the income. In Fig. 2.1 we depict such a demand curve for money.

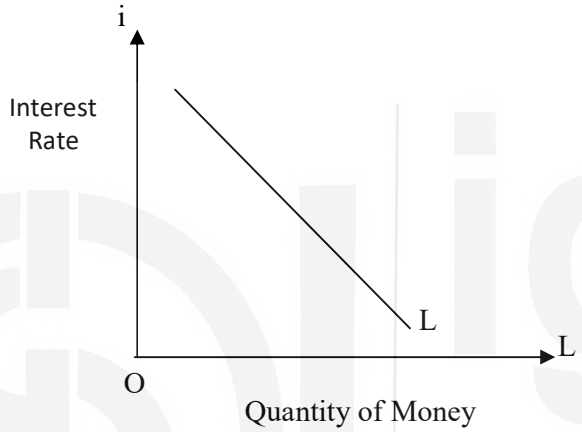

Fig. 2.1: Demand for Money

The supply of money is generally taken as fixed. The nominal quantity of money supply is controlled by the Central Bank of the country. So, we take it as given at $\overline{M}$. We also assume that the price level is constant ($\overline{P}$). Thus, the real money supply would be ($\frac{\overline{M}}{\overline{P}}$).

In Fig. 2.2 we show that money supply in the economy is constant; represented by a vertical line.

An implication of the vertical money supply curve is that it is independent of interest rate. Thus any change in interest rate does not lead to a change in money supply.

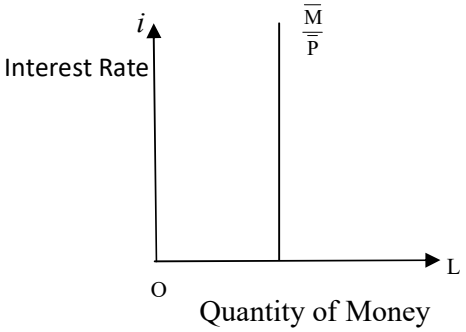

Fig. 2.2: Money Supply

2.4 MONEY MARKET EQUILIBRIUM

When demand equals supply in the money market, we achieve equilibrium in the money market. In Fig. 2.3 we combine the money demand curve given at Fig. 2.1 and money supply curve given at Fig. 2.2. The money demand curve is downward sloping while the money supply curve is vertical. The equilibrium takes place at E_1. This equilibrium is achieved at a given income level (Y_1). The rate of interest is i_1.

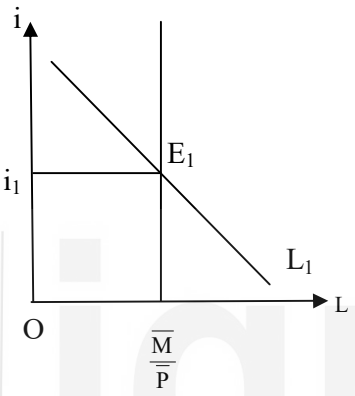

Fig. 2.3: Money Market Equilibrium

Now suppose that the level of income increases from (Y_1) to (Y_2). From equation (2.4) we find that money demand (L) will increase. Accordingly, the money demand curve will observe a rightward shift from $L_1(Y_1)$ to $L_2(Y_2)$ and the equilibrium point will shift from E_1 to E_2. In Fig. 2.4, the new equilibrium is at E_2 which corresponds to the equilibrium level of income, Y_2, and the interest rate, i_2.

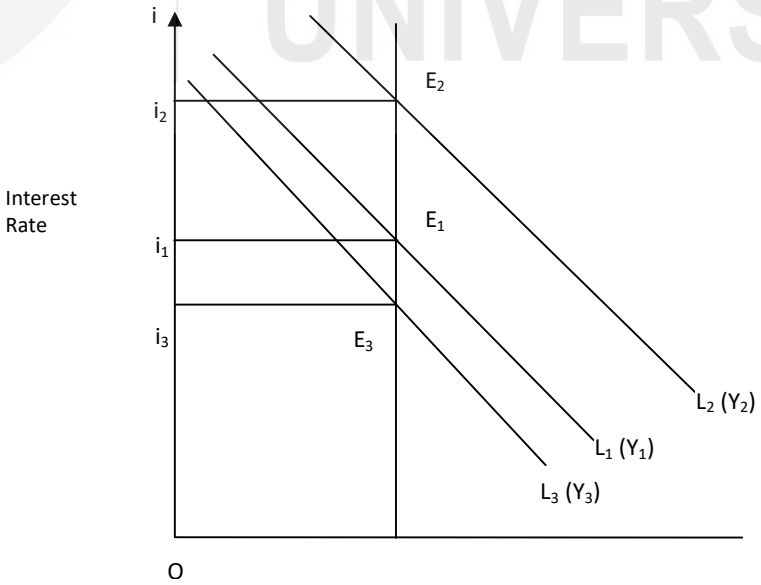

Fig. 2.4: Change in Money Market Equilibrium

With the new equilibrium, we have received another combination of income and rate of interest where money market is in equilibrium. At the rate of interest i_1, there exists excess demand for money due to increase in income level (Y).
This excess demand pushes up the rate of interest to i_2 to achieve the new equilibrium where demand for money equals supply of money.

If the income level decreases to Y_3, the money demand curve will shift leftwards (see Fig. 2.4) and this will lead to excess supply of money. This excess supply of money pushes the interest rate down and the equilibrium rate of interest is realized at i_3 so that the supply of and the demand for money are equal. We observe that a lower level of income (Y_3) is associated with a lower rate of interest (i_3).

Check Your Progress 1

1) Distinguish between real and nominal demands for money.

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2) Write down the equation of the demand for money and interpret it.

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2.5 LM CURVE

The combinations of income (Y) and interest rate (i) which we discussed in the previous sections are important for understanding the LM curve. A series of such combinations eventually generates the LM curve. The LM curve shows the combinations of interest rates and levels of income such that the demand for real balances is equal to the supply of real balances. All the points on the LM curve indicate the money market equilibrium and all the points outside the LM curve indicate the disequilibrium in the money market. The LM curve is positively sloped, i.e., as Y increases, the rate of interest increases.

In Fig. 2.4 we obtained three equilibrium points, as the level of income changed, viz., E_1, E_2 and E_3 corresponding to $(Y_1 i_1)$, $(Y_2 i_2)$, and $(Y_3 i_3)$ respectively. We plot these points in Fig. 2.5. In Fig.2.5 we take output on the x-axis and interest rate (i) on the y-axis. When we plot the three combinations $(Y_1 i_1)$, $(Y_2 i_2)$, and $(Y_3 i_3)$ we obtain an upward sloping curve. It is called the LM curve; 'L' representing liquidity and 'M' representing money supply.

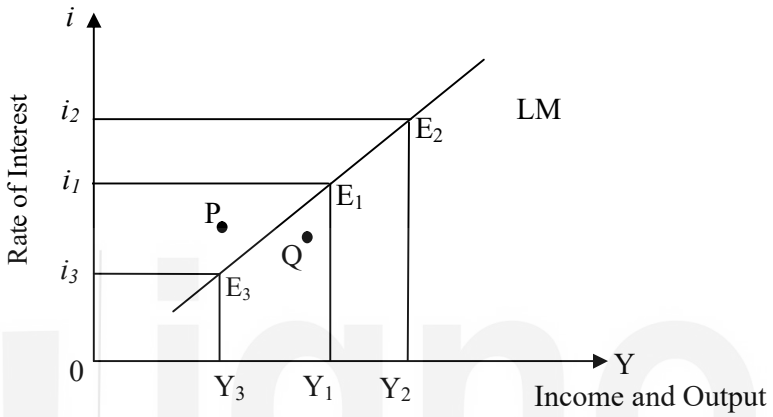

Fig 2.5: LM Curve

You should note that on each and every point of the LM curve, the demand for real balances is equal to the supply of real balances. Thus the money market is in equilibrium if the economy is operating at any combination of output and interest rate, which are on the LM curve. An implication of the above is that the money market is not in equilibrium condition if the economy is operating at any point outside the LM curve. Let us consider two such points, P and Q in Fig. 2.5. At point P, which is to the left and above the LM curve, there is excess supply of money for given level of income. This will push the interest rate down and the money market will be in equilibrium. At point Q, which is to the right and below the LM curve, there is excess demand for money. This will push the interest rate up so that there is equilibrium in the money market.

Now let us derive the equation for the LM curve. In equation (2.4) we have the demand for real balances.

The supply of real balances is given by $\frac{\bar{M}}{\bar{P}}$. By equating the demand for real balances with the supply of real balances we obtain the equation for the LM curve. Algebraically it can be shown as follows:

$$\frac{\overline{M}}{\overline{P}} = kY - hi$$

$$\text{Or, } hi = kY - \frac{\overline{M}}{\overline{P}}$$

$$\text{Or, } i = \frac{1}{h}\left(kY - \frac{\overline{M}}{\overline{P}}\right) \qquad \ldots(2.5)$$

where, h = the responsiveness of the demand for money to income, and

k = the responsiveness of the demand for money to the interest rate.

2.5.1 Slope of the LM Curve

The slope of LM curve can be derived from the LM equation, given by (2.5). You should note that the slope of the LM curve denotes the change in rate of interest due to change in income, i.e., $\frac{\Delta i}{\Delta y}$, where 'Δ' represents a small change in a variable. Thus,

$$\frac{\Delta i}{\Delta y} = \frac{k}{h} \qquad \ldots(2.6)$$

Those of you, who are familiar with the concept of differentiation, will find that slope of a curve is given by the first derivative of a function. We obtain the slope of the LM curve by taking partial derivative of equation (2.5) such that $\frac{\partial i}{\partial y} = \frac{k}{h}$.

From (2.6) we find that the slope of the LM curve is given by the ratio of k and h. An implication of the above is that greater the responsiveness of the demand for money to income (k) and lower the responsiveness of the demand for money to the interest rate (h), the steeper will be the LM curve.

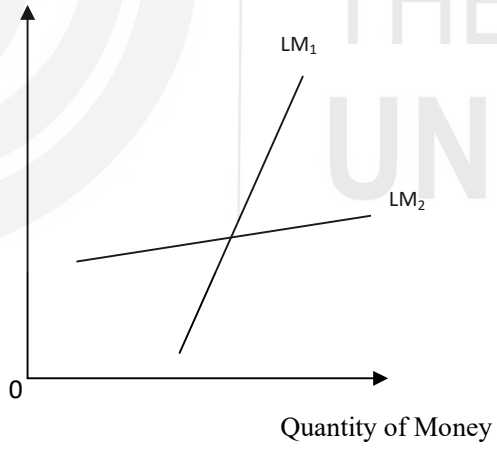

Fig. 2.6: Slope of LM Curve

In Fig. 2.6 we present two LM curves with different slopes. If the demand for money is relatively insensitive to the interest rate (i.e., h is close to zero), then the LM curve will be nearly vertical (LM_1). On the other hand, if the demand for money is very sensitive to the interest rate (i.e., h is large), then the LM curve will be nearly horizontal (LM_2).

2.5.2 Position of the LM Curve

Along the LM curve, the real money supply $\left(\frac{\overline{M}}{\overline{P}}\right)$ is held constant. So if there is a change in real money supply, the LM curve will shift. If the real money supply increases, LM curve will shift to the right. Remember that an increase in real money supply can take place in three ways, viz., (i) there is an increase in nominal money supply while price level is unchanged, (ii) there is a decrease in price level while nominal money supply is constant, and (ii) there is such change in both M and P that the ratio $\frac{M}{P}$ increases. In this Unit, for simplicity, we assume that the price level is constant so that an increase in nominal money supply implies an increase in real money supply. Let us describe a situation where real money supply increases from $\frac{\overline{M}}{\overline{P}}$ to $\frac{\overline{M'}}{\overline{P}}$. This will shift the money supply curve (the vertical line in Fig. 2.3). Such a shift in the money supply curve will result in a decrease in the rate of interest for each level of income. Thus there will be a rightward shift in the LM curve.

In Fig. 2.7 the rate of interest changes from i_1 to i_2 for each level of income. We have kept the income level unchanged at Y_1 to highlight the fact that at each level of income, the equilibrium interest rate has to be lower to induce people to hold larger real balances. Similarly, at each level of the interest rate, the level of income has to be higher so as to raise the transactions demand for money (kY) and thereby absorbing the higher real money supply.

If there is a decrease in real money supply, the LM curve will shift to the left.

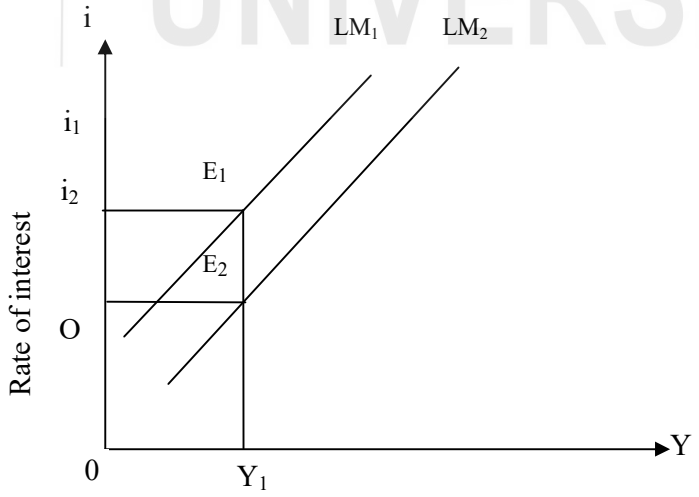

Fig 2.7: Shift in the LM Curve

Check Your Progress 2

1) Explain how the LM curve is derived.

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2) Interpret the slope of an LM curve.

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3) Explain how the position of LM curve is determined.

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4) Draw a suitable diagram to show the impact of a decrease in money supply. Explain why the rate of interest will increase.

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2.6 LET US SUM UP

We began the unit with a discussion on the options for individuals to hold money. We assumed that an individual holds money either in the form of cash or in terms of interest-bearing assets i.e., bonds. Further, we showed that if we study the money market, the bond market is also understood side by side. So the focus was laid on the money market. The demand for and supply of real balances was explained with the help of diagrams. The LM curve was derived in terms of equation and diagram.

The movements in the rate of interest due to change in the money demand and money supply were explained. The impact of such movements on the LM curve was discussed.

Further, the slope and position of the LM curve was discussed. It was observed that the change in nominal money supply is the major factor that affects the position of the LM curve.

2.7 ANSWERS/HINTS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress 1

1) Refer to Section 2.2.

3) $L = kY - h\,i$

Check Your Progress 2

1) Refer to Section 2.5.

2) Refer to Sub-section 2.5.1.

3) Refer to Sub-section 2.5.2.

4) Refer to Fig 2.7 and draw a diagram with left-ward shift in the LM curve. Rate of interest will increase because supply of real balances will be lower compared to demand.

UNIT 3 NEOCLASSICAL SYNTHESIS*

Structure

3.0 OBJECTIVES

After going through this Unit, you should be in a position to

- describe the simultaneous equilibrium in goods market and money market;
- explain the adjustment process in the equilibrium output and interest rate; and
- distinguish between the classical and the Keynesian zones in the IS-LM model.

3.1 INTRODUCTION

In Unit 1 we derived the IS curve which indicates the points on which there is equilibrium in the goods market. In Unit 2 we derived the LM curve, which indicates the equilibrium in the money market. Now, the problem at hand is to bring about equilibrium, simultaneously in both the markets. In this unit, we will discuss the interaction of the IS and the LM curves, shifts in these curves, and the adjustment process in case disequilibrium exists.

3.2 SIMULTANEOUS EQUILIBRIUM

For simultaneous equilibrium in the goods market and the money market, there needs to be a single combination of interest rate and income level which satisfies the equilibrium in both goods and money markets simultaneously. In Fig. 3.1 we super-impose the IS and the LM curves. In the figure, we represent income/ output level (Y) on the x-axis and the interest rate (i) on the y-axis.

In Fig. 3.1 we find that the goods market and the money market clear at point E_1. The equilibrium rate of interest is i_1 and the equilibrium level of income and output is Y_1. You should remember that we assume the price level to be constant ($\bar{P}$). An implication of the above is that firms are willing to supply any amount of goods and services at that price. At E_1, the economy is in equilibrium as both goods and money markets are in equilibrium. Thus, the firms are willing to supply Y_1 level of output and equilibrium interest rate is i_1. Firms are producing

* Dr. Nidhi Tewathia, Assistant Professor, Gargi College, University of Delhi.

their planned amount of output and individuals have their portfolio composition according to their plan. There is no unplanned inventory accumulation or rundown of inventories.

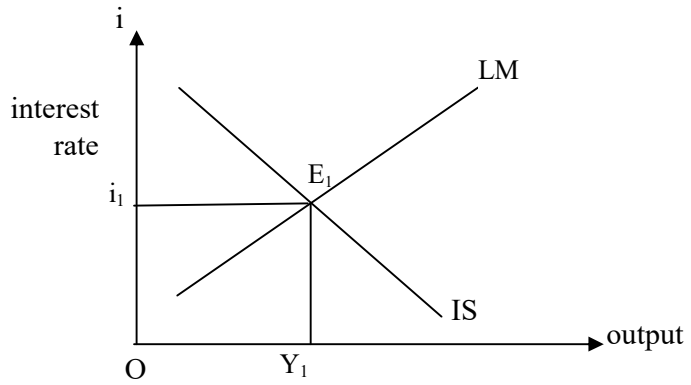

Fig. 3.1: Simultaneous Equilibrium in Goods and Money Markets

If any of the two curves (viz., IS and LM) changes, there will be a change in the equilibrium levels of income and interest rate. The impact of the shifts in the IS and the LM curves on equilibrium output and interest rate, however, will be different.

3.2.1 Shift in the IS Curve

In Fig. 3.2 we describe a situation where the IS curve shifts to the right. Let us consider the changes an economy goes through if such a shift takes place.

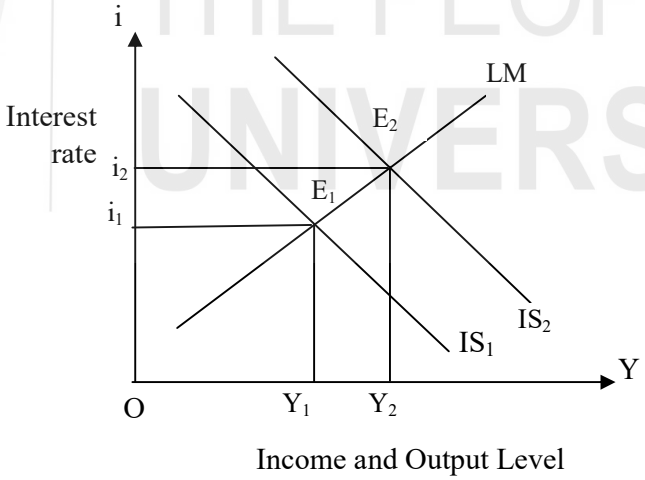

Fig. 3.2: Shift in the IS Curve

Let us assume that there is an increase in the autonomous investment. This results in an increase in the autonomous spending($\bar{A}$) and hence there is a parallel shift in the IS curve from IS_1 to IS_2 (see Unit 12). Correspondingly, the equilibrium shifts from E_1 to E_2 which indicates higher equilibrium level of income and output, and higher rate of interest.

In Fig. 3.2 you can see that output increases from Y_1 to Y_2, and interest rate increases from i_1 to i_2.

You should observe that the extent of change in the level of income ($=\alpha_G \Delta\bar{A}$) is not the same as the extent of shift in the IS curve. This is because we are dealing with the money market also. Increase in $\Delta\bar{A}$ leads to increase in income, which affects the demand for money. Supply of money remains fixed while the demand for money increases. Consequently the rate of interest increases in the money market. This has a negative impact on the investment spending. As interest rate rises, investment falls to some extent. Hence, the final change in the income is less than $\alpha_G\ \Delta\bar{A}$.

3.2.2 Shift in the LM Curve

In Fig. 3.3 we describe a situation where the LM curve shifts to the right. Let us consider the changes an economy goes through if such a shift takes place.

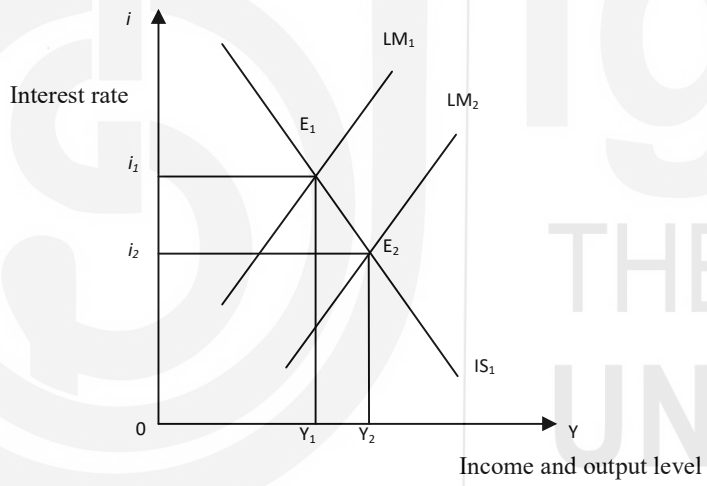

Fig. 3.3: Shift in the LM Curve

Let us assume that there is an increase in the money supply in the economy. Consequently there is a right-ward parallel shift in the LM curve from LM_1 to LM_2 (see Unit 13). Consequently, the equilibrium changes from E_1 to E_2. As we can see from Fig. 3.3, interest rate decreases from i_1 to i_2 while output level increases from Y_1 to Y_2.

Since we assume price level to be constant, an increase in money supply results in an increase in the supply of real balances as a consequence of which there is a decline in the rate of interest.

A decline in the rate of interest leads to an increase in the level of investment in the economy as a result of which there is an increase in the level of output.

Check Your Progress 1

1) Explain the simultaneous equilibrium in the goods market and the money market.

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2) Explain the impact of a leftward shift in the IS curve through appropriate diagram.

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3) Explain the impact of a leftward shift in the LM curve through appropriate diagram.

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3.3 EQUILIBRIUM AND ADJUSTMENT PROCESS

In the previous Section we found that equilibrium output and interest rate are realized at the intersection of the IS and the LM curves. In this Section we will show that there is a tendency of the market to reach back to the equilibrium. If the economy is outside the IS and the LM curves (when there is no equilibrium in the economy), an adjustment process in the economy takes place and the economy moves to a new equilibrium point. Let us appreciate the following two points:

a) If there is an excess demand for money, the interest rate will increase. The interest rate will fall in case we observe excess supply in the money market.

b) Excess demand for goods leads to an increase in output and excess supply of goods leads to a decline in output. The former involves run down of inventory with the firms while the latter leads to accumulation of inventories.

Let us consider Fig. 3.4, which shows the adjustment process that market follows to regain equilibrium if there is some shock/ disturbance.

Let us assume that the economy is operating at a point which is not on the IS and LM curves.

In other words, Fig. 3.4 shows few points (for example F, G, H and K) which do not reflect the equilibrium in the money market as well as the goods market. From such points, how does the economy reach towards equilibrium?

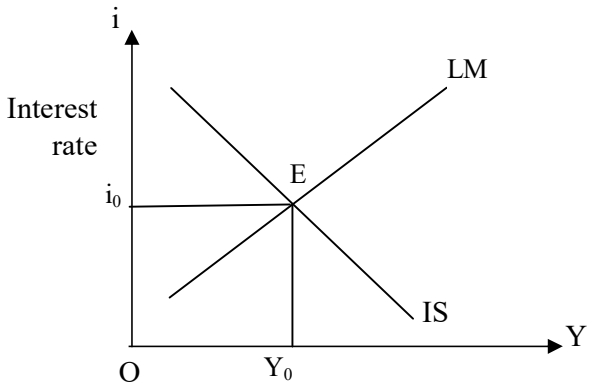

Fig. 3.4: Adjustment towards Equilibrium

Any point to the left of the LM curve shows excess supply of money (see Unit 13). On the other hand, any point to the right of the LM curve shows excess demand for money. Similarly, any point to the left of the IS curve shows excess demand for goods (see Unit 12). On the other hand, any point to the right of the IS curve shows excess supply of goods.

Let us take any random point G (it represents excess demand for money and excess supply of goods). The arrows given at point G specify the direction in which adjustment takes place. Excess demand for money will cause interest rate to rise. This is because assets are sold off for money and price of assets decline. Upward pointing arrow represents rising interest rate. Excess supply of goods leads to involuntary accumulation. So the firms start reducing the output. The leftward pointing arrow represents the declining output. Points F, H and K in Fig. 3.4 are similarly points of disequilibrium where adjustment takes place and eventually the economy reaches at E, the point of equilibrium. Even if only one of these two markets is observing disequilibrium, the economy reaches back to equilibrium after the adjustment process.

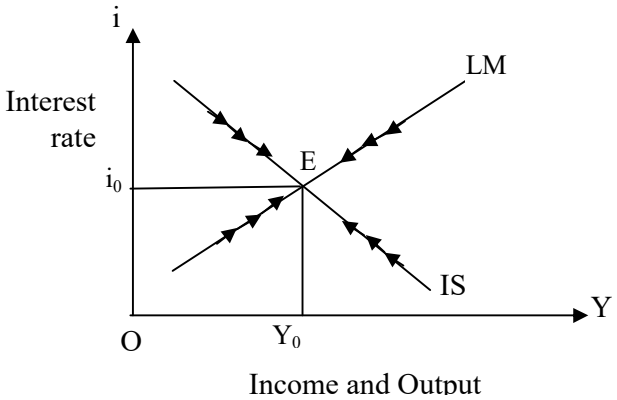

Fig. 3.5: Adjustment Process in the Economy

In Fig. 3.5 we have indicated the direction of change by arrow marks. Any point on the IS curve, apart from E, shows equilibrium in goods market but a disequilibrium in the assets market.

Similarly, any point on the LM curve, except point E, shows disequilibrium in the goods market (see Fig. 3.5). In case we are above the IS curve and on the LM curve, then the movement towards the equilibrium point E would mean lowering interest rates and the lowering of output too. Assets market does not take time to clear and hence the equilibrium is attained immediately. This kind of adjustment process will lead to an equilibrium position which is stable till the concerned economic variables do not change.

3.4 CLASSICAL AND KEYNESIAN ZONES

In Unit 13 we discussed about the slope of the LM curve which shows the sensitivity of money supply on interest rate and output level.

There could be two extreme cases with respect to the LM curve, viz., i) the LM curve is horizontal, and ii) the LM curve is vertical. We will see the implications of both the situations.

In the first situation, when the LM curve is horizontal, the public is prepared to hold all the money at a given interest rate. It reflects a situation known as *liquidity trap*. In such a case, monetary policy has no effect on the rate of interest and the level of output. A condition of liquidity trap exists when the rate of interest is very low (for example, nearly zero). Public would not want to hold bonds at such low interest rate.

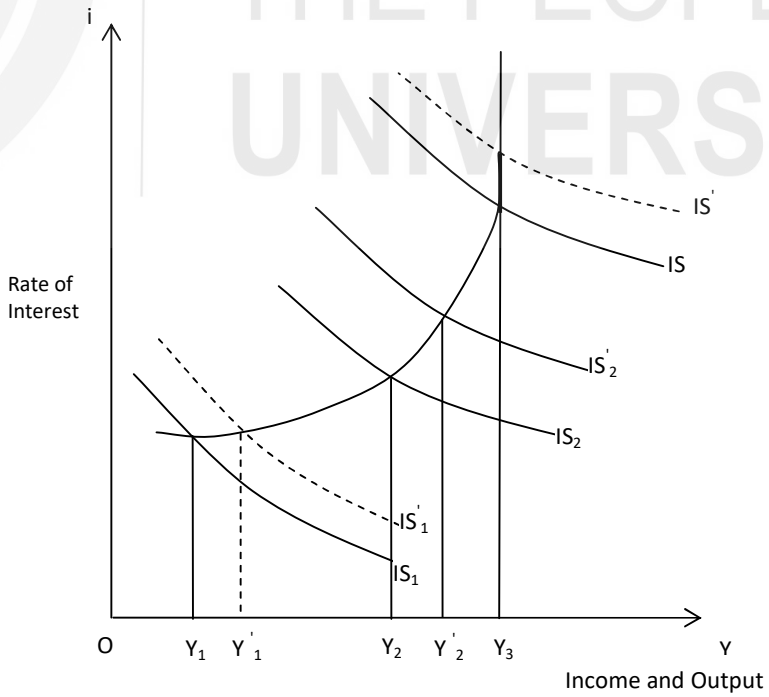

Fig. 3.6: Classical and Keynesian Ranges

Let us now learn about classical and Keynesian positions through the IS–LM model. Fig. 3.6 shows the classical and the Keynesian ranges in the LM curve

Let us assume that the economy is operating at Y_1. The LM curve is infinitely elastic at Y_1. In case the government exercises an expansionary fiscal policy, which means government expenditure increases, then the IS_1 curve shifts to IS'_1. There is nearly no increase in the rate of interest but income level has risen from Y_1 to Y_1'. Rate of interest does not increase because sufficient idle money is available in the economy. This is the **Keynesian range** as individuals are in a situation of liquidity trap. Under such circumstance monetary policy is ineffective and government should take up fiscal measures.

If we see the other extreme in Fig. 3.6, where economy is operating at Y_3 level, we realise that the LM curve is nearly vertical. Rate of interest is too high for people to hold money. The interest bearing assets are lucrative to invest the money. Hence, the real money balances are low. When government borrows (with an intention of increasing the level of investment), in such a situation, government investment becomes a competitor of private investment and there is no increase in total investment in the economy. Due to this high competition, the rate of interest rises but not the income level. This range of the LM curve is known as the **classical range**. Under such circumstances, fiscal policy is not much effective. We have already discussed the distinction between classical and Keynesian views in Unit 9.

The moderate range seems to be more realistic vis-à-vis the Keynesian and the classical ranges of the IS-LM model. Such a moderate range is depicted in Fig. 3.6 by the income level Y_2. When government investment increases, the complete 'crowding out' of the private investment does not take place. There is an increase in the rate of interest but there is an increase in the level of output also. In Fig. 3.6 we find that the output level increases from Y_2 to Y_2' due to the shift in the IS curve from IS_2 to IS_2'.

Check Your Progress 2

1) Explain how the adjustment process takes place in the IS-LM model.

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2) In what respects the classical range of the LM curve is different from the Keynesian range?

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3.5 LET US SUM UP

We started this unit with a discussion on the simultaneous equilibrium in the goods market and the money market. It led to the unique combination of interest rate and the output level which indicates simultaneous equilibrium in both the markets. Any point away from the IS curve and/or the LM curve indicates the state of disequilibrium. In case of any disequilibrium, the adjustment process starts and the equilibrium in both the markets are restored.

Further, we discussed about the Classical and Keynesian ranges with respect to the LM curve. When the LM curve is vertical, it reflects a situation similar to the classical model where the output level does not change as a result of government borrowing. On the other hand, when the LM curve is nearly flat, it reflects a situation similar to the Keynesian model because the public investment leads to shifts the income level only and not the interest rate.

3.6 ANSWERS/HINTS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress 1

1) Refer to Section 3.2.
2) Refer to Section 3.2.1.

Check Your Progress 2

1) Refer to Section 3.3.
2) Refer to Section 3.4.
3) Refer to Section 3.5.
4) Refer to Section 3.6.