UNIT4 ADAPTIVE EXPECTATIONS*

Structure

4.0 OBJECTIVES

After going through this unit, you will be able to

- explain the concept of adaptive expectations;
- formulate the idea of adaptive expectations with the help of algebraic equations;
- identify the pros and cons of adaptive expectations; and
- explain the implications of adaptive expectations for change in the AS curve.

4.1 INTRODUCTION

Expectations play an important role in our life. We take several decisions on the basis of expectations every day. For example, if we expect that it may rain later in the day, we carry an umbrella or a rain coat. If we expect traffic jam on the route, we start early for office. Economic agents also keep in mind the future value of economic variables while taking decisions. If a producer, for example, expects that profits will be higher in the coming years she will invest further to expand production capacity. If a housewife expects that prices of onion may increase in the coming weeks, she may buy some more quantity of onion and store it. If a stock holder expects that net asset value (NAV) of a particular share is likely to decrease tomorrow, she will sell it today. If a worker expects that inflation will be higher next year, he will bargain for a higher wage rate while entering into a contract with his employer. How do we incorporate such

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expectations into economic theory? There are two important hypotheses regarding expectations formation, viz., adaptive expectations hypothesis and rational expectations hypothesis. We discuss adaptive expectations hypothesis in the present Unit while rational expectations hypothesis is discussed in the next Unit.

4.2 ADAPTIVE EXPECTATIONS HYPOTHESIS

Adaptive expectations is a theoretical concept that deals with formulation of expectations for future on the basis of experiences and events in the recent past. For example, if inflation rate in the recent past was higher, people will expect that inflation rate will be higher in the current year. In this context, suppose we expected that rate of inflation for last year would be 12 per cent and the actual rate of inflation for last year was 12 per cent. In that case, the adaptive expectations hypothesis says that we will not change our expectations about the rate of inflation for current year. We will expect inflation rate to be 12 per cent for the current year too. On the other hand, suppose the rate of inflation for the last year was higher than 12 per cent, say 15 per cent. The adaptive expectations hypothesis says that we will change our expected rate of inflation for this year. In short, we will increase our expected rate of inflation for the current year from 12 per cent to a higher rate (say, 14 per cent). Further, suppose the rate of inflation in the past year was less than 12 per cent, say 8 per cent. The adaptive expectations hypothesis suggests that our expectations about inflation rate for current year will be lower than this somewhere between 12 per cent and 8 per cent.

The adaptive expectations hypothesis does not predict the correct amount by which there will be increase or decrease in the actual value of a variable. It only shows the change in expected value of a variable. The change will be different for different cases and can be only determined empirically. Thus, the message of the adaptive expectations hypothesis is clear. People will change their expectations of a variable if there is difference between what they were expecting for the past year and what actually happened in that year. Precisely, people will increase their expectations if the actual value of a concerned variable was higher than what they were expecting and they will reduce their expectations if the actual value of concerned variable was lower than what they were expecting. If expectations turned out to be correct then there will be no change in their expectations.

4.3 ALGEBRAIC TREATMENT OF ADAPTIVE EXPECTATIONS

For clear understanding, we can express adaptive hypothesis in simple algebraic equations. Suppose, we wanted to use the concept of expected income to check

that consumption is depend on expected income rather than actual income. As per correct adaptive expectations hypothesis, the following equation will be true:

$$Y_t^e - Y_{t-1}^e = \alpha(Y_{t-1} - Y_{t-1}^e) \quad \text{... (4.1)}$$

where Y_t^e is the value of expected income in time period t,

Y_{t-1} is the actual income in time period t-1, and α is a coefficient and its value is positive but less than one.

Equation (4.1) can be simplified and can be rewritten as

$$Y_t^e = Y_{t-1}^e + \alpha(Y_{t-1} - Y_{t-1}^e)$$

or,

$$Y_t^e = \alpha Y_{t-1} + (1-\alpha)Y_{t-1}^e \quad \text{... (4.2)}$$

If equation (4.2) is true, then it must be true for the last time period and the time period before that and so on. Mathematically, we can write the following equations:

$$Y_{t-1}^e = \alpha Y_{t-2} + (1-\alpha)\, Y_{t-2}^e \quad \text{... (4.3)}$$

$$Y_{t-2}^e = \alpha Y_{t-3} + (1-\alpha)\, Y_{t-3}^e \quad \text{... (4.4)}$$

$$Y_{t-3}^e = \alpha Y_{t-4} + (1-\alpha)\, Y_{t-4}^e \quad \text{... (4.5)}$$

and so on.

On the basis of the above equations, we can substitute for Y_{t-1}^e in equation (4.2) and obtain the following equation:

$$Y_t^e = \alpha Y_{t-1} + \alpha(1-\alpha)Y_{t-2} + \alpha\,(1-\alpha)^2 Y_{t-3} + \alpha\,(1-\alpha)^3 Y_{t-4} \ldots \quad \ldots(4.6)$$

You should observe equation (4.6) closely. It links the unobservable variable, i.e., expected income (Y_t^e) to the observable actual income in the previous time periods ($Y_{t-1}, Y_{t-2}, Y_{t-3}, \ldots$). In other words, this is another way of understanding adaptive expectations hypothesis. It shows that the expectations of any variable can be written purely as a function of its past values. Since $\alpha < 1$, the coefficients attached to each lag declines as the number of lag increases. For example, if $\alpha = 0.5$, equation (4.6) can be written as

$$Y_t^e = 0.5Y_{t-1} + 0.25Y_{t-2} + 0.125Y_{t-3} + 0.0625Y_{t-4} + \cdots$$

There is one problem however. Equation (4.6) shows that to find out the value of expected income for the current period, we require data on actual income of the beginning time period (Y_0). If the value of α is less than one (which the adaptive expectations hypothesis says), then the actual income in any period will have less impact on current expected income. In simpler words, the latest data on actual income dominate the formulation of expectations about future income.

Check Your Progress 1

1. Explain the concept of adaptive expectations.

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2. Write down the basic equations of adaptive expectations hypothesis.

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3. In 2019 the expected rate of inflation was 7 per cent while actual rate of inflation was 5 per cent. If $\alpha = 0.5$, find out the expected inflation rate for 2020.

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4.4 LIMITATIONS OF ADAPTIVE EXPECTATIONS HYPOTHESIS

There are certain limitations of the adaptive expectations hypothesis. There could be situations in which the adaptive expectations hypothesis is improbable. For example, the adaptive expectations hypothesis assumes that economic agents ignore all available information. They rely on past experience and events only. Latest information can help in improving accuracy of expectations. Suppose the rate of inflation in the economy fluctuates between 0 per to 10 per cent. Then, according to the adaptive expectations hypothesis people will expect that the future rate of inflation will be between 0 per cent and 10 per cent. Suppose, there is an external disturbance (say, war, oil crisis, or global financial crisis) that will eventually affect the general price level in the country. In the recent past such an event was not there. Thus, according to adaptive expectations hypothesis, economic agents will not take it into account. However, if this information is ignored, the adaptive expectations hypothesis can give misleading signals. Let us consider some examples.

EXAMPLE 1: Assume that there is a regular increase in the value of a variable (say, inflation) in an economy. As per adaptive expectations hypothesis the expected value of the variable will be less than the actual value of the variable.

Let people form expectations according to the following equation:

$$P_t^e = 0.5\ P_{t-1} + 0.5\ P_{t-1}^e \quad \text{...(4.7)}$$

where P_t is the actual rate of inflation in time period t and P_t^e is the expected rate of inflation in time period t.

Now, let us assume that the rate of inflation is rising by one percentage point each year. So it will be 1 per cent in year 1; 2 per cent in year 2; 3 per cent in year 3; and so on. Suppose we are in time period '0' at the moment; and the values of expected inflation and actual inflation are 0 per cent. As per adaptive expectations hypothesis, the expected rate of inflation for the first year will be 0 per cent because last year the expected inflation was 0 per cent.

$$P_1^e = 0.5\ P_0 + 0.5\ P_0^e = 0.5 \times 0 + 0.5 \times 0 = 0$$

In year two, the expected inflation will increase to half the difference between actual inflation in year 1, (that is, 1 per cent) and the expected inflation in year 1 (that is, 0 per cent). Therefore, expected rate of inflation for the second year is 0.5 per cent.

$$P_2^e = 0.5\ P_1 + 0.5\ P_1^e = 0.5 \times 1 + 0.5 \times 0 = 0.5$$

By applying the above formula, you can find out that expected inflation will be 1.25 per cent for the third year, 2.125 per cent for the fourth year, and so on. However, each year the actual rate of inflation would be higher than what was expected. So, a question arises: Is it possible for people to continue with this method of predicting wrong data every year? Will they not realise that their method of computing expectations is yielding wrong result? Will they not try to change the method of forecast of inflation?

In the above example, we considered a situation where there is an increase in the value of a variable. We found that expected value will be smaller than actual value. Let us take a variable whose value is decreasing over time. In this case, the expected value will be higher than the actual value in the subsequent time periods!

In this context, Fleming (1976) gives a suggestion that it can be resolved by 'shifting gear', i.e., people may take the rate of change of inflation rather than the level of inflation into consideration for formulation of expectations. However, if people change the method of formulating expectations by shifting gear or in some other way, the adaptive expectations hypothesis as shown above is inadequate. It does not give any guidance about when and under what circumstances such changes in the method of computations of expectations will take place.

EXAMPLE 2: Let us consider a situation in which government announces to increase the money supply over the coming year by 10 per cent. There are various possibilities. The government may increase the money supply by 5 per cent at the beginning of the year, for the first six months. So money supply at the beginning of the year will be higher by 5 percent. But if government increases money supply in the starting of the year by 10 per cent, then the increase in money supply in the beginning of the year will be 10 per cent. As per the adaptive expectations hypothesis, what do we expect about the increase in money supply for the first six months? Is it 5 per cent or 0 per cent? Therefore, there is some ambiguity on what we should expect for the next six months.

EXAMPLE 3: Talking about the implausibility of the adaptive expectations theory let us consider the example of ending the fixed exchange rate in early 1970s. The UK moved to a more flexible exchange rate system with expansionary fiscal policy in the form of higher government expenditure and increased rate of monetary growth. As is known that fixed exchange was abandoned because of pressures for exchange rate to depreciate were bound to occur as a result of the sharp increase in aggregate demand and the government did not want these pressures to interfere aggregate demand policies. Under these conditions it would surely have been naïve to base our expectations of the future course of the exchange rate on the past values of exchange rate alone. People at that time were informed that exchange rate was going to fall. Why should people not use freely available information in formulating their expectations about exchange rate? Why should we consider only the previous value of exchange rate at the time of predicting its future value?

All these examples explain the same thing – adaptive expectations hypothesis assumes that people do not pay attention to information which enables them to formulate accurate expectations. The adaptive expectations hypothesis assumes that people ignore information which would help them form better expectations. Therefore, the adaptive expectations hypothesis is known as a simple approximation which may be useful in certain situations. When expected value of any variable is being determined largely by its own lagged values, it should not be applied without consideration of whether those conditions are likely to hold.

4.5 ADVANTAGES OF ADAPTIVE EXPECTATIONS HYPOTHESIS

The main idea behind the adaptive expectations hypothesis is that people will adapt or change their expectations on the basis of past experience. It has certain attractive features. First, imagine that the rate of inflation increases from 8 per cent to 15 per cent and remains there. In that case expectations will increase gradually till it reaches to 15 per cent. Likewise, if actual rate of inflation decreases from 15 per cent to 8 per cent and it halts there, then expectations of people will decrease gradually till it reaches 8 per cent. Therefore, the adaptive expectations hypothesis has an attractive feature.

It shows that people can be fooled temporarily with the changes that we have assumed in the inflation rate. However, they cannot be fooled in the long run. You should be note that it will take some time for people to adapt their expectations fully. Further, another attractive feature of the hypothesis is that it allows people to relate the expected (i.e., unobservable) variables to the actual (i.e., observable) variables.

As acknowledged by the Milton Friedman, adaptive expectations were instrumental in evolving economic concepts such as Phillips curve. Phillips curve, as you will see in Unit 6, is a downward sloping curve which shows the relationship between inflation rate and unemployment rate. According to the Friedman, workers form adaptive expectations and they can be surprised by the government through unexpected change in monetary policy. .

As workers may be trapped by monetary illusion, they are unable to understand the dynamics of wages and prices. Hence, unemployment can be reduced through monetary expansions. This will result in a trade-off between inflation and unemployment. If the government chooses to fix unemployment at a low rate, there will be increase in inflation, and vice versa. However, as mentioned above, there will be also some problem because agents are arbitrarily supposed to ignore the source of information which otherwise affects their expectations. For example, with announcement by the government about a change in monetary policy, workers/ economic agents should modify their expectations, and break with the previous trends. Because of this, the hypothesis of adaptive expectations is regarded as a deviation from the rational tradition of economics.

Adaptive expectations hypothesis can be easily substituted for predicting unemployment or rate of interest or the growth rate of real income on the basis of previous data of related macroeconomic variables. For example, it suggests that investors will adjust their expectations of future behaviour based on recent past data. If the market has been trending downward, people are likely to expect that it will continue that way, because that is what it has been doing in the recent past.

In short, this hypothesis suggests that if the market has been trending downward, people will expect that this trend will continue in current and future time. However, it should be noted that this tendency could be misleading because it can cause people to lose sight of larger, long term trends. In reality, a variable could move in the opposite of the forecast by adaptive expectations hypothesis. For example, before the sub-prime crisis in the USA, home prices was increasing and trending upward for a considerable length of time. People focused on this fact and assumed that home prices would continue to increase indefinitely. Thus, they leveraged up and purchased assets with the assumption that price will not fall. However, fact is in front of us. The cycle turned and prices fell as the bubble burst.

Check Your Progress 2

1. Point out the limitations of adaptive expectations hypothesis in brief.

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2. Point out the advantages of adaptive expectations hypothesis.

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4.6 ADAPTIVE EXPECTATIONS AND SHIFT IN THE AS CURVE

Aggregate supply is total quantity of supply of goods and services in an economy in a particular time period. Aggregate supply is influenced by actual inflation and the level of output. When we incorporate adaptive expectations into the supply we get a dynamic aggregate supply curve. Let us analyse the behaviour of the AS curve in the short run and the long run.

4.6.1 Short-Run Aggregate Supply Curve

Short-run aggregate supply curve (AGS) shows relationship between price level and output when the expected rate of inflation is constant (i_0). The economy is initially in equilibrium at point E_0 where the actual output Y is equal to the full employment output Y* and the actual price P is equal to the expected price P^e. Point E_0 is determined by the intersection of the upward sloping SRAS curve, the downward sloping AD curve, and the vertical long run LRAS curve. To begin with, equilibrium is at point A, which is both the short run and the long run equilibrium point.

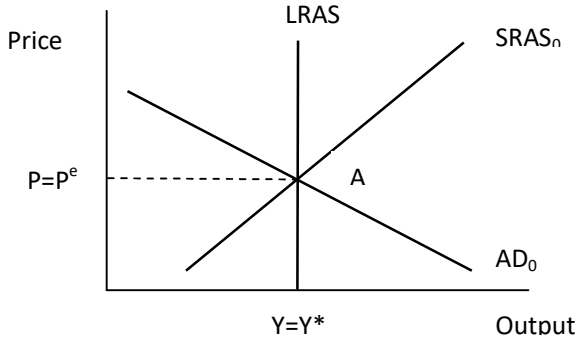

Fig. 4.1: Equilibrium in the Short Run

If there is change in expected inflation, there will be a shift in the SRAS curve. For example, if expected inflation increases, then there will be an upward shift in the SRAS curve. Similarly, if there is an increase in expected prices, there will be a shift in the SRAS curve.

4.6.2 Long-Run Aggregate Supply Curve

You should note that full employment level of output Y* is defined as that level of output at which actual price level is equal to expected price level $P_0 = P^e$.

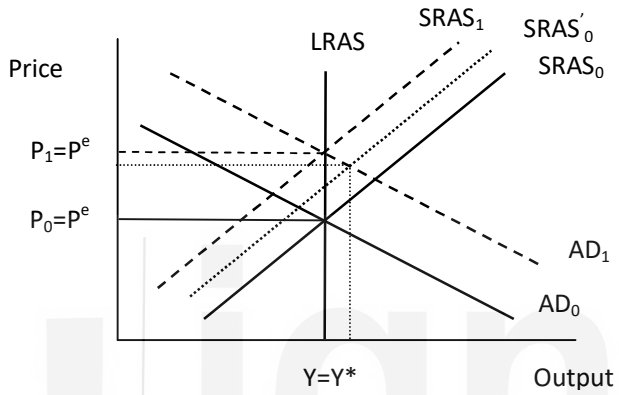

Fig. 4.2: Long-run Dynamic AS Curve

Let us assume that there is a favourable demand shock to the economy. The shock can happen either because of expansionary monetary policy (by increasing money supply) or expansionary fiscal policy (by increasing government spending or reducing taxes). The demand shock shifts the AD curve upward to the right (from AD to AD_1) as shown in Fig. 6.2.

Now if we see Fig.4.2, the shift in the AD curve to AD_1 has disturbed the short run equilibrium. Due to the increase in demand, the new equilibrium will be at the intersection of the $SRAS_1$ curve and the AD_1 curve. This would result in an increase output as well as prices. Thus actual output is more than natural output. Recall that expected prices in the economy was equal to P_0. The economy is in a situation of boom period. Therefore, $Y > Y^*$ and $P > P^e$.

This increase in the actual price level reduces the real wages of the workers in the current period as the actual price is now greater than what they expected the price to be. As a result, the workers in the next period will revise their expectations about the prices upward and hence demand higher nominal wages so as to keep their real wages constant. This change in the expectations of the prices upwards shifts the SRAS curve upwards.

The SRAS curve will shift upwards until the actual output Y is equal to the natural output Y* and actual prices $P_1=P^e$. It implies that equilibrium in the medium run will be at a higher level of output. In the long run, however, the economy will move back to the natural output level Y*. It also shows that in the long-run, the LRAS curve is vertical which shows the attainment of output at full employment level.

Check Your Progress 2

1) Discuss the shift in aggregate supply curve in the short-run.

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2) Explain why the long-run aggregate supply curve is vertical.

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4.7 LET US SUM UP

The adaptive expectations hypothesis deals with a method that enables people to forecast future probabilities on the basis of data of recent past. Thus the adaptive expectations hypothesis is backward looking. However, it is widely used in various fields of macroeconomics such as investment decision, consumption, saving, etc. for predicting future trends and formulating important policies. This hypothesis is easily understood with the help of algebraic equations. There are certain problems with the adaptive expectations hypothesis because at the time of formulation of predictions on the basis of previous data, people may ignore certain important information; and hence their expectations could be erroneous. Once a forecasting error is made by households or firms, they cannot forecast an accurate result. Persistence of this problem could create some kind of uneasiness among economists and policy makers. This led to development of an alternative model of how expectations are formed, i.e., the rational expectations hypothesis. The rational expectations hypothesis has largely replaced adaptive expectations hypothesis in macroeconomic theory. The adaptive expectations hypothesis also helps in explaining the shape of Phillips curve and the aggregate supply (AS) curve. If there is mismatch between expected inflation and actual inflation, there will be a shift in the AS curve in the short run. There will be no change in the shape of the AS curve in long run because expected inflation and actual inflation will always be the same. Therefore, the AS curve will be vertical in the long run.

4.8 ANSWERS/HINTS TO CHECK YOUR PROGRESS

Check Your Progress 1

1) Go through the first paragraph of Section 4.2 and answer.

2) Go through Section 4.3 and answer.

3) Apply the formula given at Section 4.3. Your answer should be 6 per cent.

Check Your Progress 2

1) Go through Section 4.6 and answer.

2) Go through Section 4.6 and answer.

UNIT 5 RATIONAL EXPECTATIONS*

Structure

5.0 OBJECTIVES

After studying this unit you will be able to:

- explain the concept of rational expectations;
- interpret rational expectations algebraically;
- identify the scope and limitations of rational expectations;
- explain the policy ineffectiveness proposition (PIP) concerning the Lucas supply curve.

5.1 INTRODUCTION

The rational expectations hypothesis is widely used in macroeconomics. According to this hypothesis, economic agents use all available information to make predictions about economic variables. In addition, this hypothesis says that economic agents, along with available information and their experience, use their human rationality to predict the future value of an economic variable. They are well aware of it that predictions may not be correct. However, they learn from mistakes and improve their predictions for the future. This hypothesis not only applies to formulate expectations about inflation and income but also explains the formation of a wide range of economic variables.

Rational expectations hypothesis was proposed by John F. Muth in his seminal paper, "Rational Expectations and the Theory of Price Movements," published in 1961 in the journal, *Econometrica*. In this Unit we will discuss the hypothesis and its criticisms.

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5.2 CONCEPT OF RATIONAL EXPECTATIONS

In the middle of the twentieth century many economists were of the view that theories based on rational behaviour were inadequate to explain observed phenomena. The argument of Muth was the exact opposite of this, i.e., existing economic models did not assume enough rational behaviour. The rationality of economic thinking can be ensured by introducing the expectations of economic variables in models used to explain human behaviour.

Given the economic model, expectations are rational if actual values of variables, on average, are equal to the expected values of variables. For example, suppose there is a producer with rational expectations and (s)he performs the following thought experiments: what price should I expect, which is equal to everyone's expected price? The producer takes into account various factors for this exercise. These factors could be the anticipated supplies by others, behaviour of other producers, inflation, etc. After consideration of all these, (s)he computes the price that will prevail in future.

Milton Friedman emphasised that economic agents act as if they are maximising profit/ utility. According to Muth, people do not work with the system of equations that economists use for maximisation of profit or utility. Further, individuals do not have similar expectations; they differ in their beliefs. However, individuals' expectations should be distributed around the actual value of the variable to be forecasted. In this sense the anticipations of an average individual should be the expected value of the variable.

There are two versions of the rational expectations hypothesis: weak and strong. In the weak version, it is assumed that people have access to limited information; but they make best use of the information. Let us take a concrete example. You buy wheat flour (*atta*) every week for household consumption. You do not know the relative prices and nutrient levels of all the brands of wheat flour available in the market. With limited information available to you, however, you usually stick to the same brand (and may be the same shop, without knowing that other shops are charging a lower price!). Individuals however vary in their decision-making. They do not stick to the same brand. Thus there is no systematic error in their choice. When we take the expected value (that is, the average value) of a variable, it is usually not different from its actual value.

In the strong version of rational expectations hypothesis, it is assumed that people have access to all information. Decisions taken are based on all information. Thus, expected value of a variable is equal to its actual value. Any error in forecast is due to unexpected developments.

5.3 ASSUMPTIONS OF RATIONAL EXPECTATIONS

To have a logical understanding of rational expectations hypothesis, you should have clear understanding of probability theory, particularly conditional probability and the expectation operator (You should have gone through Units 9,

10 and 11 of BECC 107: Statistical Methods for Economics). The basic premises under which the rational expectations hypothesis is developed are given below.

(i) Economic agents have full and perfect information to predict the value of a future event.

(ii) Event/variable should be quantifiable to facilitate data collection and its analysis.

We know that it is difficult to quantify many variables. Changes in economic environment are difficult to quantify. We assume that probability distributions of the events are known. We are in a position to find out at least the first two moments (mean and standard deviation) of the probability distribution.

(ii) Economic agents (firms, household and government) are assumed to be rational.

They compare among available alternatives. They have the cognitive ability, time and resources to evaluate each alternative against the others. Households maximise utility while firms maximise profits. People are consistent in their choices.

5.4 ALGEBRAIC EXPRESSION OF RATIONAL EXPECTATIONS

The rational expectations hypothesis argues that people will use all available information related to the determination of the expected value of any variable. Let us assume that there is an economic variable Y and its expected value is determined by its own lagged values and by lagged values of other variables (X and Z) in any time period 't'.

$$Y_t = a_0 + a_1 Y_{t-1} + a_2 X_{t-1} + a_3 Z_{t-1} \quad \ldots (5.1)$$

where X, Y, and Z are variables

$\alpha_0, \alpha_1, \alpha_2$ are fixed coefficients

Equation (5.1) is an expression of general hypothesis about formulating expectations. Here we are neither defining any variable nor saying anything about the values of the coefficients in this equation. It is only an algebraic representation of a process.

Let us assume that there is a person who is formulating expectations about the value of Y in time period 't' at the end of time period t-1. He knows the process of determining the value of Y is given by equation (5.1). Let us also assume that the person knows the values of all the lagged values of X, Y, and Z by the end of time (t-1). If he is rational, his expectations about the value of Y in time period (t) will be based on his information set at the end of time period t-1. The process of determining Y will be

$$E_{t-1} Y_t = a_0 + a_1 Y_{t-1} + a_2 X_{t-1} + a_3 Z_{t-1} \quad \ldots (5.2)$$

where $E_{t-1}Y_t$ is the expected value of Y in time period 't' and it is formed on the basis of the information set available at the end of time period t-1.

Formally, $E_{t-1}Y_t$ is equal to $E(Y_t/I_{t-1})$ where E is the mathematical expectation operator and I_{t-1} is the information set available at time period (t-1). The rational expectation of Y at time (t) is formulated on the basis of available information at time period (t-1). 'E' is rational expectations operator for expectations anticipated based on information of time period (t-1).

If Y is following the process mentioned in equation (5.1), then the implication of equation (5.2) is that expectations will be accurate. In other words, forecasting error will be zero. Forecasting/prediction error is the difference between the actual and the expected values of a variable.

You should note that the value of prediction error will not always zero, i.e., the expected value of a variable is not always equal to it true value. It is true when the economic process of formulating the expected value of a variable is deterministic. However, in a real sense, most of the economic processes are stochastic, not deterministic. A stochastic process includes an element of unpredictability or uncertainty. As you know, economics deals with the unpredictable/ random behaviour of human beings. This element of unpredictability in the process of formulating the rational expectations can be explained by adding a random variable in equation (5.1). That makes this process more realistic.

$$Y_t = a_0 + a_t Y_{t-1} + a_2 X_{t-1} + a_3 Z_{t-1} + v_t \quad \ldots (5.3)$$

Here, v_t is a random variable and its value may be positive or negative. The variable v_t represents a large number of random variables that affect human behaviour. Therefore, a smaller value of v_t is better. It implies that probability distribution of the stochastic variable v_t is concentrated at zero. In other words, the expected value of v_t is zero.

The assumptions pertaining to v_t are

(i) v_t can be positive or negative.

(ii) It has a constant and finite variance (σ_v^2)

(iii) The smaller values of v_t are supposed to occur more frequently than large values of v_t so probability distribution of v_t is centred at 0.

(iv) v_t is unknown at the end of t^{th} period. It is also not the part of Information Set [I_{t-1}].

The process of rational expectations of Y in time period (t) is based on the set of information at the end of time period (t-1). It is formed in (5.3) equation as

$$E_{t-1}Y_t = a_0 + a_1 Y_{t-1} + a_2 X_{t-1} + a_3 Z_{t-1} + E_{t-1}v_t \quad \ldots (5.4)$$

where $(E_{t-1}v_t)$ is the expectation of (v_t). That is formed based on a set of information available at the end time period (t-1).

The rational expectations hypothesis must assume that the formulated expectations of this period's value of (v) by a rational individual is made on the basis of the process determining (Y_t), given the set of information for time period (t-1). Further, assume that the rational expectations of v in time period (t) based on a set of information in time period (t-1) is zero. It can be written as:

$$E_{t-1}v_t = 0 \quad \ldots (5.5)$$

Now, based on the available information in time period (t-1), the rational expectations of Y in time period (t) can be written as follows:

$$E_{t-1}Y_t = a_0 + a_1Y_{t-1} + a_2X_{t-1} + a_3Z_{t-1} \quad \ldots (5.6)$$

If the value of Y is determined as per specifications of equation (5.3), then the value of prediction error is given by following equation:

$$Y_t - E_{t-1}Y_t = v_t \quad \ldots (5.7)$$

In stochastic models the prediction error is equal to the actual value of v_t. The value of v_t is known only after it has occurred. If v_t happens to be large, it implies that error is large because it is difficult to predict the actual v_t. In rational expectation hypothesis, there is no systematic pattern of v_t. Thus, forecasting error also does not show any pattern.

5.5 IMPLICATIONS OF RATIONAL EXPECTATIONS HYPOTHESIS

It is understood from the above discussion that if the process of determining the value of rational expectations of the variable Y remains unchanged, there will some components of randomness in Y which is represented by v. The implications of above are given below.

(a) **The mean or average of the error term is zero** - Once the random variable v is included in the process of determining Y, the rational expectations of Y will not be perfectly accurate. The best thing which a rational forecaster can do is to assume that the value of v is zero. It means that error made by forecaster in each period will be equal to value of v in that period. Sometimes this error will be positive, at other times it will be negative. In certain rare cases the error will be zero. However, over several periods, negative errors will cancel out with positive errors. Then the average of error will be zero.

(b) **Errors of rational expectations exhibit no pattern -** the hypothesis of rational expectations rule out any pattern in forecasting errors because of the assumption that random element itself exhibits no pattern. It cannot be predicted based on the available information at the time of the forecast. However, what if the random element (v) shows some pattern? For example, if the current value of (v) is linked to its previous period's value as:

$$v_t = \beta v_{t-1} + \epsilon_t \quad \ldots (5.8)$$

where ϵ_t is a random error with a zero mean and which cannot be predicted based on any information available at the end of time period (t-1). The value of parameter β varies between –1 and +1.

If (v) is determined according to the process mentioned in equation (5.8), then the rational economic agents will formulate expectations about the present value of (v) by following that process. Since the value of (v) in period (t-1) will be a part of the information at the end of time period (t-1), the forecast value (v) will deviate from the actual value of (v) by an unknown, unpredictable element (ε_t).

This element (ε_t) shows no pattern and its mean value is zero. Therefore, even if (v) shows a pattern, the rational forecast of Y will still be correct on an average and forecasting error will show no pattern.

(c) **Rational Expectations are the most accurate expectations** - the forecasted value of Y follows the process discussed above and it is based on available information in time period (t-1). Uncertainty about expected the value of Y arises because of the presence of random element (v). Although the mean of the random variable is zero, it can be positive or negative in any time period. There is the variance (σ_v^2) that tells the value of (v) that will occur. If the variance (σ_v^2) is very high then the value of v will be high and vice versa. Therefore, the variance of v is a measurement of the inherent unpredictability of Y. Higher the value of the variance higher will be the unpredictability of Y. If the value of variance is zero then the predictability of Y is perfect. Therefore, the range of the forecasting errors is in the same range of the unpredictable component of the process determining Y.

In other words, rational expectations are the most efficient method of forecasting because the variance of the forecasting errors (due to random element) will be lower under rational expectations than the use of any other method for forecasting or formulating expectations.

5.6 LIMITATIONS OF RATIONAL EXPECTATIONS HYPOTHESIS

Criticism of the rational expectations hypothesis can be understood through the following points:

(a) **The logic of rationality -** This rational expectations hypothesis assumes that an individual is a rational human being. However, in reality, is it plausible to assume that a typical individual is sensible enough to use all available information to forecast the value of any variable? Is it not that the people are more often ignorant about the economic phenomenon?

For example, how many people would be able to give a reasonably precise definition of money supply? So, if an individual is forming rational expectations about the rate of inflation, he is expected to know what the money supply is and how it is growing. In a normal situation,

rationality in economic theory implies that a person compares the cost and benefit of any activity and carries out that activity up to the point where marginal cost is equal to the marginal benefits. For example, a firm will produce up to the point where marginal revenue from producing and selling an additional unit of a good is equal to the marginal cost. If we apply to the hypothesis of rational expectations, the individual (forecaster) will compare the marginal cost of acquiring information about the process of determining a variable and the marginal benefits of making more accurate forecasts. However, the point at which marginal cost and marginal benefits are equal does not necessarily correspond to the point at which the forecasting error is equal to the purely random component of the determining process.

(b) **The availability of information -** The rational expectations hypothesis assumes that the process of determining Y is known and the values of other variables in that process are known at the end of time period (t-1). But what if the value of any of these variables used in the determination of Y is not known at the end of time period (t-1)? How will a rational forecaster determine the value of Y in time period 't'? While there may be mathematical solutions to the above questions, lack of knowledge about information will adversely affect the accuracy of rational expectations.

(c) **Unrealistic elements** - It is unrealistic to say that the expectations of every individual are precisely the same, as every individual cannot track the data of every variable necessary for predictions. Information collection and processing is a costly affair which is not possible for all individuals. If an individual is not using all relevant information for predication then there is a higher chance of formulating wrong rational expectations.

(d) **Flexible price and market clearing mechanism-** Rational expectations hypothesis assumes that price is flexible and there is continuity in market clearance. It is not true because of the prevalence of stickiness in prices and wages.

Check Your Progress 1

1. Briefly discuss the concept of rational expectations.

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2. Discuss the role of a random variable v in rational expectations.
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3. Briefly discuss the implications of rational expectations hypothesis.
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4. Briefly discuss the limitations of rational expectations hypothesis.
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5.7 POLICY INEFFECTIVENESS PROPOSITION

As per the rational expectations hypothesis, there is no impact of predictable macroeconomic policy on output and employment. Unpredictable policy actions have some impact on the real GDP and employment level. The rational expectations is a cause that negates the change in the AS and AD. There is increase in price level but output remains constant.

If people forecast changes in policy correctly, then there will be an increase in the price level. With an increase in prices, there will be a demand for higher wages and it will lead to a decrease in AS.

If people forecast changes in policy incorrectly, then they cannot forecast change in prices caused by policy. Consequently, there will be an increase in output and increase in aggregate supply with the increase in prices.

5.7.1 Lucas Supply Curve

Robert Lucas was the first economist who highlighted the importance of public expectations in macroeconomic policymaking and forecasting. According to Lucas, the anticipations of economic agents (public, firms, and government) are more important than that of the policymakers. Hence, policymakers have to know how the economy works and to understand the expectations of economic agents (households, firms, and government).

In the early 1970s, Robert E. Lucas developed an alternative model of Phillips' Curve by assuming the rational expectations hypothesis. Lucas showed that a positive relationship between output and inflation can arise because of imperfect information about the price level in the economy. The Lucas Model says that with rational expectations, only unanticipated changes in the money supply make an impact on real output. On the other hand, all anticipated changes in money supply only affect the price level. It is known as **the Policy Ineffectiveness Proposition.**

5.7.2 Lucas' Imperfect Information Model

As per the rational expectations hypothesis, subjective expectations are made according to the following:

$X_t^e = \mathrm{E}[(X_t|I_{t-1})]$

$X_t^e = \mathrm{E}[(X_t|I_{t-1})]$, i.e., the expectations of a variable 'x' in this period (t) is a conditional mathematical expectation on all the information available till this period (t). In the rational expectations hypothesis, the value of mean forecast error (MFE) ≡ 0.

There are three characterisations of rational expectations:

(i) Mean forecast error (MFE) = 0
(ii) There is no systematic pattern in the forecast error
(iii) It is the most accurate forecast; since by definition, we are using all the information and we cannot have a better forecast.

Therefore, the critical assumptions underlying the Policy Ineffectiveness Proposition are:

(i) Prices and wages are perfectly flexible (perfect competition set up)
(ii) Expectations are rational

If prices are sticky, anticipated changes in the money supply will affect real output, even under rational expectations.

5.7.3 Assumptions of Lucas Model

The main idea behind the Lucas Model is as given below.

(i) When a firm observes a change in the price of the product, the firm does not know whether this change in the price of the product is caused by the change in the aggregate price level or a change in the product's relative price level. Any change in the relative price will change the optimal quantity of the good that the firm produces. This is the Signal Extraction Problem.
(ii) Since prices and wages are assumed to be flexible in this model, a firm produces according to the rule: P = MC (perfectly competitive set up).
(iii) The firm produces more only if there is a rise in the price of the good it produces relative to the prices of other goods. When the aggregate price level (say, CPI) rises, not necessarily the relative price, the firm's output

will not rise. Firms are assumed to have imperfect information on the prices. These imperfections are due to informational barriers. Firms tend to confuse overall price movements with the relative price movements, which lead to them to deviate from their optimal production, in the short run.

(iv) Lucas also assumes that people make decisions according to the rational expectations.

The Imperfect Information Model of Lucas has the following three structural/behavioural equations:

1. **AS equation**:

$$Y_t = \bar{Y} + \beta(P_t P_t^e); \beta > 0 \quad \ldots (5.9)$$

The AS equation implies that the output in this period is the sum of the full employment output.

2. **AD equation:**

$$M_t + \bar{V} = P_t + Y_t (\text{taking log of QTM equation}) \quad \ldots (5.10)$$

The AD equation is the usual Quantity Theory of Money (where the velocity of money, V, is assumed to be constant).

3. **Monetary Feedback Mechanism**:

$$M_t = \alpha(Y_{t-1}) + \varepsilon_t; \varepsilon_t \sim \mathrm{N}(0, \sigma^2); \text{ where } \alpha < 0 \quad \ldots (5.11)$$

If output is more than the full employment level of output, the use of expansionary monetary policy and hence, the policy parameter is negative. Here, money supply is some function of the actual output in the previous period (t-1) plus some stochastic error (ε_t) component which follows a normal distribution (with mean zero and constant variance).

In effect, α or the policy parameter is the anticipated part of the money supply (since it depends on the actual output of the previous period Y_{t-1}). While ε_t is the unanticipated part of the money supply (say, due to unforeseen situations such as oil price shock, war with neighbours, drought, etc.), on average, the stochastic error term is zero.

We will prove that the policy is ineffective, i.e., anticipated changes in policy have no effect on real variables and only unanticipated changes can affect real output.

Mathematical Derivation of the Model:

$$P_t = (aY_t + e_t) + \bar{V} - Y_t \quad \ldots (5.12)$$

We assume rational expectations, i.e., $P_t^e = \mathrm{E}[\, P_t | \, I_{t-1}]$ The expected prices are prices conditioned upon all the information available till the point the expectations are made.

This means: $P_t^e = \mathrm{E}[(\alpha Y_{t-1} + \varepsilon_t) + \bar{V} - Y_t | \, I_{t-1}]$

$i.e., P_t^e = \mathrm{E}[\alpha Y_{t-1}|I_{t-1}] + \mathrm{E}[\varepsilon_t|I_{t-1}] + \mathrm{E}[\bar{V}|\, I_{t-1}] - \mathrm{E}[Y_t|I_{t-1}]$

(as the expectation is a linear operator).

$i.e., P_t^e = \alpha Y_{t-1} + +\bar{V} - \bar{Y}\ (this\ follows\ by\ definition)$

$i.e. P_t^e = \alpha Y_{t-1} + \bar{V} - \bar{Y}\ (under\ RE)$ …(5.13)

Summarising, we have: $P_t = (\alpha Y_{t-1} + \varepsilon_t) + \bar{V} - Y_t$

and, $P_t^e = \alpha Y_{t-1} + \bar{V} - \bar{Y}$

that is, $P_t - P_t^e = \bar{Y} - Y_t + \varepsilon_t$ … (5.14)

Substituting (5.14) in (5.9):

$Y_t = \bar{Y} + \beta(\bar{Y} - Y_t + \varepsilon_t)$

that is, $(Y_t\bar{Y})(1 + \beta) = \beta(\varepsilon_t)$

$Y_t = [\beta(\varepsilon_t)/(1 + \beta)] + \bar{Y}$ … (5.15)

In equation (5.15), we see that the policy parameter (α) does not appear in Y_t. It implies that the anticipated part of monetary policy is ineffective. Further, the term α does not affect output. Only unanticipated part of the money supply (ε_t) will have an impact on output in this model. This is the Policy Ineffectiveness Proposition.

Also, it can be proved that in this model, the Mean Forecast Error (MFE) for Output (Y_t) and Prices (P_t) = 0. Hence, this model is consistent with rational expectations hypothesis.

According to Lucas (Signal Extraction Problem), all unemployment is voluntary because the workers speculate about leisure, over time. They work more in the present if wage rate is higher, with a belief that they will enjoy leisure when wage rate low. There is uncertainty in such speculation, as there is imperfect information. Temporary changes induce certain actions and we attach a probability to the change being temporary.

Check Your Progress 2

1. Explain the underlying idea behind policy ineffectiveness proposition.
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2. Point out the factors that affect output as per Lucas's understanding of supply.
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5.8 LET US SUM UP

Rational expectations hypothesis is an improvement over the adaptive expectations hypothesis. It says that people use all available information for formulating predictions about economic variables. It also says that people use their human rationality, available information and their experience to predict the future value of any economic variable. People know that predictions may not be correct always. However, they learn from mistakes and improve upon their predictions for the future. This hypothesis is widely used in macroeconomics. It not only applies to formulate expectations about inflation and income but also explains the formation of a wide range of economic variables.

Lucas pointed out that under the rational expectations hypothesis there is no impact of anticipated macroeconomic policy on output and employment. Unanticipated policy actions, however, have some impact on output and employment.

5.9 ANSWERS/HINTS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress 1

1. Go through Section 5.2. Provide the intuitive idea behind rational expectations hypothesis.
2. Go through Section 5.5. You should write the implications of the stochastic error term.
3. Go through Section 5.5 and answer.
4. Refer to Section 5.6 and answer.

Check Your Progress 2

1. Refer to Section 5.7 and answer.
2. Refer to equations (5.12), (5.13) and (5.14).

UNIT 6 INFLATION AND UNEMPLOYMENT *

Structure

6.0 OBJECTIVES

After going through this unit you should be able to

- identify various types of unemployment;
- explain the concept of natural rate of unemployment;
- establish a relationship between unemployment and inflation;
- explain how the short-run Phillips curve shifts; and
- reconcile the difference in shape of the Phillips curve in short-run and long-run.

6.1 INTRODUCTION

In Units 7 and 8 of BECC 103 we gave some preliminary ideas of inflation – its definition, causes and effects. In this Unit we describe the relationship between inflation and unemployment. In the process, we discuss various types of unemployment and its measurement. Recall that classical economists believed in dichotomy of real and monetary variables. Thus, inflation being a monetary variable should not have any effect on a real variable such as unemployment. Keynesian economists, however, believed that change in monetary variables could affect real variables.

Inflation, as you know, is defined as a *persistent* rise or, a tendency towards persistent rise in the *general level of prices*. As and when there will be

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increase in the general price level, purchasing power of households decline. Increase in inflation is likely to reduce the value of national currency and it's vice versa. Although there are many types of inflation, it can be mainly classified into three types of inflation- demand pull (caused by increase in demand), cost push (cause by increase in cost of production) and built-in inflation (mainly caused by past events). The rate of inflation could vary from a low level to a very high level. As of 2021, Venezuela for example has an inflation rate of nearly 10,000 per cent per year.

Unemployment is a state in which healthy person fails to get employment at prevailing wage. It is caused by various factors that are concerned with demand and supply. There are broadly six types of unemployment- structural (arises due to change in structure of economy, frictional (arises due to time gap between changing jobs), cyclical (arises due to change in cycle of economy i.e. boom, recession, etc.), seasonal (arises due to change in season), disguised unemployment (it is also called hidden unemployment where marginal product of labour is very much close to zero) and under employment in which better qualified person end with low quality, low paid jobs because of excess supply of labour and lower availability of job opportunity.

6.2 TYPES OF UNEMPLOYMENT

'Labour force' as a concept includes all persons in the age group of 16 years to 64 years who are willing to work. Thus it includes both employed and unemployed persons. The persons not included in the labour force include those who are retired, too ill to work, keeping the house, or simply not looking for work.

'Work force' as a concept is somewhat narrower – it includes the employed persons only. Thus the difference between the labour force and the work force gives us the number of unemployed.

By employed persons we mean those who perform any paid work (thus homemakers are not included) and those who have jobs. On the other hand, the unemployed as a category includes people who are not employed but are actively looking for work. While considering unemployment we do not take into account those who are not in the labour force. We define unemployment rate as the number of unemployed divided by the total labour force. You should remember that the concept of unemployment implies 'involuntary unemployment'. This concept implies that a person is willing to work at the prevailing wage rate, but cannot find work.

There are three types of unemployment, viz., frictional, structural and cyclical. We explain the differences below.

(i) Frictional unemployment: It takes place because people switch over from one job to another. In many cases the tenure of job gets over and workers remain unemployed till they get another job. In other cases workers migrate from one region to another in search of better jobs or opt to remain out of job for short time periods. Frictional unemployment takes place because in an economy with imperfect information, job search and matching is not smooth and there are frictions in the economy.

(ii) Structural unemployment: It results from the mismatch between supply and demand for different kinds of jobs. For example, in recent years, the number of engineers and management professionals looking for jobs in India has been much higher than available jobs. This has resulted in a number of persons with technical qualification opting for low qualification jobs. Structural unemployment takes place largely due to structural shifts in an economy and adjustments to such shifts take time. A large number of educational institutions in India have discontinued their engineering education programmes.

(iii) Cyclical unemployment: It arises due to fluctuations in aggregate demand, which is a part of business cycles. When aggregate demand declines, there is simultaneous decline in the demand for labour and consequent increase in unemployment. On the other hand, a general boom in the economy increases the demand for labour and unemployment decreases. Thus cyclical unemployment is pro-cyclical in nature.

Empirical data shows that the labour force in an economy is much less than the total population. Total labour force in India, according to certain sources, is about 50 crores compared to an estimated population of 138 crores in 2020. Persons above 65 years and children below 15 years of age however should not be taken into consideration while comparing the size of the labour force to total population. A relevant ratio in this context is the 'Labour Force Participation Rate (LFPR)'. It is defined as follows:

$$\text{LFPR} = \frac{\text{Size of the labour force}}{\text{Size of population in the age group of } 16-64 \text{ years}}$$

The labour force participation rate (LFPR) varies across countries, and over time for the same country. If we take gender into account, there could be male labour force participation rate and female labour force participation rate. Usually, there is a gap between male LFPR and female LFPR. In India, for example, female LFPR is much lower compared to male LFPR. Further, there is a sharp decline in female LFPR in recent years. Such a decline could be due to cultural and structural issues.

The rate of unemployment u is defined as the ratio of unemployed persons to total labour force. The rate of unemployment varies across countries and for a country over time.

6.3 PHILLIPS CURVE

The Phillips curve, named after A W Phillips, describes the relationship between unemployment and inflation. In 1958 Phillips, then professor at London School of Economics, took time series data on the rate of unemployment and the rate of increase in nominal wage rate for the United Kingdom for the period 1861-1957 and attempted to establish a relationship. He took a simple linear equation of the following form:

$$\dot{w} = a - bu$$

where $\dot{w}$ is the rate of wage increase, a and b are constants and u is the rate of unemployment. Phillips found that there exists a stable and inverse relationship between $\dot{w}$ and u, with the implication that lower rate of unemployment is associated with higher rate of wage increase.

Subsequent to the publication of the results by Phillips, many economists followed suit and attempted similar exercises for other countries. Subsequently, it was established that there is a stable relationship between rising wage rate and rising price level. This led some economists to refine the simple equation estimated by Phillips and use of inflation (the rate of increase in prices) instead of wage rate increase. In many cases the scatter of plot of variables appeared to be a curve, convex to origin. As empirical studies reinforced the inverse relationship between the rate of inflation and the rate of unemployment the Phillips curve soon became an important tool of policy analysis.

The policy implication of such a result was astounding – an economy cannot have both low inflation and low unemployment simultaneously. In order to contain unemployment an economy has to tolerate a higher rate of wage increase and vice versa. Thus the Phillips curve justifies the discretionary stabilization policy of a government.

In Fig. 6.1 we depict a typical Phillips curve. Suppose the economy is operating at point A with inflation rate of π_1 and unemployment rate of u_1. If the government wants to reduce the rate of inflation to u_2, the economy has to tolerate a higher rate of inflation (π_2).

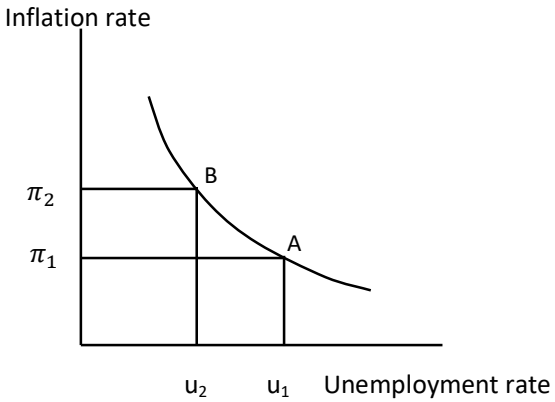

Fig. 6.1: Phillips Curve

During the 1960s and early 1970s the Phillips curve was considered to be an important tool of policy analysis. The prescription was simple and straight forward: During periods of high unemployment the government could follow an expansionary monetary policy which leaves more money in the hands of people. Such a policy may accelerate the rate of inflation while lowering unemployment. Conversely, during periods of high inflation the government could follow a contractionary economic policy so as to reduce inflation rate; the cost of such a policy however was supposed to be higher rate of unemployment. Thus, economists believed that there was a trade-off between inflation and unemployment. The government could choose any combination of inflation rate and unemployment rate depending upon the slope and position of the Phillips curve.

During the late 1970s and early 1980s, however, such a belief got shattered. The prescriptions of the Phillips curve did not work at all. Economies suffered from both high inflation and high unemployment. As unemployment increased, there was a lower level of output implying stagnation in economic growth. When governments tried to follow Keynesian policy prescription of higher government expenditure so as to increase aggregate demand, the rate of inflation accelerated. Thus, what most countries experienced was 'stagflation' – a combination of stagnation and inflation. The reason for stagflation was found to be supply shocks due the 'oil crisis' of 1973 and 1979 (refer to Unit 6). Stagflation prompted economists to explore further into the reasons for stagflation.

Check Your Progress 1

1. Write a brief note on the various types of unemployment.

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2. Explain how the Phillips curve could offer policy options before the government.

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3. Define the following concepts:
   a) Involuntary Unemployment
   b) Natural Rate of Unemployment
   c) Labour Force Participation Rate
   d) Inflation-Unemployment Trade-Off

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6.4 NATURAL RATE OF UNEMPLOYMENT

You might have come across the term full employment, which implies that all workers in the economy are employed. Have you ever thought of such a situation? Can it be attained? When we say that an economy is operating at 'full employment' level, we do not mean that there is zero unemployment. Because of imperfections in markets, rigidities in wages and prices, and various frictions in the economy it is not possible to obtain zero unemployment.

For example, at any point of time, some workers are in the transition process from one job to another (frictional unemployment). Similarly, a fraction of workers cannot be employed because of mismatch between the skill they possess and the skill required (structural unemployment).

In view of the above, a new concept termed 'natural rate of unemployment' was introduced in the 1960s independently by Milton Friedman and Edmund Phelps. Natural rate of unemployment takes into account the frictions and imperfections in the economy and assumes that it is natural for an economy to have certain fraction of its labour force unemployed, at any point of time. We observe that any unemployment that is not natural could be due to business cycle, or policy related.

For empirical purposes natural rate of unemployment is the total of frictional unemployment and structural unemployment in an economy.

It varies across countries, and over time for the same country. For the US economy, for example, natural rate of unemployment is estimated to be between 3.5 per cent and 4.5 per cent. Many countries do not report any estimate of natural rate of unemployment.

The concept of natural rate of unemployment reshaped macroeconomic analysis in subsequent years. As we will see later in this Unit, expectations of economic agents (such as households, firms and government) about future economic environment play a major role in the shape and position of the Phillips curve.

6.5 EXPECTATION-AUGMENTED PHILLIPS CURVE

The Phillips curve discussed earlier could not explain stagflation in an economy. For explaining stagflation we need to bring in expectations into our analysis. In fact, Phillips curve given in Fig. 6.1 holds true if there is no change in expectations in the minds of people. In case people perceive that there is a change in expectations, then the Phillips curve will shift. Both adaptive expectations and rational expectations have important implications for Phillips curve.

6.5.1 Phillips Curve under Adaptive Expectations

You know from microeconomics that workers and employers take decisions regarding employment on the basis of real wage; not nominal wage. According to Friedman and Phelps, expectations do matter. Thus the 'expected real wage' should be looked into account for determining equilibrium output and wage rate.

Workers usually enter into a contract with the employer regarding their salary for certain time period. During contract period, salary cannot be re-negotiated; it can be changed only after the contract period is over. As the workers are aware of these conditions, they incorporate expected inflation into the contract. For example, if the workers expect that inflation rate would be 3 per cent in the coming year, they will negotiate the wage rate in such a manner that the real wage rate does not decline due to price increase.

For an expected inflation rate of π_1 per cent, suppose the Phillips curve is given by $SRPC_1$ (see Fig. 6.2). Suppose the economy is at point A. At this point the expected inflation rate is π_1 (say 3 per cent) and unemployment rate is at the natural rate u* (say 6 per cent). At point A, the workers and firms expect an inflation rate of 3 per cent and they are getting it. Thus there is no pressure on the economy for a change.

There is a possibility of trade-off between inflation and unemployment along the curve $SRPC_1$. If there is higher inflation, then real wage will decline (because nominal wage cannot be increased due to existing contracts). Consequently, firms will employ more labour thereby leading to a decline in unemployment.

Suppose the government pursues an expansionist fiscal policy (government expenditure increases or tax rate decreases), which will boost aggregate demand. As a result, there is an increase in prices (means higher inflation rate). An expansionist monetary policy, such as increase in money supply or decrease in interest rate, will also have the same effect. It will lead to an increase in investment which will, to some extent, increase the demand for labour also. In either case, there is an increase in inflation rate to π_2 (say 6 per cent). The rate of unemployment reduces to u_2 (below the natural rate). It implies that more workers are employed, as a result of which output will be higher than potential output. In Fig. 6.2 we have shown this situation as point B.

Equilibrium at point B, however, is temporary. Workers very soon realize that there is an unexpected increase in inflation rate. In order to compensate for the price rise, workers will demand a higher wage rate. It will lead to a shift in the Phillips curve from $SRPC_1$ to $SRPC_2$. Equilibrium in the economy will be at point C in Fig. 6.2. Consequently, inflation will be at π_3 while unemployment will be at the natural rate, i.e., u*.

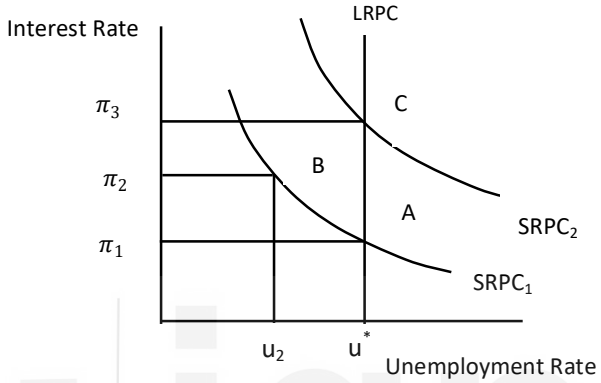

Fig. 6.2: Shift in Phillips Curve

Notice that unemployment in the economy is back at the natural rate (6 per cent). The inflation rate however is much higher (π_3). Thus the attempt of the government to reduce unemployment rate below the natural rate inflation rate, results in higher and higher inflation. In view of this, the natural rate of inflation is often termed as the 'non-accelerating inflation rate of unemployment' (NAIRU). It means that there is no acceleration in inflation if unemployment is maintained at this. Further, the term natural rate of unemployment indicates that it is inflexible, but social optimal. The term NAIRU, on the other hand, does not indicate any social optimality or desirability.

When unemployment is at the natural rate or NAIRU, there will be stability in the rate of inflation. When unemployment departs from the natural rate, there is acceleration or deceleration in inflation rate. Thus if actual unemployment is less than u^*, inflation will continue to accelerate – higher and higher in subsequent years. The concept of NAIRU and expectations formation explains the hyperinflation witnessed by many countries. Unless unemployment returns to its natural rate the inflation spiral will keep on accelerating.

The above analysis brings us to an important conclusion. Under adaptive expectations, the short run the Phillips curve is downward-sloping. In the long run however, it is vertical. In Fig. 6.2, the vertical line LRPC depicts the long run Phillips curve. Thus there is no trade-off between inflation and unemployment in the long run.

6.5.2 Phillips Curve under Rational Expectations

Under rational expectations economic agents such as firms and households are forward looking. They take into account all available information – past experience as well as present and future developments in the economy. There is no perfect foresight under rational expectations, but the errors cancel out on the whole.

An implication of the above is that actual inflation rate is equal to expected inflation rate. Thus workers and firms do not commit any error regarding wage rate during negotiations. Thus, there is no trade-off between inflation and unemployment under rational expectations. Unemployment rate in the economy is at the natural rate.

Suppose unemployment in the economy is at the natural rate. Firms and workers expect inflation to be at the rate of π_1^e. Suppose, the government pursues an expansionary policy as a result of which there is an increase in aggregate demand. Consequently, there is an increase in the rate inflation. If this policy was expected by the economic agents, they would have factored in the increase in inflation rate into their decision-making. If the policy is unexpected, then it would have the desired effect, that is, reduction in unemployment. This brings us to an important issue: how effective is government policy under rational expectations? If government policy is expected, it will not have any impact.

Check Your Progress 2

1. In 2019 the expected rate of inflation was 7 per cent while actual rate of inflation was 5 per cent. If $\lambda = 0.5$, find out the expected inflation rate for 2020.

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2. How do you reconcile the vertical long run Phillips curve with the downward sloping short run Phillips curve? Explain through a diagram.

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3. Explain the following concepts:

a) Adaptive Expectations

b) Rational Expectations

c) Non-Accelerating Inflation Rate of Unemployment (NAIRU)

d) Long-Run Phillips Curve

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6.6 LET US SUM UP

Unemployment results in loss of not only potential output at the macro level but also in income at the individual level. Many a time unemployment culminates into a crisis situation when there is widespread unemployment in the economy. The social sigma and psychological trauma associated with unemployment often compels policy makers to cut down on the rate of unemployment.

The classical economists assumed flexibility in real wage and prices which ensured full employment in the economy all the time. Keynesian economists, however, contest such an assumption and speak about rigidities in wage rate and prices. In case of sticky prices there is a possibility of unemployment as per the Keynesian model.

Phillips curve describes the inverse relationship between inflation and unemployment. It shows the possibility that unemployment can be reduced at the cost of higher inflation.

During the 1970s most economies in the world passed through a phase of stagflation. The trade-off between inflation and unemployment was proved to be false. In order to explain such a situation we bring in expectations into our analysis. There are two models of expectations: adaptive and rational.

According to adaptive expectations, the Phillips curve is stable in the short-run but in the long run it shifts. The long run Phillips curve is vertical. Thus there could be some trade-off between inflation and unemployment in the short-run, but in the long-run there is no trade-off. We explained the process through which the shift in the Phillips curve takes place. According to rational expectation, there is no trade-off between inflation and unemployment. Any policy of the government to reduce unemployment becomes ineffective, as people can forecast the expected changes correctly.

6.7 ANSWER/HINTS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress 1

1. Your answer should include frictional, structural and cyclical unemployment. Go through Section 6.2 for details.
2. Go through Section 6.3 and refer to Fig. 6.1.
3. These concepts are discussed in Sections 6.2 and 6.3.

Check Your Progress 2

1. Refer to the text in Section 6.5. You should explain Fig. 6.2.
2. These concepts are defined in Sections 6.5.