CHAPTER –II

Survey of the Literature

2.1 The Rational Expectations Hypothesis:

The rational expectations hypothesis is the hypothesis that, when forming expectations about any variable, people will make optimal use of the available information. This information includes the actual value of certain variables and, more widely, the nature or structure of the world in which people are operating.

Let the value a variable 'y' takes in period t depend upon, or be a function f (.) of, the value of other variables, x_1, x_2 and x_3 have taken in some previous periods. But let y also be influenced by a random event, u. So the true nature of the world is the following:

$$y_t = f(x_{1t-1} \text{-----} x_{1t-n}, x_{2t-1} \text{-----} x_{2t-n}, x_{3t-1} \text{-----} x_{3t-n}) + u_t \qquad (2.1)$$

Here the state of the world is represented by the actual value of all the variables and the nature of the f(.) function. Assuming the nature of the function and values of all the variables in period't-1'then the rational forecast of y_t will be:

$$Ey_t/I_{t-1} = f(x_{1t-1} \text{-----} x_{1t-n}, x_{2t-1} \text{-----} x_{2t-n}, x_{3t-1} \text{-----} x_{3t-n}) + Eu_t/I_{t-1} \qquad (2.2)$$

Where Ey_t/I_{t-1} means the expectation of y_t formed on the basis of information (I) available in period t-1.The distribution of u is another element of the 'state of the world' which

people are assumed to know. What they do not know is the actual value 'u' will take in period t. Usually this distribution is assumed to be normal around zero so that u has a mean of zero and the best guess one can form of u_t in period t-1 is that it will be zero. Hence,

$$Ey_t/I_{t-1} = f(x_{1t-1} \text{-----} x_{1t-n}, x_{2t-1} \text{-----} x_{2t-n}, x_{3t-1} \text{-----} x_{3t-n}) \quad (2.3)$$

And the forecast error is,

$$y_t - Ey_t/I_{t-1} = u_t \quad (2.4)$$

There are two important implications of this:

- Only u_t appears in the forecast error, the terms in the f (.) function do not appear. This is a more formal illustration of the implication of rational expectations that only the inherently unpredictable element affecting y_t will fool rational people; the predictable element will be predicted by them.

- If the process driving the predictable component were to change, then the process would drive people's expectations. So, if, for example, the process driving y_t changed to,

$$y_t = f(z_{1t-1} \text{-----} z_{1t-n}, z_{2t-1} \text{-----} z_{2t-n}, z_{3t-1} \text{-----} z_{3t-n}) + u_t \quad (2.5)$$

Where the 'z's are other variables, expectations would be given by,

$$Ey_t/I_{t-1} = f(z_{1t-1} \text{-----} z_{1t-n}, z_{2t-1} \text{-----} z_{2t-n}, z_{3t-1} \text{-----} z_{3t-n}) \quad (2.6)$$

The forecast error in any period would still be the unpredictable event, u_t.

2.2 The Lucas Critique

A key macroeconomic question in the late 1970s was whether the aggregate supply curve was best thought of as a new classical formulation or an alternative type. Consider the following example. Suppose the aggregate supply function is defined as,

$$y_t = \alpha m_t + \beta m_{t-1} + \chi y_{t-1} + \varepsilon_t \qquad (2.7)$$

Where m_t is the money supply, y_t is output, and ε_t is an error term. By lagging this relationship and repeatedly substituting it back into the equation to eliminate lagged output terms, output can be shown to be a function of past money supply.

$$y_t = \alpha m_t + (\beta + \alpha\chi) m_{t-1} + \text{----------} + \varepsilon_t \qquad (2.8)$$

A systematic money supply rule based on the previous level of money supply, m_{t-1}, and a random component u_t, such as

$$m_t = \delta\, m_{t-1} + u_t \qquad (2.9)$$

The random component 'u_t' would be influenced on output.

Consider now the equation above rating output to lagged money supply, we know that

$$E_{t-1}\, m_t = \delta m_{t-1} \qquad (2.10)$$

and by adding and subtracting the terms of $E_{t-1}\, m_t$, $E_{t-2}\, m_{t-1}$ from the equation we can rewrite the relationship between output and lagged money supply as relationship between output and unanticipated money supply stocks:

$$y_t = \phi(m_t - E_{t-1}\, m_t) + \gamma(m_{t-1} - E_{t-2}\, m_{t-1}) + \ldots + \chi y_{t-1} + \varepsilon_t \qquad (2.11)$$

This model shows that unsystematic 'surprise' in money stock affect output, but this has been derived from exactly the same equation as the model which purported to show the *systematic* monetary policy can affect output. With the additional assumption, that the public make rational expectations about monetary policy, the two models can be said to be observationally equivalent. The general implication is that any estimated reduced-form equation which an econometrician discovers in the data is compatible with many different structural models with different theoretical priorities and policy implications. (Lewis and Mizen 2000:229)

Lucas (1972) introduced a rider to this debate which became a turning point in relation to the econometric estimation of economic models involving expectations, known as the 'Lucas Critique'. His observation was that many reduced-form models treat the expectational terms in the same way as they treat the structural parameters of the model, that is, as if they are given and unchanging. He made a substantive and a methodological contribution in his paper, 'Expectations and the Neutrality of Money'. The substantive contribution is to develop and analyze a specific mechanism by which monetary instability leads to fluctuations in output and inflation. In this mechanism, people with limited information confuse monetary disturbances with relative price movements, so that monetary fluctuations lead to aggregate output fluctuations. The methodological contribution is to illustrate how one goes about constructing dynamic, stochastic general equilibrium models to shed light on questions of substantive economic

interest. In order to test the proposition that, where nominal aggregate demand shocks are highly volatile, the effect of any particular nominal aggregate demand shock is less. Lucas got data on nominal and real output/ expenditure covering the years 1951-1967 for 18 countries. He then assumed that, for each country, the mean value of the growth in their nominal expenditure over the whole period was a reasonable estimate of what people were expecting nominal spending growth to be in any particular year. The difference between the actual growth in nominal spending and this mean in any year was used by Lucas as his measure of unpredictable nominal spending growth in that year which is denoted by 'pyr_t'. The variance of this series can be taken as a measure of the volatility of nominal aggregate demand shocks. For each of his 18 countries Lucas then carried out the regression:

$$y_t = \beta_0 + \beta_1 \, pyr_t \qquad (2.12)$$

Actually Lucas has estimated a more complex equation which allows for natural rate and lagged effects on y. Using the above equation Lucas has had 18 estimates of 'β_1'- one for each country-and 18 measures of the volatility of nominal aggregate demand shocks-again, one for each country. But 'β_1' estimates the influence an aggregate demand shock has on real output or unemployment. If the misperceptions model of the business cycle were true then countries with high volatility should be those countries with low estimates values of 'β_1'. Lucas' results did appear to reveal such a negative relationship. One criticism of this test is that there are only 18 countries in the data set, and only two of these had markedly high volatility measures. So the result was rather dependent upon two

observations. However, later studies used more countries and found the same relationship.

2.3 The Policy Ineffectiveness Theorem: The Invariance Proposition

Sargent and Wallace (1973, 1975) used tests of the direction of causality between economic variables to try to validate Lucas's new classical model on econometric grounds, concluding that the new classical approach was not inconsistent with the data. They first proposed the strong conclusion of Policy Ineffectiveness Theorem in a simple model made up of aggregate supply and aggregate demand equations, a money demand function and a monetary policy rule. The aggregate supply function is the Lucas 'surprise' function. Aggregate demand depends on the expected real interest rate, that is, the nominal interest rate, R_t, and the expected change in the general price level (inflation) given by ($E_{t-1}p_{t+1}-E_{t-1}p_t$):

$$y_t^D = \{ R_t - (E_{t-1}p_{t+1} - E_{t-1}p_t)\} \tag{2.13}$$

The demand for money depends on income, y_t, prices, p_t, and nominal interest rates, R_t, that affects nominal money balances, m_t^D, according to a fixed parameter, χ, and is written as

$$m_t^D = pt + yt - \chi R_t \tag{2.14}$$

$$m_t^S = \eta(y_{t-1} - y^*) + \varepsilon_t \tag{2.15}$$

Equation (2.15) provides the information that the money supply is the function of the difference between output last period and its natural rate. 'η' is the systematic part of monetary policy. Solving the system, Sargent and Wallace assume that markets clear, and by equating the money demand and supply, $m_t^D = m_t^S$, the interest rate can be determined as a function of prices and output, since

$$pt + yt - \chi R_t = \eta(y_{t-1} - y^*) + \varepsilon_t \qquad (2.16)$$

Hence,

$$Rt = 1/\chi \{\eta (y_{t-1} - y^*) + \varepsilon_t - p_t - y_t\} \qquad (2.17)$$

Equating the aggregate demand and aggregate supply, $y_t^S = y_t^D$, gives

$$y^* + \alpha(p_t - E_{t-1}p_t) = \{ R_t - (E_{t-1}p_{t+1} - E_{t-1}p_t)\} \qquad (2.18)$$

and substituting for the interest rate they are able to derive an expression entirely in terms of prices, the natural rate of output, expectations of prices and coefficients of the model η, α and χ given as

$$(\chi+1)\, y^* + \alpha\, (\chi+1)\, [p_t - E_{t-1}p_t] = \varepsilon_t - p_t - \chi[E_{t-1}p_{t+1} - E_{t-1}p_t] + \alpha\eta\, [p_{t-1} - E_{t-2}p_{t-2}] \qquad (2.19)$$

From this equilibrium expression, the system can be closed by assuming that expectations are formed rationally.

2.4 The New Keynesian Economics: Alternative to Invariance Proposition

Fischer (1977) constructed a model in the spirit of Sargent and Wallace. It was assumed in the model that expectations were rational but replacing the market-clearing hypothesis in the labor market by the assumption of multi- period contracts negotiated in nominal terms. These contracts inject an element of short-run wage stickiness in the model. In this context the policy ineffectiveness proposition is found to be invalid. Monetary policy can affect output and employment if the length of the period of the labor contracts is larger than the time it takes the monetary authority to react to changing economic circumstances. For instance, if the monetary authority increases the money supply (reacting to some recent economic disturbances) during the negotiated time period, this will affect the price level and therefore, the real wage (for the contract period) and in turn employment and real output will be affected. In this model public and private agents have the same information set at any time but the public agent has the larger opportunity set. The Fischer's model has been explained using the following equations.

The nominal wage in period t+1 is given by

$$W_{t+1} = 1/2\ ({}_{t-1}W_t + {}_tW_{t+1}) \qquad (2.20)$$

Where, ${}_tW_{t+1}$ indicates a wage negotiated in time t+1 on the basis of information available up to time t. Wages are based on the achievement of the level of real wages and are therefore dependent on price expectations, hence

$${}_{t-1}W_t = E_{t-1}p_{t+1} \qquad (2.21)$$

$$_tW_{t+1} = E_t p_{t+1} \tag{2.22}$$

By substituting,

$$W_{t+1} = 1/2\ (E_{t-1}p_{t+1} + E_t p_{t+1}) \tag{2.23}$$

If we define the aggregate supply function as dependent on the real wage rate,

$$y_{t+1} = 1/2\alpha\ (W_{t+1} - p_{t+1}) + y^* \tag{2.24}$$

Then substituting for nominal wage rate gives

$$y_{t+1} = \alpha/2\ (p_{t+1} - E_{t-1}p_{t+1}) + \alpha/2\ (p_{t+1} - E_t p_{t+1}) + y^* \tag{2.25}$$

The equation (2.25) shows that the supply function differs from the Lucas supply function in that half the workforce is subject to a contract which is based on information from two periods ago.

Phelps and Taylor (1977) and Taylor (1979, 1980) had shown that despite the presence of rational expectations on the part of individual agents, anticipated policy could still have real effects, if nominal contracts are long term. In such models unanticipated money matters but anticipated money matters too if wages and/ or prices are not flexible.

2.5 Barro's test of the Misperceptions Model of the Business Cycle

The Misperceptions Model of the Business Cycle has two predictions:-

i. Predictable movements in variables influencing nominal aggregate demand should have no effect on real variables though unpredictable ones can.

ii. In countries where nominal aggregate demand shocks are highly volatile the effect of any particular nominal aggregate demand shock is less.

Barro(1977,1978) attempted to confirm the results by modeling directly the aggregate supply relationship. In order to do this he specified the money supply process and from it derived estimates of the unexpected changes in monetary policy. He then introduced both variables into a model to explain output and found that whilst anticipated monetary policy did not have a statistically significant effect on output the unexpected component did-seeming to confirm the new classical approach. Barro provided some initial evidence that indicated that the R.E. Hypothesis could not be dismissed simply as a theoretical curiosum. His approach was to use past values for money growth and other lagged variables to forecast money growth. These forecast equations were then identified explicitly with agents' expectations of money growth rates. Barro tested his hypothesis by entering the actual money growth rates into the equation to determine if they added significant explanatory power to the regression explaining unemployment in terms of unanticipated growth. However, it did not happen. Barro argued that he could not reject the hypothesis that only unanticipated money growth causes unemployment to deviate from its natural rate. Barro's methodology has been forwarded on the basis of following equations. Assuming the quantity of money has the main influence on nominal aggregate demand and estimating the relationship between the quantity of money and the variables X and Z.

$$\dot{M}t = a_0 + a_1X_{t-1} + a_2Z_{t-1} + dmr_t \qquad (2.26)$$

In the equation (2.26), the component 'dmr_t' is the estimate's error term. This error term presents the unpredictable part of the quantity of money on its movement. Barro argued that his estimated relationship in the equation is part of the state of the world which rational agents would have been aware of. So, their one-period-ahead forecasts of monetary growth should be consistent with this estimate. The expected change in the quantity of money can be identified as.

$$M_t^e = a_0 + a_1 X_{t-1} + a_2 Z_{t-1} \qquad (2.27)$$

The unpredictable component as the equation's error term can be identified as.

$$\dot{M}t - M_t^e = dmr_t \qquad (2.28)$$

Barro has obtained for each period in his data set an observation on the unpredictable and predictable components of the quantity of money, which, since the quantity of money is assumed by Barro to be the influence on nominal aggregate demand, amounts to a set of observations on unpredictable and predictable nominal aggregate demand. According to the misperceptions model of the business cycle, the first component should cause fluctuations in real output and unemployment whilst the second component should not. To test this he carried out a regression of a real variable-unemployment in his first paper, real output in his second- on dmr_t and M_t^e. So he used the regression,

$$y_t = b_0 + b_1 dmr_t + b_2 M_t^e \qquad (2.29)$$

and his test is of the hypothesis that $b_1>0$, and $b_2=0$. In fact Barro's estimate was more complicated than this. He included terms to capture movements in the natural rates of unemployment and output, and allows for the possibility of lagged effects of movements in nominal aggregate demand. If unemployment is the dependent variable the hypothesis is that $b_1<0$. He found that neither hypothesis could be rejected. A number of other studies applied the same idea and the results are rather mixed. As time went on sufficient evidence accumulated suggesting that predictable movements in nominal aggregate demand can have real effects to cast doubt on the misperceptions model of the business cycle in its strictest form.

2.6 Theoretical and Empirical Explorations

There have been a huge theoretical and empirical explorations on effectiveness (or ineffectiveness) of monetary policies.

Sargent (1979) established from theoretical first principles that the econometric approaches could be misleading. His reasoning was to become known as the observational equivalence argument by which it is possible to show that systematic monetary policy can affect output and can be rearranged with some reasonable additional assumptions to show contrary, i.e. only unanticipated policy can affect output. The problem for the econometric work is that while these models have different assumptions which set them apart in theory, they are observationally equivalent in practice because it is not possible to specify them in such a way that they can be separated on econometric grounds when estimated in reduced form.

J. Grossman (1979) used nominal Gross National Product (GNP) as a proxy for policy instruments to test the hypothesis that only unanticipated money growth causes unemployment to deviate from its natural rate. Grossman's study used quarterly data as a contrast to Barro's original study on annual data. His study lends support to the invariance proposition.

McCallum (1980) explained the notion of rational expectations that the real sector of the model is completely independent of anticipated monetary policy. The expected rate of inflation fully reflects any change in the systematic component of the growth of the money supply and this directly raises the actual rate of inflation without any repercussions in the real sector. This result of the R.E. School is known as the "Policy Ineffectiveness" proposition and has been the subject of heated dispute. After a slow start the concept of rational expectations became widely accepted, primarily because it seems to be the 'Natural Rate Hypothesis' in the neo-classical model.

W.Buiter (1980), in surveying R.E. debate, distinguished two types of models- the walrasian model with frictionless markets and market-clearing prices and non-Walrasian model with sluggish wage and price adjustments. If the Walras type is combined with R.E., the policy ineffectiveness proposition will result. If, on the other hand, a non-Walrasian model is combined with R.E., demand management policy will have real consequences. Such policy will influence employment and output rates.

Gordon (1981) has forcefully challenged the studies claiming to have found support for the invariance proposition. He developed a model of gradual price adjustment. In it, the

invariance proposition may be obtained as a special case. Money is neutral in Gordon's alternative model in the long run but anticipated money growth may be non-neutral in the short run. Gordon's empirical work on quarterly data covered the period 1890-1980. His basic finding was that prices did not move one for one with anticipated changes in nominal income as required by the invariance propositions. This finding was also true for the 1890-1930 periods during which prices of commodities were volatile than in the post-war era.

Mishkin's (1982) own empirical results somewhat support the assumption of rational expectations but generally throw doubt on the assumptions of neutrality of money. In addition, Mishkin also found that, with rise in lag-structure, tests of the invariance proposition on longer time support the hypothesis.

McGEE and Stasiak (1985) first used the VAR model to test all hypotheses involved in monetary policy and real output. Their study supported the non-neutrality theory of Rational Expectations Proposition. They introduced the methodology that focus on the stationarity and restriction issues of the variables. Their results supported the findings of Mishkin's study.

Beladi and Samanta (1988) examined the issue using the two step method for the period 1952 to 1982. They also rejected the hypothesis of neutrality of money when industrial production (IP) was used as the measures of output while the results using GDP was mix. Their argument in using IP was that GDP of India consisted of higher proportion of agriculture products which was very volatile as agriculture depended on weather. They had three different money processes. First one was standard money supply process

equation, second one was recursive ex post forecast of money growth, and the final one was ARIMA model. Their argument in using recursive forecast and ARIMA model was dubious. Since, the research interest lies on the monetary authority's money supply process, the use of ARIMA model and recursive forecast in determining anticipated monetary policy seems to be dubious.

Choudhary and Parai (1991) explored the issue for Latin American countries in which they employed Mishkin's econometric procedure, i.e., two step methods, for the period starting early fifties to late eighties. This is one of the paper in which the theories were tested on LDC. They used Theil's adjusted R^2 criterion in determining the lag length. They hold "Examination of the F-statistics shows that the effect of anticipated money growth on the rate of growth of real output is significantly different from zero for 11 of 13 countries at 5% level and for all countries in our sample at 10% level." (p 584). Their results validated the non-neutrality theory of Fischer, Phelps and Taylor.

Ghani (1991) concluded that only unanticipated money matters in the Indian context. However, his study had certain stark shortcomings. For instance, he used spurious variables in the monetary growth equation, regressed I (1) series on I (0) series and so on.

Cover (1992) studied the positive and negative money shocks for the United States for the period 1951 (I) to 1987 (IV). As many empirical tests have been done on the United States, the paper mainly concentrated in testing the positive and negative NEWS. It employed two step methods. The lag length was determined using Akaike Information Criterion. He defined positive money shock as positive errors from the money supply process while negative money shock as negative errors from the money supply process.

The results concluded that the negative money supply shocks had significant effect on output.

Marashdeh (1993) studied the effect of anticipated and unanticipated money on real output of Malaysia for the period 1970 (I) to 1990 (IV). He employed a VAR model which allows interactions between monetary policy, fiscal policy, inflation, balance of payments and real output. Upon imposing restrictions on coefficients of monetary shocks and other parameters, the results showed that the null hypotheses of LSW policy ineffectiveness were rejected at 5% level. Moreover, he found that unanticipated changes in inflation do influence real output in the short run, supporting the LSW proposition. Marashdeh concludes, "However, unanticipated changes in monetary policy, balance of payments and fiscal policy did not influence real output, lending support to the classical view of the economy and rejecting the LSW proposition." (p 925)

R.Mandal(1997) concluded in the Indian context that output level is related to the anticipated part of money supply only, unanticipated part of money supply is not found to affect output level significantly during the period of 1950-1991.

R.Jha and K.Donde(2001) obtained exactly opposite results in the Indian context, in contrast to Barro's conclusion for the US economy that anticipated monetary policy has no significant effects on real variables. They hold that for the Indian economy anticipated policy matters whereas no significant influence from the unanticipated monetary policy exists. According to them, economic agents in India may have rational expectations at the micro- level, but the existing rigidities in the system do not let this 'rationality' get reflected in their behavior and consequently in the macro level data.

S. Ranjit (2004) obtained the empirical results for Nepal which supported the non-neutrality of money. Both anticipated and unanticipated money supply shocks were found to have statistically significant positive impacts on the output level in the economy. The further break-down of the unanticipated part of money showed that both of positive and negative shocks had equal positive impacts on real output.

****