

## **CHAPTER III**

### **REVIEW OF LITERATURE**

This chapter attempts to review the literature relating to definition, measurement and classification of inflation. A review of different models of inflation is discussed. It is followed by some empirical studies related to inflation and its major determinants in developed and developing countries of Asian and Nepal.

#### **1. DEFINITION, MEASUREMENT AND CLASSIFICATION OF INFLATION**

This section consists of the definition, measurement and classification of inflation.

##### **(A) Definition of Inflation**

Inflation is a process in which the aggregate price level of goods and services rises continuously or appreciably (Laidler and Parkin, 1975). Although the relative prices of individual commodities may change during the course of inflation, the main feature of inflation is that, on an average, all prices are on the rise (Levacic and Rebmman, 1982). Inflation is a rise in the aggregate price level of goods and services. Inflation is a condition of generalized excess demand of goods and services in which “too much money chases too few goods”. It is a rise in money stock or money income in excess of money demand that can cause inflation. Inflation is a rise in price levels under the condition of incomplete anticipation that leads to further rises in inflation through cost increase but constant employment and real output (Bronfenbrenner and Holzman, 1963). Friedman (1970b) has given a causal definition of inflation as ‘inflation is always and everywhere a monetary

phenomenon.....and can be produced only by a more rapid increase in the quantity of money than in output”.

### **(B) Measurement of Inflation**

In a true inflationary situation the rise in prices persists over time and it is this rate of growth in the price level which is referred to as the inflation rate (Chowdhary and Dowling, 1982). Inflation is measured as the rate of change over time of some general index of prices, where a price index of a commodity is a ratio of its price in the period to its price in the base period (usually the beginning of a year) which has its price level fixed at 100. Inflation is commonly calculated as (Levacic and Rebmann, 1982):

$$\text{Rate of inflation} = \frac{P_t - P_{t-1}}{P_{t-1}} * 100$$

Where,  $P_t$  = price index or price level at time t. The price level is measured by taking the weighted average of the prices of a large number of commodities at a particular moment in time. The weight attached to the price of each commodity is the proportion of total expenditure devoted to that good. The primary means of collecting the basic information to derive the weighting pattern of a price index is a survey.

### **(C) Classification of Inflation**

Frisch (1983) has given following four types of inflation and corresponding criterion for classification.

S.No.	Classification of Inflation	Criterion for Classification
i.	Open or suppressed inflation	Working of the market mechanism
ii.	Creeping, moderate, or galloping inflation, hyperinflation	Rate at which prices increase
iii.	Anticipated and unanticipated inflation	Expectations of inflation
iv.	Cost-push or demand pull inflation	Causes of inflation.

### **(i) Open or Suppressed Inflation**

If inflation is open, it is determined by the continuous forces of demand and supply of goods and services between the market participants. Excess demand leads to an increase in prices and money wages in the commodity and the labour market respectively. Suppressed inflation occurs when government controls prevent goods prices and money wages from rising, so that excess demand is suppressed. If the controls are lifted, one must reckon with a rise in the general price level and money wages (Hansen, 1951).

### **(ii) Creeping, Moderate, Galloping and Hyperinflation Inflation**

According to the rates at which prices rise, rates of inflation can be classified in various ways. When prices rise slowly or an inflationary process in which the rise in prices does not exceed 2-3 percent is called “creeping” inflation (Frisch, 1983, Acocella, 2005). The expectation of future inflation during the creeping inflation is virtually zero. If the rise in inflation is less than 10 percent annually, it is called “moderate” inflation. However, Dornbusch and Fischer (1993) in their famous paper on “Moderate Inflation” classified 15-30 percent annual rate of inflation as moderate inflation. When prices rise at double or even triple digit rates per annum, it is called “Galloping Inflation”. “Hyperinflation” is the rate at which the rise in prices is at least 300 percent (Acocella, 2005). Cagan (1956) argues that the extraordinarily high rates of price rise can be labeled as “hyperinflation”. He defines hyperinflation as a condition in which the general price level rises at a rate of more than 50 percent per month. However, one cannot set exact boundaries between any two of these categories (Frisch, 1983).

### **(iii) Anticipated and Unanticipated Inflation**

The classification of anticipated and unanticipated inflation is important in determining the effects of inflation. Anticipated and unanticipated theories of

inflation are comparatively newer as against the classical demand pull and cost push theories of inflation. They are classified on the basis of expectations (Frisch, 1983). Inflation can only be perfectly anticipated in an economy if all people and organizations hold the same expectations. If some expectations are bound to be wrong, it is the situation of unanticipated inflation. Perfectly anticipated inflation is equilibrium situation while imperfectly anticipated inflation is disequilibrium (Laidler and Parkin, 1975). Only unanticipated inflation produces real effects (changes in output and employment) but not by the anticipated inflation.

#### **(iv) Demand Pull and Cost Push Inflation**

The difference between demand-pull and cost-push inflation depends on the factors that determine rise in inflation. The former is associated with rise in price due to excess aggregate demand over the productive capacity of the economy. The latter is associated with a shift in the aggregate supply function due to cost factors. Economists have traditionally suggested the existence of two alternative kinds of sources of domestic inflation: “excess-demand” (or “demand-pull”) inflation and “cost-push” inflation. If the percentage rate of money-wage increase exceeds the percentage rate of increase in man-year (or man-hour) labour productivity, inflation arises from the supply side. Conversely, if the rate-of-wage is not more than the rate-of-productivity rise, any residual inflation must arise from demand side (Bronfenbrenner and Holzman, 1963).

Considering the causal relation to generate inflation, demand pull and cost push factors reinforce each other. In order to identify the sources of inflation whether demand pull or cost push, it is argued that if the demand-pull precedes the cost-push, the source of inflation is from the demand-pull side, and the source of inflation is cost-push when cost-push precedes demand-pull inflation. Similarly, if inflation is accompanied by a fall in unemployment or rise in

output, it is demand-pull and if it is accompanied by an increase in unemployment, it is cost-push (Gupta, 2004). Cost push inflation is mainly caused by three forces: wage push, profit-push and increase in mark-up.

In the recent literature on inflation, however, the dichotomy of demand pull and supply push distinction has lost the central role with which traditional theory endowed it (Frisch, 1983). Since inflation is a phenomenon affecting the whole economy, the cost-push/demand-pull distinction is considered analytically unhelpful as a device for classifying those developments in inflation theory that are grounded in macro-economics (Laidler and Parkin, 1975).

## **2. MODELS OF INFLATION**

This section consists of Classical, Keynesian, Phillips Curve, Monetarist, Adaptive Expectation, Rational Expectation, Structuralist models and some international aspects of inflation.

The different theories of inflation are important in analyzing the sources of inflation. Classical, Keynesian, Monetarist and Structuralist approaches to inflation are important theories that give basic guidelines to understand the sources of inflation in an economy.

### **(A) Classical Model**

The quantity theory is described as the classical / neoclassical<sup>1</sup> theory of inflation (Frisch, 1983). The “Transactions” equation formulated by Fisher (1922) and the “Cash Balance” equation by the Cambridge school are the two forms of equation of quantity theory of money (Frisch, 1983). The quantity theory of money has, in one form or another, dominated the literature on

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<sup>1</sup> By “Classical” economics we generally mean the work of Adam Smith (1723-90), David Ricardo (1772-1823), and J.S. Mill (1806-73); “Neoclassical” refers to the work of L. Walras (1834-1910), A. Marshall (1842-1924) and A.C. Pigou (1877-1959).

inflation for the greater part of the last three hundred years (Laidler and Parkin, 1975). Fisher's transaction equation uses a macroeconomic explanation of the theory of inflation (Frisch 1983). It formulates the relationship between money supply and the general price level (Froyen, 2003). The link between transactions and money is expressed in the following transaction equation (Mankiw, 2004):

$$M.V. = P.T. \text{-----} (1)$$

The left-hand side of the equation tells us about the money used to make the transactions. M is quantity of money. V is called the transaction velocity of money which measures the rate at which money circulates in the economy. The right-hand side of the quantity equation tells us about transactions. T represents the total number of transactions during period of time. P is the price of a typical transaction. Analogously, the left-hand side of the equation represents the demand side and right-side represents the supply side. According to Fisher the velocity of money is determined by institutional developments in the monetary sector or financial habits of the public, and it remains constant in the short-run (Fisher, 1920). Similarly, the volume of output is fixed from the supply side and is also fixed in the short-run (Froyen, 2003). Under these assumptions, transactions equation can be interpreted as determining the general price level as:

$$P = (\bar{V}/T)M \text{-----} (2)$$

Thus the quantity of money in the economy is related to the number of dollars exchanged in transactions (Mankiw, 2004). Under constant velocity and given level of real income, prices would be directly proportional to the nominal money supply, and the adjustment would be instantaneous (McCulloch, 1982). If the economy has more money supply, it ultimately pours over fixed supply of output resulting in pressure on the general price level. People never hold money because of the increase in opportunity cost of holding money balance.

Therefore, the price level is proportional to the money supply where the constant of proportionality is the ratio of  $\bar{V}/\bar{T}$  (Friedman, 1970a). In fact this relationship is an identity from which one cannot draw behavioural conclusions (Frisch, 1983).

However, each dollar does not have the same “velocity”. Some people spend or invest money as fast as they receive it, giving their dollars a very high ‘v’ and others may retain money for months or even years, giving their dollars a low ‘v’. Velocity is sensitive to interest rates. There is a direct relation between the two. Laidler argues that the Fisherian equation of exchange is not a demand theory of money in the strict sense of the term because the stress is on ‘have to hold’ rather than on ‘wish to hold’. To remedy this difficulty the Marshallian demand analysis has been used to derive the cash balance equation. This problem has been identified by Cambridge economists, chiefly Walras, Marshall, Wicksell and Pigou.

Cambridge “cash balance” equation uses a microeconomic explanation of the theory of inflation (Frisch 1983). Inflation is determined by the magnitude of the amount of money an economic agent wishes to hold on (demand for money) to conduct transactions (Laidler, 1977). If an individual demand for money is aggregated into macroeconomic demand for money then it should be proportional to the nominal level of income. The Cambridge focus on a theory of money demand leads to an answer to the question about the way money affects the price level (Froyen, 2003). Therefore, they focus on the quantity theory as a theory of the demand for money. The data on the value of transactions is less readily available than that on national output. So, the demand for money to transact national output can be written as (Levacic and Rebmann, 1982):

$$M^D = k.yP \text{ ----- (3)}$$

As formulated by A. Marshall and A.C. Pigou, demand for money ' $M^d$ ' would be a proportion ' $k$ ' of income ' $y$ ' where ' $k$ ' is factor proportionality. As ' $k$ ' treated as fixed in the short-run and real output ' $y$ ' is also fixed by supply conditions, the demand for money was viewed as being proportional to the general price level or, equivalently, as being a demand for real money balances. With the determinants of the demand for real balances held constant and the demand for nominal money required to be equal to its nominal supply, the general price level was uniquely determined which is proportional to the nominal money supply. In other words the percentage rate of inflation is equal to the percentage rate of change of the nominal money supply (Laidler and Parkin, 1975).

In equilibrium, the exogenous supply of money must equal the quantity of money demanded ( $M^s = M^d = kPY$ ). If there is excess supply of money over the amount demanded, they increase their demand for commodities. This increased demand for commodities puts upward pressure on prices. In the language of the classical economists, there is "too much money chasing too few goods" (Froyen, 2003).

The formal equivalence of the Cambridge equation and Fisher version of the equation of exchange can be written as:  $M \frac{1}{k} = P\bar{Y}$  (Froyen, 2003). If we assume  $V = 1/k$  the equation becomes as:  $MV = P\bar{Y}$ . These two formulations are equivalent, with  $V$  equal to  $1/k$ . The proportional relationship between the quantity of money and the price level resulted from the fact that the proportion of nominal income people wish to hold in the form of money ( $k$ ) was constant and the level of real output was fixed by supply side. Where the income velocity of money in Fisher's equation equals the reciprocal of the cash balances coefficient. Since velocity is constant, it follows that the elasticity of the general price level with respect to a change in the supply of money equals unity (Frisch, 1983).



The neoclassical approach to inflation is based on the assumption of a dichotomy in the economic system. Relative prices and the quantities of goods supplied and demanded are determined in the real sector; in contrast, the general price level is determined in the monetary sector (Frisch, 1983). This dichotomy allows one to analyze the real and monetary sector separately. Determination of relative price is independent of the level of the money supply. In contrast, nominal prices or the general price level is a function of the supply of money. The quantity equation records this relationship. This property of the neoclassical model- a change in the supply of money influences only the general price level and leaves relative prices and therefore production and unemployment unchanged- is known as the “neutrality of money”. Therefore, in determination of general price level, the concept of classical and neo-classical economists arrived at the same conclusion.

Summing up, the equation of exchange of quantity theory of money as propounded by Fisher (1922) gives the mathematical or identity solution to the determination of inflation. Fisher postulated that the equilibrium values of the variables of equation of exchange (i.e.  $MV = PY$ ) are determined by other forces except price level (P). Real output variable is supply determined; velocity of money is determined by payment habit and payment technology of society, and money supply is controlled by monetary authority. Since, output and velocity are regarded as fixed in the short-run, the monetary authorities can control inflation by controlling money supply.

Neo-classical economists interpreted the quantity theory of money as a theory of the demand for money as:  $M^d = kPY$ . The latter theory tries to answer the question about the way money affects price level. They postulated that demand for money ( $k$ ) would be a proportion of nominal income (PY), where  $k$  is  $1/v$  in quantity theory of money. Money being a medium of transaction and convenience, demand for it varies closely with the level of income. The

proportion of nominal income people wished to hold in the form of money and real output are fixed in the short-run. In such a situation, an excess supply of money over the demand for it motivates people to reduce their money holdings to the optimal proportion of their income by putting this excess money into alternative uses of consumption and investment in production activities (Froyen, 2003). It increases people's demand for commodities leading to a rise in price level.

## **(B) Keynesian Model**

Before Keynes' famous pamphlet entitled "*How to Pay for the War*" was published, economists largely imputed changes in the price level to changes in the quantity of money. These theories fell into dispute during the 1930's because of the sharp changes in the velocity of circulation because they were treating constant velocity of money. Keynes gave secondary importance to the problem of inflation rather than to the problems of other macroeconomic variables such as output and employment. Policymakers tried to focus their attention to achieve the target level of output and unemployment by adjusting inflation as postulated by the Phillips Curve. Therefore, Keynes, in his celebrated work, emphasized the level of income and expenditure as the main determinant of the price level (Ball and Doyle, 1969). Conventional Keynesian Cross is the tool of analysis of the theory. It stresses the level of national expenditure (a flow) as a main determinant of the price level with increasing expenditures opening an inflationary gap after full employment is attained. Keynes talks about short-run macroeconomic issues under less than full employment situation in an economy. However, in a full employment economy, in the long-run, money supply is still considered the major single determinant of the price level. Therefore, the reason for inflation in a full employment economy, according to Keynes, in the long-run is similar to that of the classical economists.

The Keynesian inflation model can be explained as:  $V = PV^e$ , where, ' $V$ ' denotes value of output, ' $V^e$ ' volume of output and  $P$  the price index. According to Keynes the volume of output (Keynes's output at pre-war prices') is virtually fixed in the short-run. An increase in aggregate spending due to an increase in government spending without taking any steps to reduce private spending, the value of output must increase by the same amount. This is because aggregate spending and the value of output are identical. Now with volume of output fixed, the only way in which the value of output can increase, so as to keep in line with the higher level of aggregate spending, is by means of an increase in the price level. Therefore, in the short-run, given a fixed level of output, a rise in aggregate demand due to an increase in government spending leads inflation to rise. This is the reason for demand pull inflation.

The increase in value of output will be matched by a higher demand for wages by workers resulting in wage push inflation in operation in the later phase. While wage rises, it leads to an increase in private spending (government spending should also be increased in actual money terms in proportion to the increase in the price index). Thus both directly through government spending and indirectly through private spending, the initial increase in the price will cause a further increase in aggregate spending leading to a re-opening of the gap between aggregate spending and the value of output, which is considered inflationary gap. In summing up, an initial increase in price due to increase in government spending closes the spending-output gap and, at the same time, makes inevitable a re-emergence of aggregate spending-output gap (inflationary gap) at a later stage, through its effects on wage income and on the real value of government spending.

### **(C) Phillips Curve Model**

The policy implication of the Keynes' model is explained by the Phillips Curve. In the short-run, the way in which the determination of output is

affected by the expansionary or contractionary policy adopted by the government at the cost of inflation is answered by the Phillips Curve. Phillips (1958) studied the relationship between unemployment and money wage in the United Kingdom using the data covering 1861-1957 and found an inverse relationship between the variables. In other words there is a trade-off between wage and unemployment. He found also the non linear relationship between these two variables. The Phillips curve hypothesis states that the rate of money wage increase depends on the excess demand for labour where the excess demand for labour is proxied by the inverse of unemployment rate (Humphrey, 1976).

Samuelson and Solow (1960) and Lipsey (1960) modified the Phillips curve as representing a relationship between the rate of inflation and the rate of unemployment, instead of the rate of change in money wages and the rate of unemployment. This modification is based on the direct relationship between money wage rate and inflation rate given the unemployment rate. The relationship can be established using two mechanisms: First, if the assumption of price level was marked-up over the wage rate by a relatively stable proportion, there is a positive relationship between money wages and rate of inflation (Pethe, 1994). Second, if changes in wage rate due to demand pressure directly correspond to the change in cost of production, motivating employers to change sales price, and hence direct relationship between wage rate and inflation. With these assumptions in hand, an inverse relationship between the rate of inflation and the rate of unemployment holds true (Phillips, 1958).

The Phillips Curve gives the two explanations of the degree of unemployment and inflation in response to higher aggregate demand (Ackley, 1971). The first explanation is that unemployment declines in response to higher aggregate demand so that prices must rise to reflect the intensifying competition among firms for increasingly scarce resources, particularly labour (demand pull factor). Similarly, another explanation is that rising aggregate demand

enhances the ability of unions and managements to push up wages and prices (cost push factor).

The trade-off between wage and unemployment as depicted by the Phillips curve relationship can be written symbolically as:  $\omega = -\delta(U - U_f)$  (McNabb and McKenna 1990). Where,  $w$  is rate of wage inflation,  $U$  is actual unemployment rate,  $U_f$  is equilibrium rate of unemployment (demand equal supply in labor market causing  $w$  equal zero), and  $\epsilon$  measures the responsiveness of wages inflation to changes in unemployment and will depend upon the relationships between excess demand for labor on the one hand, and wage increases and unemployment on the other. This equation states that wages fall when the unemployment rate exceeds the equilibrium rate, that is,  $U > U_f$ .

The Phillips curve relation is based on three model (Mankiw, 2004): sticky-wage model, sticky-price model and imperfect information model. These models explain the negative slope of the Phillips curve or the upward slope of the supply curve.

Sticky-wage model- When the nominal wage is stuck, a rise in the price level lowers the real wage, making labour cheaper, inducing firms to hire more labour and production to increase or unemployment to decrease. The Phillips Curve implies that nominal wages are set by long-term contracts so that any rise in the price level due to higher aggregate demand lowers the real wages, making labour cheaper. This motivates firms to hire more labour and hence results in more output and less unemployment. If  $\epsilon$  is larger, unemployment has large effect on the wage and the Phillips curve is steeper.

Sticky-price model- Prices are sticky because of the markets are structured. Once a firm has printed and distributed its catalogue or price list, it is costly to alter prices. When a firm expects a higher price level in the future, it fixes high

price in advance leading to a high price level. The effect of output on the price level depends on the proportion of firms with flexible prices. Those firms with flexible prices set their price high, which leads to a high price level.

*Imperfect information model-* The suppliers, because of imperfect information, sometimes get confused between changes in the overall level of prices and changes in relative prices. The confusion influences decisions about how much to produce and supply. Ultimately suppliers are motivated to produce at least some more quantities of goods and services which show a positive relationship between the price level and output.

### **Policy Implication of Phillips Curve Model**

Phillips utilized his results to make certain recommendations towards price stabilization. Reduction of inflation and unemployment are the two major important goals of macroeconomic policies. These are the conflicting goals for policymakers, that is, there is a trade off between these goals (Mankiw, 2004). Demand stimulating policies (monetary and fiscal) would move the economy along the short-run Phillips curve- combination of lower unemployment (higher output) and higher price level. Therefore, in order to achieve lower unemployment, policymakers should sacrifice higher cost of inflation.

Further, an increase in inflation to achieve lower unemployment, as mentioned above, would tend to increase the nominal wage rate (may be when the new wage contract is signed, if there is price rigidity), which would increase the cost of production and, thus, shift the aggregate supply curve upward, which would further increase the price and reduce the real income. The aggregate demand will be pushed up again through the expansionary fiscal/monetary policy to restore the real income level (to neutralize the fall in employment), which would lead to further increase in price. Therefore, one shot rise in price would lead to more than one shot rise in inflation (Gupta, 2004).

Demand pull inflation generates real effect if lags or money illusion temporarily delays the upward shift of the supply curve, and supply generates real effect if monetary accommodation is delayed to shift the demand curve upward. Price level can be affected by changes in the product market, and hence any changes in the money supply could affect output as well as prices both given less than full employment level of economy.

To sum up the Keynes' approach to inflation: he gives theory of determination of level of real income and employment (Laidler and Parkin, 1975). It was so because of the prevailing world economic depression of the 1920s and 1930s. The Classical quantity theory fell into dispute during the 1930's because of sharp changes in the velocity of circulation, which was earlier treated as constant. The Conventional Keynesian Cross is the tool of analysis of the inflation theory. It stresses the level of national expenditure (a flow) as a main determinant of the price level. An initial increase in inflation due to increase in government spending closes the spending-output gap (inflationary gap). At the same time, because of the wage pressure, re-emergence of inflation takes place.

#### **(D) Monetarist Model**

The Monetarists theory of inflation came into being with Friedman's publication of 'Studies in the Quantity Theory of Money' (1956). After World War II, a central issue became the behaviour of price level in general, and a revival of interest in the Classical quantity theory in particular. Friedman set out a theory of the demand for money but not a theory of the determination of prices. His work is concerned with the role of money in generating inflation. Further the decision of holding money for future purposes is determined by the expected rate of inflation over some time-horizon rather than that of actual inflation prevalent at a particular instant. Rate of inflation will vary in

proportion to the rate of monetary expansion if the expected rate of inflation is constant (Laidler and Parkin, 1975).

The behavior of inflation, as depicted by the stable Phillips curve trade-off, failed to explain the stagflation in developed countries during the late 1960s due to the influence of price expectation, which is considered an important explanatory variable in the determination of inflation. Though Samuelson and Solow (1960) have questioned the long run stability of the Phillips curve, it lacked a formal theoretical formulation. Friedman (1968) and Phelps (1967), for the first time, examined the issue of the long-run stability of the Phillips curve relationship in a theoretical way. They found that the trade-off between inflation and unemployment, as postulated by the Phillips curve, is essentially a transitory phenomenon. Friedman (1977) argued that “there is no long-run stable trade-off between inflation and unemployment” on the ground that both demand for and supply of labour depend on the real rather than nominal wage rate. However, in the long run, the shape of the Phillips curve becomes vertical as explained by “Natural Rate Hypothesis (NRH)” Friedman (1977). NRH assumes that there is only one rate of unemployment sustainable in the long run, called natural rate of unemployment.

The Phillips Curve theory is incapable of explaining the persistence of rapid wage inflation in the face of slack labour markets, where excess demand is zero or negative (Humphrey, 1976). The expectation-augmented/excess-demand hypothesis introduces the price-expectations variable into the Phillips curve and states that the rate of wage increase is determined by excess demand in the labour market as a result of workers’ and employers’ anticipations of future inflation (Humphrey, 1976). Symbolically it can be written as:  $w = w(x, p^e)$ , Where, the rate of wage ‘ $w$ ’ is a function of demand pressure ‘ $x$ ’ and expected rate of inflation  $p^e$ . The greater the demand pressure, the faster is the rise in wages. Even if demand pressure were absent or negative, wages would still exhibit a tendency to rise because of the expected rate of inflation. When



workers are primarily concerned with real wages (i.e. purchasing power of money wages), they bargain for money wage increases that is sufficient to protect real wages from anticipated future inflation ( $p^e$ ). In such a situation, there is upward pressure of rate of inflation even in the absence of demand pressure. Therefore, even in a situation of zero excess demand, employers are bound to raise wages to compensate for anticipated rise in prices.

Accelerationists argue that inflation stimulates economic activity only if it is unanticipated. Unexpected inflation induces producers, who are pleasantly surprised to find their product prices rising faster than their real costs, to expand output and employment. Thus, the stimulative effect eventually disappears when the inflation is fully anticipated by them. This conclusion can be expressed in accelerationist price equation as:  $p = ax + p^e$  or,  $p - p^e = ax$ . Where, coefficient 'a' expresses the numerical magnitude of the trade-off between the variables of the equation. The equation states that the trade-off between unanticipated inflation ( $p - p^e$ ) and output (x) vanishes when inflation is fully anticipated resulting the term ( $p - p^e$ ) equal to zero. Using an expectations-augmented/excess demand version of the Phillips curve equation, the accelerationist school derived the temporary trade-off between inflation and output. This trade-off is possible only when people are fooled by unanticipated inflation. However, it vanishes in the long-run when price expectations are fully realized through wage-price setting behavior.

### **Policy Implication of the Monetarist Approach to Inflation**

The Monetarists' version of quantity theory of money is closest to the neo-classical approach to demand for money function as:  $M^d = \bar{k}PY$ . Friedman extended neo-classical demand for money function to:  $M^d = k(r_b, r_e, r_d)PY$ . Where,  $r_b, r_e, r_d$ , are nominal interest rate on bonds, return on equities and return on durables goods, respectively. Instead of constant 'k' (Cambridge k),

monetarists express it as a function of the rates of return of alternative assets (bond, equity, durable goods) to demand for money. A rise in the return of these alternative assets would cause 'k' to fall reflecting the increased desirability of the alternative assets over demand for money. Not only that, expected rate of inflation also has a substitution effect on financial assets to real assets. If the supply of money, which is assumed exogenous, is higher than the desired holding of money 'k' (where 'k' and  $r_b, r_e, r_d$  are inversely related), inflation takes place. The basic departure of Monetarists' approach of demand for money from Keynes is that; for Monetarists' demand for money is a stable function of some return variables; while for Keynes demand for money is highly sensitive to rate of interest via speculative demand for money. Keynes assumes two asset world (bond and money) but Monetarists assume multi-asset world (money and other return variables). So, Keynes assumes unstable demand for money function, and hence difficult to predict real income (Mankiw 2004).

#### (i) **Adaptive Expectation Model (AEM)**

Inflation expectation model depends on the formation of inflation expectation by the economic agent. It has two versions: adaptive expectations model and rational expectations model. Friedman (1968) popularized Adaptive Expectations Hypothesis (AEH) in macroeconomics during the Fifties and Sixties. Rational Expectations Hypothesis (REH) proposed by Muth (1961) and popularized by Lucas (1973), Sargent and Wallace (1975) during Seventies.

The Adaptive Expectation theory of inflation assumes that the current inflation is a function of excess demand and expected rate of inflation, where expected rate of inflation is again a function of past rates of inflation. Adaptive expectation model of inflation is a backward-looking model. It is therefore, able to explain the dynamic behaviour of inflation where inflation is sustained on its own momentum. Cagan (1956) explained hyper inflation on the basis of

this model. This model assumes the neutrality of money supply in the long-run but it does not hold true in the short-run. The basic assumption of this model is that people expect rise in inflation this year at the same rate as last years'. This year's inflation ( $\pi_t$ ) depends on expected inflation ( $\pi^e$ ) which in turn is determined by last year's inflation( $\pi_{t-1}$ ) (Mankiw, 2000).

The adaptive expectation model is used to explain the formation of expectations of economic decision making. It has two characteristics: The first belongs to the way private agents correct their errors in forecasting when the expected level of inflation deviates from the actual level. And the second is related to the way expectation of future inflation is related to observations of past inflation (Frisch, 1983). For the first characteristic, we can develop the model of adaptive expectation as:  $\pi_t^* - \pi_{t-1}^* = \theta(\pi_{t-1} - \pi_{t-1}^*); 0 < \theta < 1$ . The equation states that the change in the expected rate of inflation (i.e., the difference  $\pi_t^* - \pi_{t-1}^*$ ) is proportional to the forecast error, which we define as the discrepancy between the actual and expected rates of inflation in the previous period. If the present rate of inflation is greater or smaller than the expected rate, then the rate of inflation expected in the next period will be revised upward or downward by an amount equal to a percentage ' $\theta$ ' of the forecast error  $\pi_t - \pi_{t-1}^*$ . A common form of adaptive expectation model, for the analytical purposes, can be represented by simple a transformation of the above equation as:  $\pi_t^* = \theta\pi_{t-1} + (1 - \theta)\pi_{t-1}^*$ . The expected rate of inflation at time ' $t$ ' is a weighted average of the actual inflation rate and the expected inflation rate at time ' $t-1$ ', where the adjustment parameters ' $\theta$ ' and  $(1 - \theta)$  serve as weights.

For the second characteristic, we can develop the model of adaptive expectation on the basis of expectations of inflation that are not directly observable but are linked to the observable past rates of inflation. The model of adaptive expectations implies that the expected variable can be explained as a weighted average of past inflation rates.

$$\pi_t^* = \theta\pi_{t-1} + \theta(1-\theta)\pi_{t-2} + \theta(1-\theta)^2\pi_{t-3} + \dots + \theta(1-\theta)^{n-1}\pi_{t-n} + (1-\theta)^n\pi_{t-n}^*$$

In the above equation the unobserved expected rate of inflation at time 't' is linked with the already known rate of inflation of the past, that is,  $\pi_{t-1}, \pi_{t-2}$  where, past rates of inflation are weighted by the parameters  $\theta, \theta(1-\theta), \theta(1-\theta)^2$  and so on. The weight expresses the influence of past rates of inflation on the formation of the present expected rate of inflation. The weight scheme can be considered a "memory". If, ' $\theta$ ' is close to zero, then the weights decline slowly and the economic agents (or society at large) are considered as having a "long" memory. This means that information from the more distant past influences the formation of expectations significantly in the future. In contrast, if ' $\theta$ ' is close to unity, then the weights decrease quickly and the economic agents are considered as having a "short" memory (Solow, 1969) implying that a few information related to the recent past are considered as relevant (Klein, 1972).

## (ii) Rational Expectation Model (REM)

The Rational Expectation Model of inflation is inherently forward-looking in the sense that the current inflation rate depends not only on the current and past inflation but also on the state of information available at the end of the period. This gives rise to the understanding of the course of events like anticipated economic policies and economic environment that are forecast at a current point of time (Begg, 1982, Frydman and Phelps, 1983, Minford and Peel, 1983, Sheffrin, 1983). If such a forecast is conditional upon the latest information available to an experienced forecaster, it is called a conditional forecast. Lucas (1973) found the adaptive expectation model faulty because it is subject to some systematic error. It implies that the latest information is not fully reflected in the coefficients of adaptive expectation model. If an economic agent has information in addition to past observations of the variable, then the use of the adaptive expectations model would lead him to waste that

information (Frisch, 1983). The rational expectations hypothesis is also known as the full information hypothesis (Gupta, 2004). In fact, the whole idea of forecasting comes from the utilization of all the information available to the economic agents and the policy makers to understand future possible events.

The Rational expectations model provides an unbiased estimate of endogenous variables where all the informations concerning the values of the exogenous and predetermined variables is known and used for prediction. If we designate  $\pi_t^*$  and  $\pi_t$  as the expected and actual rates of inflation, and  $I_{t-1}$  as the state of information available at the end of period t-1, then the existence of rational expectations should hold the following two assumptions:

$$E(\pi_t / I_{t-1}) = \pi_t^* \quad \dots\dots (1)$$

$$\pi_t - \pi_t^* = E(\pi_t / I_{t-1}) - \pi_t = \varepsilon_t \quad \dots\dots (2)$$

First equation states that the rational expected rate of inflation depends on the extent of relevant information  $I_{t-1}$  available before the forecast at time t-1 is made. Second equation states that rational expectations do not imply perfect foresight. Instead, it allows for a random error  $\varepsilon_t$ . The estimated error does not contain a systematic component.

The basic departure of the rational expectationist from the adaptive expectationist is in terms of easy availability of information about the economic variable with the help of modern technology. They assume that the economic agents in the market have full information. In such a situation, the actual rate of inflation rarely deviates from the expected rate of inflation. If the monetary policy tries to influence changes in aggregate demand by supplying more money leading to a rise in actual price level, with no time lapse, the expected rate of inflation is modified into actual inflation resulting into neutrality of money supply in the short-run. Therefore, rational expectationists concede that monetary shocks are neutral both in the short-run as well as long-run.

### **(E) Structuralist Model**

The structuralists argue that an inflationary situation is attributable to the basic structural constraints experienced in the process of industrialization and development by an economy. The structuralist approach to inflation, which has gained rapid acceptance in developing countries, originated mainly from the economic events in Latin American countries. This school maintains that there are basic socio-economic and institutional differences between developed and developing countries. Therefore, any economic analysis that emanates from industrialized western economies needs to be substantially modified in order to be applicable to under-developed economies (Pethe, 1994).

The fundamental constraints that most structuralists agree upon are agricultural supply constraints, finance constraints and foreign exchange constraints (Pethe, 1994). In supply constrained economies, excess money supply cannot generate output because technology and real resources cannot be augmented by a mere increase in money supply. Structuralists further argue that inflation in a developing economy is not a monetary phenomenon because structural disequilibrium in the growth process as such cannot be cured by monetary regulation. Therefore, in a modified structuralist model price level is considered to be determined by money supply but the direction of causality need not run from money to price (Pethe, 1994).

According to the structuralists, as against the monetarists, money supply in a closed economy is considered as an endogenous variable. As the demand for nominal money balances increases due to rise in price level, the banking system seeks to create more money to maintain required money balances (Levacic and Rebmann, 1982). Though money is an important determinant of inflation, it is not the only factor affecting aggregate prices. Further, money supply itself is growing on account of government budget deficit caused by

structural imbalances in the growth process. It appears that a mere reduction in money supply may reduce inflation at the expense of income and output. Demand shift, export instability, agricultural bottlenecks and the foreign exchange scarcity as structural factors play some role in generating inflation. Therefore, non-structural factors, such as government deficit and money supply, combined with structural factors significantly contribute to the acceleration of inflation in developing countries (Argy, 1970).

Factors like, shifts in the composition of demand (as distinct from generalized excess demand), changes in the tastes, distribution of income and composition of production exert pressure on inflation. Similarly, to the extent that resources are less mobile in developing economies than in developed countries, a given change in the output-mix is likely to require a higher rate of inflation. Similarly, export receipts variability and foreign exchange scarcity also tends to create a long-term upward movement in the price level. According to the agricultural bottleneck hypothesis, under the supply inelastic agriculture production, the combined effects of population growth, growth of living standards, and urbanization may increase the demand for agricultural products, causing the prices of the products to rise. In some countries for a number of reasons, the agricultural sector is not adequately responding to these factors.

#### **(F) International Aspect**

Inflation in a small open economy may be of external origin. The degree of openness has significant influence on domestic inflation. Domestic inflation is determined by the world rate of inflation (Blejer, 1977). There are two factors that are responsible in transmitting the world inflation into domestic inflation (Levacic and Rebmann, 1982); (a) goods arbitrage- a country's demand for tradables switches to domestically produced goods when their prices fall relative to the world price. The increased demand bids up the price of domestically produced goods. (b) portfolio adjustment- in the interim period,

while the domestic prices are below the world price, the domestic country runs a balance-of-payments surplus. This leads to increase in foreign exchange reserves under a fixed exchange rate system. Higher forex reserve ultimately leads to rise in domestic money supply. Therefore, portfolio adjustment by domestic residents creates additional demand for domestically produced goods resulting in a rise in inflation.

Changes in the inflation rate in the world markets can be transmitted to non-tradable goods of the domestic market through two routes: First, an increase in the rate of inflation in the world markets results in an increase in the rate of change of money wages in the tradable sector. Given labour mobility between the tradable and non-tradable, an increase in tradable sector leads to rise in money wage of non-tradable resulting to rise in inflation. Second, an increase in the rate of inflation in the tradable sector initially changes the structure of relative prices and later help to switch demand towards non-tradable, and hence generates pressure on inflation.

### **3. REVIEW OF EMPIRICAL FINDINGS**

Economic theories are formulated and reformulated on the basis of empirical findings of specific economic behaviour. These theories are not considered invariant. Expectations of the economic units, changes in policies of the government, international effects transmitted within the country affect the behaviour of economic decision makers. Similarly, the theories developed on the basis of experiences of developed economies may be different from those relevant for developing economies. The model developed to represent particular economic phenomenon, as mentioned above, may not necessarily be constant. In the following section, the empirical findings of the determinants of inflation in different economic environments particularly in developed, Asian along with Nepal are reviewed.



### (A) Developed Country Case

Lucas (1973) empirically analyzed the real output-inflation tradeoff of eighteen developed countries using annual time-series from 1951 to 1967. The main objective of his study was to see whether the terms of the output-inflation “tradeoff” vary across countries rather than to explain output and price level movements within a country. The countries selected for the analysis were Argentina, Austria, Belgium, Canada, Denmark, West Germany, Guatemala, Honduras, Ireland, Italy, Netherlands, Norway, Paraguay, Puerto Rico, Sweden, United Kingdom, United States and Venezuela. He uses the following reduced form model.

$$y_{ct} = -\pi\delta + \pi\Delta x_t + \lambda y_{c,t-1}$$

$$\Delta P_t = -\beta + (1 - \pi)x_t + \pi\Delta x_{t-1} - \lambda\Delta y_{c,t-1}$$

$y_{ct}$  is cyclical component of real output,  $\Delta x_t$  is change in the nominal expansion rate (demand shift),  $\pi$  is parameter of output effect due to unanticipated demand shifts which depends on ‘fooling’ suppliers (thinking relative prices are moving in their favor).

For the United States:

$$y_{ct} = -.049 + .910\Delta x_t + .887y_{c,t-1}$$

$$\Delta P_t = -.028 + .119\Delta x_t + .758\Delta x_{t-1} - .637\Delta y_{c,t-1}$$

For Argentina

$$y_{ct} = -.006 + .011\Delta x_t + .126y_{c,t-1}$$

$$\Delta P_t = -.047 + 1.114\Delta x_t + .083\Delta x_{t-1} - .102\Delta y_{c,t-1}$$

Lucas found that growth promoting policies tend to have a large initial effect on real output combined with a small impact on inflation in a country like the United States where inflation found to be almost stable. However, in a country with a volatile inflation like that of Argentina, nominal income changes are

associated with equal, contemporaneous price movements with no marked effect on real output. This signifies inflation is stimulating real output if, and only if, it succeeds in ‘fooling’ suppliers of labour and goods into thinking that relative prices are moving in their favour. What can be concluded from the Lucas’s finding is that the real effects of any shock in the future (forward-looking behavior) depend on the policies adopted by the government prior to implementation. Therefore, the credibility of the government affects the expectation of the private agent’s decision making.

Blejer (1977) empirically analyzed the short-run behaviour of prices and the balance of payments behaviour of Mexico over the sample period 1950-73. The model is based on the monetary approach to the balance of payments in a small open economy with a fixed exchange rate. As an application of the monetary approach to the balance of payments, the emphasis is on the interaction between the supply and the demand for money in explaining a country’s balance of payments. The disequilibrium in the money market, in the short-run, affects balance of payments as well as the internal level of prices through relative prices of non-traded to traded goods. He uses the following model:

$$p_t = \frac{1}{1 + \lambda(1 - \beta)} (P_t^*) + \frac{\lambda(1 - \beta)}{1 + \lambda(1 - \beta)} \left[ D \left( \frac{Dc}{H} + a^* - m_a^* \right)_t \right] + \frac{\lambda(1 - \beta)}{1 + \lambda(1 - \beta)} P_{t-1}^*$$

Here rate of inflation is expressed as functions of the world rate of inflation  $P_t^*$  (assumed to be equal to the rate of change in the price of traded goods), the rate of change of the ex ante excess flow supply of money (second term), and the past period’s rate of inflation  $P_{t-1}^*$  (reflecting lagged values of the former exogenous variables).  $\lambda$  is elasticity of relative prices with respect to the excess flow of supply of money, and  $\beta$  is the share of traded goods in expenditure. Two dummy variables are introduced to account for the effects of the devaluation for the year 1954: one accounting for the effects of the devaluation on the rate of inflation during that year ( $D_0$ ) and the other for its

effects during the following year ( $D_1$ ). All the estimated coefficients are highly significant except those of  $D_1$ .

Mexico is a country with almost unrestrained international mobility of capital and with relatively few restrictions on the movement of goods. In addition, its proximity to the United States increases the array of goods and services that are likely to be traded. The central implication of the theoretical inquiry is that an increasing domestic credit component of the monetary base at a faster than the growth of the demand for money will result in a balance-of-payments deficit through an increase in import as well as, in the short-run, higher rate of inflation than that of the rest of the world. The results support the belief that the total adjustment to changes in domestic monetary conditions is completed faster than the adjustment to changes in the international price level.

Spitaller (1978) empirically analyzed the determinants of inflation in the case of seven major industrial countries (Canada, France, the Federal Republic of Germany, Italy, Japan, the United Kingdom, and the United States). He used the simultaneous equation model for the analysis with data covering 1958 to 1976. The variables used in the reduced form equations are as:

$$\dot{P} = \dot{P}[\text{cons tan } t, \dot{M}, \frac{Y}{\bar{Y}}, (\frac{Y}{\bar{Y}})_{-1}, M\dot{P}, \dot{P}_{-1}]$$

and,

$$\dot{P} = \dot{P}[\text{cons tan } t, \dot{M}, w\dot{Y}, (w\dot{Y})_{-1}, M\dot{P}, \dot{P}_{-1}]$$

Where,  $\dot{P}$  is measured by the rate of change in consumer prices;  $\frac{Y}{\bar{Y}}, w\dot{Y}$  are current output gap and current output changes respectively, and are expected to have theoretically positive sign.  $M\dot{P}$  is import prices which are measured in import unit values.  $\dot{M}$  is money stock is expressed in terms of narrow money, M1. This applies to all countries in the sample except for Japan, where institutional characteristics make it preferable to define inflation in terms of wholesale prices and to define the money stock in terms of broad money. This

price equation assumes that the rate of price change is the function of the rate of changes in money stock, output gap, import price and lagged value of itself.

#### **Effect of money stock, output gap and import price on inflation**

S.N	Countries	Response of inflation with respect to rate of change in money supply.	Response of inflation with respect to rate of change in import prices.	Level of the Output Gap
1.	Canada	0.23	0.46	41.62
2.	France	0.32	0.39	16.27
3.	Germany, Fed.Rep.	0.57	0.29	54.43
4.	Italy	0.16	0.47	-
5.	Japan	0.33	0.31	24.75
6.	United Kingdom	0.56	0.56	119.78
7.	United State	0.20	0.27	26.33

The study found that the changes in money supply affect the rate of inflation in all countries except Italy. The demand pressure effect on inflation as measured by the output gap is found in all the countries except France and Italy. The demand pressure effect as measured by the lagged percentage change in output is borne out for Canada, the United Kingdom, and the United States. For Japan, the same effect appears to operate through the current rather than the lagged output changes. For France, a similar tendency may be noted, but the effect is statistically not significant. Import price changes are important determinants of changes in consumer price index in all countries except the Federal Republic of Germany. The speed of adjustment in the inflation process, as measured by the coefficient on the lagged dependent variable, seems generally low; Japan being the only exception.

Nelson (2003) examined the relationship between money supply and CPI inflation for the United States using data from 1970 to 2001 to provides decisive evidence in favour of ‘inflation is always and everywhere a monetary phenomenon’ (AEMP). Regressing annual CPI inflation ( $\pi_t^A$ ) on contemporaneous annual M2 growth ( $X_t^A$ ), following short-term money-inflation relationship as follows is found:

$$\pi^A_t = 0.036 + 0.211X^A \quad R^2=0.052$$

The money-growth coefficient is far from unity. However, if one instead allows explicitly for lags by regressing inflation on M2 growth two, three, and four years earlier, the result is:

$$\pi^A_t = -0.006 + 0.257X^A_{t-24} + 0.376X^A_{t-36} + 0.182X^A_{t-48} \quad R^2=0.55$$

The sum of the coefficients is found 0.85; decidedly more favorable to the coefficient of money supply growth according to the quantity theory of money. He further regressed annual consumer price (RPIX) inflation on contemporaneous money growth for January 1970-August 2001, in the case of the United Kingdom, and found a coefficient of 0.910. The total sum of the coefficient including two lags increased to 1.097. His analysis provides decisive evidence in favour of 'inflation is always and everywhere a monetary phenomenon' (AEMP).

Using time series data ranging from 1951 to 1986, Abizadeh and Yousefi (1989) analyzed the inflationary effects of deficits in the economy of the United States through Ordinary Least Squares (OLS) method. They used the method of principle components to reduce the effect of multicollinearity in the regression equation having a number of independent variables. The variables they chose for the estimation of inflation are:  $\dot{P}_t = f(Y_{t-1}, DF_t, \dot{q}_t, M1_t)$ , Where,  $\dot{P}_t$  is rate of inflation,  $Y_{t-1}$  is one period lag real gross domestic product,  $DF_t$  is rean NIA deficits (Surpluses),  $\dot{q}_t$  is foreign rate of inflation,  $M1_t$  is money supply.

With the main objective of testing whether the government is an important factor contributing to inflation in the USA, they found a negative sign of deficit coefficient with the combination of other variables. Further, when they used nominal deficit and M1 monetary aggregate as explanatory variable of inflation, the deficit again carried negative sign. The result suggests that deficits have no significant bearing on the rate of inflation in the USA. It

doubts the notion of a crowding-out effect by the government deficit. Therefore, they conclude that public deficits are not always bad. Certainly in times of deep recession, short-term deficit financing can stimulate aggregate demand, increase national income, and reduce unemployment in a Keynesian manner.

Gerlach and Svensson (2003) examined the relationship between inflation, output, money and interest rates in the euro area using data from 1980 to 2001. The central finding is that both the output gap and the real money gap (the difference between the real money stock and the long-run equilibrium real money stock) contain considerable information regarding future inflation. The gradual decline in inflation can be interpreted as corresponding to a fall in the average (implicit) inflation objective,  $\hat{\pi}_t$  of the central banks in the euro area. The implicit inflation objective affects level of inflation through expectations. European Monetary System, which was founded in 1979, sought to facilitate a reduction in members' inflation to levels similar to those of Germany.

## **(B) Asian and Other Developing Countries Case**

Bhattacharya and Lodh (1990) analytically surveyed the inflation trend of India using annual time series data from 1951 to 1988. Both the monetarist and structuralist approaches to inflation are analyzed in their study. In order to test the monetarist proposition of inflation, they used two bi-variate regression models with inflation and money supply in excess of real GDP as dependent and explanatory variables respectively. They found little systematic relationship between these variables as follows:

$$PW_t = 1.5 + 0.53Z3 \dots \dots R^2 = 0.21$$

$$PW_t = 2.04 + 0.64Z1 \dots \dots R^2 = 0.22$$

Where, PW is rate of change of wholesale price index (inflation), Z3 is rate of change of M3 monetary aggregate in excess of real income; Z1 is rate of

change of M1 monetary aggregate in excess of real income. Money supply is found to be only one of the important determinants of inflation rate. A greater proportion of variation in inflation is caused by factors other than excess growth of money. The explanatory power of both the above equations is found to be very poor. They concluded that the biggest source of monetary expansion is government deficit financing (BD) which is proxied by budget deficit as a ratio of GDP. Therefore, the supply of money is found endogenous in India because of the tendency of budget deficit widely fluctuating during the periods of wide fluctuation of money supply.

Among non-monetary factors, food supply and government buffer stock operation through public distribution system and import price are found to be important sources of inflation. The relative disparity between agricultural and non-agricultural income is another important factor contributing to inflation. In summing up, the overall behaviour of inflation in India corresponds neither to the purely monetarist view nor to the purely structuralist view due to the unstable relationship between inflation and output growth and, between inflation and money supply growth.

Pant (1988) analyzed the theory and evidence of the sources of inflation in Asian countries, using annual data from 1951 to 1971. He selected four countries namely, China, India, Philippines and Thailand as representative countries in his study. His study focuses on the quantification of the variation in inflation rates determined by external and domestic sources in the Asian countries, under the fixed exchange rate system. Pant expects that any theory that performs well for these selected countries will be capable of explaining inflation in many developing countries. The two reduced form models in a log-linear form used for the analysis are as follows:

$$\Delta P = \Delta \beta_o + \beta_1(\Delta M^s) + \beta_2(\Delta Y) + \beta_3(\Delta P_2^f) + \beta_4(\Delta P_3^f) + \beta_5(\Delta^2 P^2) \dots \dots \dots (1)$$

$$\Delta P = \Delta C_o + C_1(\Delta M^s) + C_2(\Delta Y) + C_3(\Delta P_2^f) + C_4(\Delta P_3^f) + C_5(\Delta P^e) + C_6(\Delta^2 P^e) \dots \dots (2)$$

$\Delta$ , refers changes,  $P$  is inflation rate,  $M^s$  is money supply,  $Y$  is real income,  $P_2^f$  is domestic product of export goods,  $P_3^f$  is domestic price of import goods,  $P^e$  is expected price. The equation (1) will hold in the presence of flexible prices. However, if domestic prices adjust only partially in response to excess aggregate demand, equation (2) is expected to perform better. The price equations estimated using equation (1) showed a contribution to the price rises made by external factors (change in export and import prices), domestic factors (change in real income and money) and other factors (expectations and residual). He defined three major sources of inflation; first, an increase in money supply; second, a decrease in real income; and third, changes in world prices of export and import goods. His summary of the findings are as follows:

Sources of Inflation (percentage contribution)

Country	Internal Factors			External Factors	Expectations and Residuals
	Total	Money Supply	Real Income		
China	-94.24	106.80	-201.04	17.77	176.47
India	49.36	91.48	-42.12	15.51	35.13
Philippines	13.11	53.33	40.22	41.81	45.08
Thailand	-19.49	4.92	-24.40	7.50	12.14

A substantial part of the rise in domestic prices over the period in the Philippines was due to external factors and the argument of “imported” inflation in an open economy is validated. In India, on the other hand, about 50 percent of the rise in price during 1950-1970 was due to the rapid rise in domestic monetary expansion.

Panchamukhi and Rao (1992) made a quantitative analysis of different aspects of inflationary behaviour in eighteen Asian countries, using annual and quarterly data from 1975-1987. Among the sample countries, five are from newly industrializing economies (Hong Kong, Republic of Korea, Singapore, Taiwan and China); four from Southeast Asia (Indonesia, Malaysia, Philippines, and Thailand); six from South Asia (Bangladesh, India, Myanmar,



Nepal, Pakistan and Sri Lanka); and two from South Pacific (Fiji and Papua New Guinea). In analyzing the relation between inflation and its determinants, they used a partial adjustment mechanism- i.e. actual inflation adjusting to some normative expected inflation rate determined by structural factors such as growth in the unit value of imports, the growth rate of real GDP and the rate of change of money supply. The model they used in their analysis is as follows:

$$INF_t = \alpha(1 - \lambda) + \lambda INF_{t-1} + \beta_1(1 - \lambda)UVIMPER_t + \beta_2(1 - \lambda)GDPCTPER_t + \beta_3(1 - \lambda)BRODMNYPER_t + U_t.$$

Where, INF is inflation rate, UNIMPER is growth in unit value of imports, GDPCTPER is growth rate of real GDP, BRODMNYPER is rate of change of money supply.  $u_t$  is a disturbance term,  $(1 - \lambda)$  is rate of adjustment of the actual inflation to the expected rate of inflation.

Among the eighteen countries, both the monetary and real factors are found to be significant for Korea and Myanmar. Only the monetary factor is found to be significant for India, Indonesia and Nepal. There are eight countries for which both monetary and real factors are not found to be significant. The external factor is found to be significant for Korea, India, Malaysia, the Philippines and Thailand. They also examined the inflation variation and uncertainty for the countries under review. They found that those countries which have higher rates of inflation also experienced higher variability inflation rates. This supports the view that high inflation is associated with high variability and hence the uncertainty in decision making.

The broad conclusion of their finding is that in those countries where domestic factors (both monetary and real) are not found to be significant in accelerating inflation, external factors such as import price are found to be significant. Generally, external factors turn out to be significant for those economies which are relatively more open, and for which the management of inflation through the domestic policy is difficult.

Herberger (1963) made a comparative analysis of the validity of monetary and structural explanation of inflation of Chile. The first equation given below is monetary one. He, subsequently, includes non-monetary factors in monetary equation to examine structural factors contributing to inflation.

$$P_t = -1.05 - 1.05Y_t + .80M_t + .34M_{t-1} \text{ ----- } R^2 = .84$$

$$P_t = -.32 - .91Y_t + .74M_t + .34M_{t-1} + .20A_t \text{ ----- } R^2 = .87$$

$$P_t = -1.15 - .89Y_t + .70M_t + .29M_{t-1} + .16A_t + .13w_t \text{ ----- } R^2 = .87$$

He regressed the consumer price level ( $P_t$ ) as dependent variable and income ( $Y_t$ ), money supply ( $M_t$ ), price expectation ( $A_t$ ) and wage rate ( $w_t$ ) as independent variables with different combination. He found a positive relationships between inflation and all independent variables except the level of income. The first equation was a monetary one, allowing for a two-year distributed lag. The coefficients of both the current and the lagged change in the money stock are statistically significant, and their sum is not significantly different from plus unity, indicating that a one percent increase in the quantity of money causes a rise of nearly one per cent in the price level, other things being equal. However, the variables like  $A_t$  and  $W_t$  add nothing to the explanation of the rate of inflation.

Aghevli and Khan (1978) examined the relationship between the changes in money supply and inflation for four developing countries viz, Brazil, Colombia, the Dominican Republic and Thailand. The study covers the period of 1961 to 1974 for the countries other than Brazil (limiting 1964 to 1974). They used a simultaneous equation model to examine the relationship between variables, and claimed the model equally applicable to developing countries with moderate rates of inflation. The structure of model is as follows:

$$\log P_t = -\lambda a_0 - \lambda a_1 \log Y_t + \lambda a_2 \pi_t - (1 - \lambda) \log (M/P)_{t-1} + \log M_t \quad \dots\dots (1)$$

$$\log G_t = \gamma g_0 - \gamma g_1 \log Y_t + (1 - \gamma) \log (G/P)_{t-1} + \log P_t \quad \dots\dots (2)$$

$$\log R_t = \pi_0 - \pi_1 (\log Y_t + \log P_t) + (1 - \tau) \log R_{t-1} \quad \dots\dots (3)$$

For expected inflation,

$$\pi_t = \beta \Delta \log P_t + (1 - \beta) \pi_{t-1}$$

An initial increase in government expenditure raises the price level from the first equation, which results in an increase in government expenditure through second equation and revenue from the third equation. If the increase in expenditures is greater than that in revenue, the fiscal deficit will increase. This will cause the money supply to increase causing inflation to rise. Rise in inflation causes fiscal deficit to increase because of the real value of government revenue decreasing in an inflationary situation. This will cause the money supply to increase further and the process will be repeated. Because of the adjustment coefficient of government expenditure not being significantly different from unit in all four countries, it confirms the hypothesis that nominal government expenditure is adjusted upward almost automatically to keep pace with inflation. Therefore, in the long run, both government expenditure and revenue would move proportionately with inflation.

Akhtar (1975) empirically examined the inflation problem in developing economies. He took India and the Philippines as representative countries in his study. The period of analysis covers 1951 to 1970 for India and 1951 to 1972 for the Philippines. He empirically examined the monetarist explanation of inflation and contribution of fiscal and foreign trade variables on inflation. The regression result in the case of monetarist explanation of inflation is as follows:

$$p_t = 1.47 - 0.40m_t + 0.89m_{t-1} - 0.02y_t, \dots\dots\dots \alpha_1 > 0, \alpha_2 > 0, \alpha_3 < 0 \quad (\text{India})$$

$$p_t = 4.03 + 0.24m_t + 0.32m_{t-1} - 0.85y_t, \dots\dots\dots \alpha_1 > 0, \alpha_2 > 0, \alpha_3 < 0 \quad (\text{The Philippines})$$

Where,  $p_t$  = rate of inflation in measured by the consumer price index,  $m_t$  = rate of growth of the money supply,  $y_t$  = rate of growth of real income. It is found

that the monetarists model better explain inflation of Philippines than India. The low value of  $R^2$  of 0.27 and contrary to expected sign of ' $m_t$ ' shows poor performance of the monetarist model of inflation in the case of India. The results of the step-wise regression approach indicate that in the case of India as well as the Philippines  $m_{t-1}$  is the most powerful monetarist variable.

Among the fiscal-development variables in explaining inflation, the rate of total government expenditure to the total national income is found to be the best explanatory variable for India with  $R^2$  of 0.40. However, fiscal-development variables yield less important results for the Philippines. Similarly, the effect of foreign trade variables on inflation is found to be better for India in comparison with the Philippines. The rate of change of ratio of total imports to income and rate of change of import prices are found to be better contributing variables to explain inflation in India. The monetarist-structural model explains a substantially large proportion of the observed variance of the rate of inflation in India and the Philippines than that explained by the monetarist model. The monetarist model is particularly inadequate in explaining the rate of inflation in India. The basic monetarist model explains only about 27 per cent of the observed variance compared with the 66 per cent explained by the monetarist-structural model.

$$P_t = -13.67 + 0.98m_{t-1} + 0.76y_t - 0.30p'_t + 2.17Z_t - 1K_t, \dots, R^2 = 0.66$$

Some degree of inflation in India is due to the mobilization of economic resources through the development policy. Because of the positive sign, which is contrary to the theoretical expected sign of coefficient of  $Z$  (import to income ratio) in inflation equation in India, it is concluded that the outward looking trade policy of India is one of the important factors contributing to inflation. Increase in import may increase the external component of capital; however, it may simultaneously increase domestic inflation, instead of decreasing it, and hence discourage domestic capital formation. The foreign sector is considerably more important in explaining inflation in the Philippines in comparison to India. Therefore, Akhtar's findings strongly suggest the

existence of powerful structural influences on inflation in a developing economy.

Argy (1970) appraises the contribution of structural elements in inflation in developing countries. Averaging the data ranging from 1958 to 1965 for each variable of the study, he made a cross-country analysis of 22 sample countries viz, Argentina, Bolivia, Brazil, Ceylon, Chile, China, Colombia, Ecuador, Guatemala, Honduras, Iraq, Korea, Mexico, Nicaragua, Paraguay, Pakistan, Peru, Philippines, Thailand, Turkey, Uruguay and Venezuela. He selected both the structural and monetary variables in the regression analysis. Argy tested four structural hypotheses: the demand-shift hypothesis, the export instability hypothesis, the agricultural bottleneck hypothesis, and the foreign exchange scarcity hypothesis. The rate of inflation is hypothesized as positively related in each case.

The selected independent variables as a determinant of rate of inflation ( $P$ ) are as follows:  $P = f(A, F, Y, S, I, V_1, V_2, M, D, P_c)$ . Where,  $A$  is excess demand for agricultural output (1958-66) average annual;  $F$  is annual average percentage change in food prices less annual average percentage change in cost of living;  $Y$  is average annual rate of growth of real Gross Domestic Product,  $S$  is index of demand shift;  $I$  is ratio of imports to Gross Domestic Product 1959-65 divided by ratio of imports to Gross Domestic Product 1954-8);  $V_1$  is variance of percentage change in export receipts;  $V_2$  is variance of percentage change in export receipts;  $M$  is average annual percentage change in the money supply;  $D$  is the deficit rate (unadjusted);  $P_c$  is computed rate of inflation (deficit adjusted).

The variables are used in various combinations; sometimes the structuralist variables are used alone and sometimes jointly with the monetary variables. The following is one of the best selected regression results with inflation as a function of structural elements only:  $P = 10.46 + 4.11F - 0.07V_2 + 2.26T + 0.06S$ .

$R^2 = 0.52$ . Where, F is index of agriculture bottlenecks, V2 is index of export instability, T is index of foreign exchange scarcity, and S is index of demand shift.

Argy found structuralist variables not that much poor in explaining the variance of inflation. A high coefficient of the index of agricultural bottlenecks (F), suggests the tendency of food prices rising faster relative to the cost of living, and hence higher rates of inflation. The index of export variability ( $V_2$ ) also explains the rate of inflation better with theoretical expected sign. Neither of the two indices of foreign exchange scarcity (I,T) performs according to the hypothesis with positive signs. This suggests that the countries experiencing high rate of inflation improves terms of trade while countries with lower import ratios tend to have lower rate of inflation. S is also having expected sign.

In every case, the addition of a monetary variable to structuralist variables is found to improve the result substantially.

$$P = 5.3 + 4.6F + 0.02V_2, \quad R^2=0.17 \quad \dots (1)$$

$$P = 1.23 + 1.35F - 0.02V_2 + 1.09M - 1.01Y \quad R^2=0.93 \quad \dots (2)$$

The  $R^2$  of second specification is found to have substantially increased from 0.17 to 0.93 after including monetary variables in the first structural equation as shown below:

Moser (1995) empirically analyzes the dominant factors influencing inflation in Nigeria, using annual data ranging from 1960 to 1993. He tests the variables to be cointegrated to examine the long-run relationship between the variables applying Dickey-Fuller and Augmented Dickey-Fuller (ADF) test statistics. Subsequently, he examined the short-run relationship between the variables, applying Error Correction Model (ECM). The regression result of cointegrated variables in order 1,  $I(1)$  is as follows:

$$P_t = -3.03 + 0.69M_t - 0.56y_t + 0.25e_t + 0.19Z_t + u_t \quad R^2=99, \text{CRDW}=1.24.$$

Where,  $M_t$  is growth rate of broad money,  $y_t$  is real GDP,  $e_t$  is naira/U.S.dollar exchange rate,  $Z_t$  is index of rainfall. The model performed well in terms of explaining the price level as a function of money, income, and the exchange rate. All the coefficients are found to have expected theoretical signs with the exception of rainfall. One per cent increase in the rate of growth of money supply affects about 0.70 per cent increasing in rate of inflation in the long run, *ceteris paribus*. The ECM of inflation, which gives the short-run relationship between the variables, is as follows.

$$\Delta P_t = 0.02 + 0.36\Delta M_t - 0.23\Delta y_t + 0.20\Delta e_{t-1} - 0.23\Delta Z_{t-2} + 0.33\Delta P_{t-1} - 0.51\Delta C_{t-1}$$

$$R^2=69 \text{ and } DW=2.34$$

The result shows that, in the short-run, increase in 1 percent money supply has an effect of 0.36 percent increase in inflation. The result confirms the basic findings of earlier studies that monetary expansion, driven mainly by expansionary fiscal policies, explains a large degree of the inflationary process in Nigeria. Other important factors contributing to inflation are devaluation of the naira and agro climatic conditions. It was also found that concurrent fiscal and monetary policies had a major influence on the impact of the depreciation of the naira and hence the rise in inflation.

Siklos (1991) made an empirical analysis of the relationship between money growth and inflation under the hyperinflation situation experienced by Hungary during the postwar period. Cagan's (1956) evidence of hyperinflationary situation was questioned because of the problem of non-stationarity in the data used by him. Siklos, using weekly data for the period from 15 July 1945 to 31 July 1946, consisting of 51 observations, confirmed Cagan's hypothesis that inflationary expectations vary positively with velocity. It implies that real balances would tend to fall continuously until the end of the period of hyperinflation. He found money supply and inflation series cointegrated. The results of the analysis are as follows:

$$\Delta p_t = 1.201 + 0.989\Delta m_t \text{ (July 1945-June 1946)}$$

$$\text{Wald (2) = 88.29}$$

$$\Delta p_t = 0.380 + 1.684\Delta m_t \text{ (July 1945-December 1945)} \quad \text{Wald (2) = 285.27}$$

$$\Delta p_t = 1.201 + 0.989\Delta m_t \text{ (January 1946-June 1946)} \quad \text{Wald (2) = 173.55}$$

His study could not reject an equi-proportionate relationship between money growth and inflation, at least for the hyperinflation sample. Inflation is found to accelerate more quickly than money growth in 1945 (second equation) while both series move in an equi-proportionate manner in the 1946 sample (third equation). It supports the view that real balances decreased at a faster rate during 1945 than during 1946 because of the large fall in the desire to hold money by the public during the period of faster rate of growth of inflation.

Sarma (2003) empirically analyzed the relationship between price, output and money supply for India using data from FY 1971/72 to FY 1989/90. He estimated the following two variants of the price equation using partial adjustment mechanism:

$$\log P_t = 3.86357 + 0.51929 \log M3_t - 1.03330 \log GDP R_t + 0.47248 \log P_{t-1}$$

$$\bar{R}^2 = 0.98 \quad DW = 1.66$$

$$\log P_t = 2.64967 + 0.41489 \log M3_t - .72031 \log GDP R_t + 0.02985 \log DM Y + 0.52643 \log P_{t-1}$$

$$\bar{R}^2 = 0.98 \quad DW = 2.07$$

The price behavior is well explained by money supply (M3) and real GDP (GDP R). The explanatory power of both the equations is quite satisfactory showing a good fit. The regression coefficients are found to be statistically significant with theoretically expected signs. He found that the lagged effects of a change in M3 on prices are significant for about three years following the change and peter out progressively in subsequent years.

Rami and Deva (2004) made an econometric investigation of the determinants of inflation in India using annual data for the period 1950 to 2000. The variables specified in the linear multiple regression equation are as follows:



$$P = a_0 + a_1m + a_2m_{t-1} + a_3Y_t + a_4Y^* + a_5p' + a_6pm + a_7b$$

Where,  $P_t$  is rate of growth of consumer price,  $m_t$  is rate of growth of money supply,  $Y_t$  is rate of growth of real income,  $Y^*_t$  is a proxy for percentage increase =  $(Y_{t-1} - Y_{t-2})/2$ ,  $p'_t$  is expected rate of price change i.e.  $P_{t-1} - P_{t-2}$ ,  $pm_t$  is price of imports,  $b_t$  is budget deficit/GNP ratio. They found that money supply has no instantaneous effects on inflation. The explanatory power of the monetarist equation was found to be increasing when  $Y_t$  and  $Y_{t-1}$  are included in the equation. A trade-off between the predictive power of the inflation model and the problem of autocorrelation was found in their study. However, this trade-off is not found when the percentage change data are used in the regression equation.

Jha and Mohanty (1995) modeled inflation for India covering data from the second quarter of 1981 to the first quarter 1994. They presented results on cointegrating vectors for wholesale price index (WPI), wholesale price index for food (WPIF), and wholesale price index for manufactured goods (WPIM). They selected a better model for forecasting WPI, WPIF, and WPIM.

$$WPI = 0.011891M1 - 1.1069CMR - 5.3165IPI - 6.5186RERX$$

$$WPIF = 0.011256M1 - 3.8765CMR - 3.5041IPI - 4.7059RERX$$

$$WPIM = 0.0047457M1 + 4.8032CMR - 0.73068IPI - 1.4836RERX$$

Where,  $M1$  is narrow money supply,  $IPI$  is industrial production index,  $RERX$  is real effective exchange rate,  $CMR$  is call money rate. A rise in  $M1$  increases all three price levels implying narrow money has a powerful effect, thus underlying the importance of monetary control for reducing inflation. Broad money, however, did not give very satisfactory results. A rise in  $IPI$  depresses price level. An increase in  $CMR$  depresses  $WPI$  and  $WPIF$ . A rise in the interest rate reduces price levels by reducing demand. However, given administered prices; an increase in the interest rate increases costs and eventually increases the  $WPIM$ . The results point to the presence of

administered pricing in the manufacturing sector of India. An increase in RERX amounts to an appreciation of the rupee which depresses prices.

Cagan (1956) empirically analyzed the behaviour of money and prices for six developed countries (Austria, Germany, Greece, Hungary, Poland and Russia) following the Second World War. He found that the ratio of the quantity of money to the price level (real cash balances) tends to fall during hyperinflation as a whole but fluctuate drastically from month to month. These fluctuations are caused by changes in the variables that determines the demand for real cash balances. One major variable that determine this demand is the cost of holding money, proxied by the rate of inflation, which, during hyperinflation fluctuates drastically. The cost of holding money will be highly elastic when the expected rate of inflation increases. However, due to lag in expectation, expected rates of inflation do not keep pace with the rapidly rising inflation initially. The weighting pattern for the lag becomes much steeper in the later months, indicating that the lag in the expected inflation behind the actual rates tends to shorten in response to continual inflation. Therefore, the effect of lagged inflation is incorporated to approximate the effect of expectations. Therefore, the expected rate of inflation (proxied by lagged inflation) is one of the major determinants of current inflation.

Khan (1980) found the stock of real money balances rising initially, or equivalently the income velocity of money falling so that there is an increase in output, associated with an increase in the nominal supply of money. This phenomenon results from the presence of lags between the change in money and the effects on inflation (nominal income). Tests of the model, based on a sample of 11 developing countries, provided empirical support for the basic hypothesis. Generally, it was found that only about one half of the change in money was reflected in an increase in prices in the initial quarter and that it would take about five quarters before the stock of real money balances return to a constant value.

### (C) Nepalese Cases

The Nepal Rastra Bank's (2001), Research Department empirically examined money-price relation in Nepal using quarterly data ranging from 1975 to 1999. The result of the distributed lag of the monetarist model is as follows:

$$d \log(CPIN) = 0.008 - 0.204d \log(M_t) + 0.106d \log(M_{t(-1)}) + 0.345d \log(M_{t(-2)}) + \\ 0.159d \log(M_{t(-3)}) \quad R^2=0.51 \quad DW=1.92$$

In order to capture the influence of Indian prices on Nepal inflation (Indian Wholesale Price Index-IWPI), it extended a model including IWPI, and found following coefficient of the variables:

$$d \log(CPIN) = -0.462 - 0.011 \log(M_t) + 0.153 \log(M_{t(-1)}) + 0.304 \log(M_{t(-2)}) + \\ 0.171 \log(IWPI_t) \quad R^2=0.99 \quad DW=0.56$$

The Bank study found that money supply has an impact on inflation only after a six months time lag and that impact of the lag lasts up to the third quarter. M1 monetary aggregate has a relatively stronger relationship than M2 monetary aggregate. There is no structural shift in money-price relationship. Neither money-price unilateral casualty is found. Though money supply and measured inflation have a positive relationship, it is not strong and robust.

Khatriwada (1994) investigated the magnitude and stability of the relationship between money supply and inflation using annual data from FY 1965/1966 to FY 1989/90. He analyzed quantity theory and structural approach to inflation in Nepal. He examined the monetary factors determining inflation individually as well as jointly with structural factors. The estimation result of the monetary model is as follows:

$$\Delta \ln P = -.016 + .531 \Delta \ln M_1 - .289 \Delta \ln Q \quad R^2=0.24$$

Where,  $\Delta \ln P$ ,  $\Delta \ln M$ ,  $\ln \Delta Q$  are growth rate of inflation, money and output respectively. A more predictable relationship is found between inflation and narrow money supply than other definitions of the monetary aggregates. In

order to analyze the long-run relationship between the money supply and inflation, he transformed the variables into three years moving average, and price elasticity of M1 is found to have increased from 0.53 to 0.64 percent with  $R^2$  of 0.47. The maximum length of the time lag that money continues to have positive impact on prices is two years.

Including Indian Wholesale Price Index (WPI) and exchange rate of the domestic currency vis-à-vis Indian currency improved the explanatory power of the equation. The best open economy model of the behaviour of prices for the long-run analysis is found as:

$$\Delta \ln P_s = -.014 + .309\Delta \ln M_s - .615\Delta \ln Q_s + .559\Delta \ln IPI_s \quad R^2=0.79 \quad DW=1.21$$

The equation has given the highest explanatory power along with significant and consistent coefficients. This shows that 1 per cent excess of money growth rate over real output growth rate leads to around 0.31 per cent increase in the rate of inflation. Similarly, a 1 percent increase in import price is found to exert about 0.55 per cent increase in the rate of inflation. His analysis provided an improvement in explanatory power of the monetary model by the introduction of structural variables.

Pandey's econometric inflation model of Nepal (2005) is based on the period of analysis from FY1973/74 to FY2003/04. M1, IWPI and exchange rate (NRs/IRs) are found to be important determinates of inflation in Nepal. Besides these quantitative factors, several other qualitative factors affecting inflation were: administered prices, supply bottleneck due to market imperfection, underdeveloped transportation and communication network and artificial shortage of commodities. It examined the relationship between short as well as long run relationships between inflation and its determinants using ECM.

Chowdhary and Dowling (1982) of Asian Development Bank analyzed inflation and different aspects of the macroeconomic variables of Nepal covering the data from 1964 to 1979. They established a relationship between

money supply and price level. The estimated regression equation of Consumer Price Index (CPI) on M1 monetary aggregate is as:  $CPI_t = 34.7 + 0.491M_t$  ;  $R^2=0.94$ . It is found that, in the long-run, monetary model gives the best fit with  $R^2$  close to unity.

The Institute for Sustainable Development, Nepal empirically analyzed the relationship between inflation and its determinants under the monetarist and structuralist framework for Nepal using data from FY 1975/76 to FY 1992/93. The Institute found that the growth of money supply in excess of real output growth exert a significant positive impact on the rate of inflation. Because of the poor explanatory power of the estimated equation, it included Indian wholesale price as an additional variable with growth of money supply and output. Including three variables, almost 55 percent of the variation in the rate of inflation is explained. The elasticity coefficients for money supply and Indian inflation are found to be 0.54 percent and 0.8 percent respectively.

Sharma (1992), investigated the causative factors of inflation in Nepal, in terms of both internal and external origin, using data from 1964 to 1990. He found following estimated result:

$$P_t = -0.0181 + 0.087m_t + 0.495m_{t-1} - 0.214Y_t + 0.322pind_t, R^2= 0.61 \quad DW=1.93$$

Where,  $P_t, m_t, y_t, pind_t$  are inflation rate, growth rates of money, output and Indian price respectively. He found that the money supply, including the lagged level, income and world prices affecting inflation. The justification of inclusion of Indian prices as an explanatory variable and thereby its role in causing inflation in Nepal is accepted in his study. The coefficient of income was found insignificant in the model, which may probably be due to imprecise measurements of income. Money supply is a prominent cause of inflation in Nepal and prices take time to respond to it.

Mathema (1998) empirically analyzed wage inflation in Nepal, using data for the period between FY 1978/79 and FY 1995/96 specifying the following multiple regression model:

$$P = a_0 + a_1GDPR + a_2M + a_3W + a_4PI + a_5PE + e$$

where,  $P$ ,  $GDPR$ ,  $M$ ,  $W$ ,  $PI$ ,  $PE$  and  $e$  are annual inflation rate as measured by CPI, real output growth, change in money supply, change in money wages, change in imported price, change in price expectation and error term respectively. He found that the wage for a carpenter in Kathmandu (capital city) and the wage of agricultural labour in Terai exert pressure on the movement of the prices. Industrial labour wage is fixed and determined by the government, so that it has no competitive power to affect prices in general.

Pant (1988) analyzed and identified the sources of inflation in Nepal in his work on the theory and evidence of the sources of inflation in Asia. Using data from 1951 to 1971, he found the following result:

$$\Delta P = -5.33 + 0.88(\Delta M^s) + 0.81(\Delta Y) + 0.16(\Delta P_2^f) + 0.08(\Delta P_3^f) + 0.18(\Delta^2 P^2)$$

$$R^2=0.99 \quad DW=1.99$$

Where,  $\Delta$  refers changes,  $P$  is inflation rate,  $M^s$  is money supply,  $Y$  is real income,  $P_2^f$  is domestic product of export goods,  $P_3^f$  is domestic price of import goods. He found real income and import price having the unexpected sign. Most of the coefficients are not found to be statistically significant. Under the peculiar relation of Nepal's economy with India, having its open border and not maintaining any exchange or trade restrictions, the monetary theory of world inflation can be applied in Nepal. Therefore, changes in world price will affect Nepalese price with a coefficient equal to unity which can be written as:

$$\Delta P = -1.59 + 0.93(\Delta WPI)$$

$$R^2=0.99$$

$$DW=1.82$$

He further included the change in exchange rate of Nepalese rupee vis-à-vis Indian rupee and the public expectation with respect to price movement as two explanatory variables in the above equation. This was done to see the

expectation playing a dominant role in determining the domestic rate of inflation. He found all the coefficients having the expected sign with reduced coefficient of WPI.

#### **4. SUMMARY OF LITERATURE REVIEW**

##### **(A) Classical and Monetarist Model: Monetary Factors**

Changes in money supply affect aggregate demand. Monetary policy exerts influence on the economy through demand management. The quantity theory of money held that velocity is fixed in the short-run because of the constant payment habits and payment technology (institutional factors) in an economy so that general price level would be directly proportional to the nominal money supply (Fisher, 1922, Froyen, 2003). The adjustment of money supply to price level is assumed to be instantaneous (McCulloch, 1982). It implies that people never hold money because of the increase in opportunity cost of holding money balances. The central bank supplying more money in the face of inflation fuels higher inflation. Money supply, according to classical theorists, is strictly exogenous. Inflation is, therefore, essentially caused by the expansion of money supply which is determined by the monetary policy. The causation runs from money supply to inflation but not the other way round. The central bank only can regulate inflation. Therefore, money supply is the sole cause of inflation.

The monetarist explanation of inflation is derived from the quantity theory of money, with some modification in terms of short-run and long-run inflation. For them, the cause of inflation is not the money supply problem but the demand problem. If demand for money exceeds money supply, inflation takes place. The determinants of demand for money in the long run are held constant. Therefore, in the long run, the effect of money supply on inflation is similar to the classical quantity theory of money. However, in the short run, a change in

money supply affects price directly but not proportionately. The effect of changes in money supply is divided between inflation and real income. The rate of inflation, therefore, is equal to the rate of growth of the money supply minus the growth in real income which is due to the rate of growth of the demand for money balances (Levacic and Rebmann, 1976). If the rate of growth of money supply is higher than the demand for the purpose of transaction, then inflation takes place. Their proposition on the determination of rate of inflation is summarized by the popular statement "Inflation is always and everywhere a monetary phenomenon" (Friedman, 1968). The transmission channel of money supply to real variable is direct from money supply to expenditure. Money is neutral in the long-run but not in the short-run.

#### **(B) Keynesian Model: Demand Factors**

Autonomous budget deficits financed by the creation of money are inflationary. To the extent of monetizing the government deficits, fiscal actions are inflationary. Therefore, inflation is the increasing function of budget deficit. Inflation results in a widening of fiscal deficits financed through the banking system (in particular, by the central bank), leading to further increases in the money supply and further increases in prices (Olivera, 1967, Dutton 1971, and Aghevli and Khan 1978). Since government spending is a major component of aggregate demand of an economy, a rise in such spending leads to inflation under full employment situation. In this context, the Keynesian argument on the sources of inflation is relevant. It attributed to the combined total of government, private and foreign sector demand exceeding the full employment supply of output, whereas the monetarist argument is based on excess of money supply. Further, monetization of fiscal deficits is not free from the crowding out effect through a rise in the market rate of interest. Therefore, a rise in fiscal deficit, on one hand, results into inflation as depicted above, and a rise in the market rate of interest on the other hand. External source of financing is exogenous because it is related to foreign policy and the credit worthiness of



the government. Financing deficit from general public is not inflationary. Fiscal expansion accompanied by monetary expansion could cause hyperinflation whereas such expansion not accompanied by monetary expansion would cause only modest inflation (Dornbusch, 1992).

There is a positive relationship between inflation and opportunity cost variables. The rate of interest and the expected rate of inflation are the two major opportunity cost variables. If the rate of interest increases, the velocity of circulation also goes up (decline in demand for money balances) due to higher opportunity cost of holding money. It results into higher rate of inflation. In most developing countries, a broad range of financial assets does not exist as an alternative to money: thus the substitution between money and physical assets becomes more important. Thus, for money holders in developing countries, the relevant opportunity cost is the rate of return on physical assets or goods. The expected rate of inflation is important in such an economy. The rate of return on financial assets can be ignored (Agheveli and Khan, 1978).

The expected rate of inflation is another important opportunity cost variable to explain inflation. The rate of inflation is functionally related to the expected rate of inflation. It is due to the fact that when economic agents expect the rate of inflation to increase in future, the current demand for goods and services also increases causing price to increase. Therefore, future expectation of inflation is an important determinant of current rate of inflation. Expected inflation measures the opportunity cost of holding money. Monetarists followed the adaptive expectation technique for the formation of expectation of future inflation that emphasizes the learning behavior of the agents. According to this technique, the forecast (expected) inflation of the next period is derived by exponentially weighting the averages of past rates of inflation, weights declining as one goes back to the distant past. However, the natural rate hypothesis imposes the restriction that the sum of the coefficients of all lagged inflation variables is equal to unity (Frisch, 1983).

### **(C) Structural Model: Structural Factors**

Inflation particularly in developing economies is determined not only by monetary variables as mentioned above, but also by structuralist variables. During the growth process developing countries face various rigidities and inelasticities that are originated from real side which are to be validated by the central banks. It helps to achieve potential economic growth and avoids losses in output if any. Such rigidities and inelasticities consist of factor immobility and downward rigidity of factor prices, supply inelasticities in agriculture and inelasticity of demand for traditional exports. In such a case, the monetary variable is assumed to be endogenous and passive. However, structuralists do not completely negate monetarist claims. They argue that some change in money supply accommodates structural changes. Therefore, structuralist variables are taken as additional explanatory variables to check the improvement in explanatory power of inflation equation.

The inclusion of budget deficit variable in monetary equation of inflation also reflects the structuralist idea that some part of the deficit may be induced by inflation. If deficit rates are positively correlated with inflation rates, the causal relation may run partly from inflation to deficits rather than wholly from deficits to inflation. In such a situation, rates of change in the money supply would also be a major factor in explaining different rates of inflation and this will be used as an alternative variable to the budget deficits. In this situation, money supply is considered endogenous. The influence of inflation on the budget deficit is a crucial element in the inflation process. The real budget deficit is not exogenous because inflation affects the real level of revenues. Inflation worsens the deficits because real value of revenue decreases due to collection lag. Deficit would be smaller if inflation could be reduced. Higher inflation leads to larger deficits and greater money creation. The adverse

response of deficits to inflation is now known as the Tanzi effect (Dutton 1971, and Tanzi 1977, 1978).

There is an inverse relationship between the degree of openness and inflation (Akhtar, 1975). Domestic inflationary pressure is spilled over into the balance of payments in an open economy through substitution of imports for domestically produced goods, thereby, resulting in less inflation at home. Therefore, total import is one of the important variables that measure the openness of the economy. The domestic rate of inflation is determined by the world rate of inflation (Blejer, 1977). There are two channels from which the world inflation is transmitted to domestic inflation. (Levacic and Rebmann, 1982): the first is goods arbitrage channel- a country's demand for tradables switches to domestically produced goods when their price falls relative to the world price. The increased demand bids up the price of domestically produced goods. The second is portfolio adjustment channel- while the domestic prices are below world price, the domestic country runs a balance-of-payments surplus. The stock of foreign exchange reserves rises and so does the domestic money supply. The consequent portfolio adjustment by domestic residents creates additional demand for domestically produced goods and, hence rises in price level.

The smallness of the economy relative to that of the trading partner leads to an expectation of unidirectional causation of business activity (Bohara and McNown, 1989). The small country, being a price taker, a rise in prices in the trading partner leads to an increase in the import price not only of consumer goods but also of industrial raw materials and capital goods of the smaller country resulting to cost-push inflation. Further, higher prices in the trading partner motivate the flow of goods to the trading partner creating acute shortage in small country leading to rise in price in the small country.

The supply inelasticities in agriculture, the increase in demand for food resulting from development in other sectors, as well as from population growth will tend to push up the relative price of food (Argy, 1970). Again, downward price rigidities in the economy will tend to translate such relative price changes into absolute price increases at given levels of employment and output in the modern developing sectors. This hypothesis can be tested by computing an index of aggregate demand for agricultural production. It is derived by subtracting average annual rate of change of food prices (food index) from the average annual rate of change in the cost of living (overall index). Similarly, inflation is positively correlated with the percentage change in the relative price of food, with the latter defined as the price of the food component of the consumer price index (CPI) divided by the total CPI (Wachter, 1976). Further, a decrease in agricultural to non-agricultural GDP ratio has a positive impact on inflation.

Due to inelasticity of demand for exports of the typical developing country, foreign exchange earnings from such exports cannot rise fast enough either to finance the growing requirements for food imports or to satisfy the demand for imports of intermediate goods by producers of export-oriented and purely domestic goods. Consequently, import substitution is required, and, in light of the low degree of comparative advantage of the country in some of these import substitutes, the cost of production will be quite high, thus creating inflationary pressures. The domestic import substitution process entails demand shifts which accentuate the inflationary situation. The argument is also that other things being equal, fluctuations in export receipts will tend to create a long-term upward movement in the price level. This argument is taken to imply that the rate of inflation is a positive function of the degree of export variability. This hypothesis is then tested by computing an index of export variability and using it as one of the explanatory variables. The direct government control for import through devaluation of a particular currency exerts pressure on domestic inflation. This hypothesis can be tested by

computing real devaluation of domestic currency in terms of representative currency such as the US dollar.

If we sum up the different theoretical approaches to inflation, as explained above, some important guidelines are available to understand the different sources of inflation and tools of analysis of inflation in open and closed economy. Classical and neo-classical economists talk about money supply being a leading explanatory variable for explaining inflation in a closed economy. Keynesians argue that in the short-run, factors of aggregate demand have impact on both inflation and output. It gives guidelines to incorporate money supply as well as GDP variables in inflation equation and examine the validity thereof. Monetarists suggest inflation expectation as an additional explanatory variable in inflation equation. Adaptive expectationists argue about the dynamic formulation of inflation equation, introducing lagged dependent and independent variables in inflation equation. The structuralist model gives some additional sources of inflation for developing countries like ours where money supply is not completely exogenous urging us to incorporate additional structural variables in the monetarist inflation model. Inflation determination in an open economy suggests incorporating international inflation as additional variables to understand international influence on domestic inflation. The rational expectationist model gives ideas for inflation forecasting and their policy implication.

#### **(D) Summary of Empirical Findings**

In summing up the empirical findings of the inflation model of developed countries, Nelson (2003) examined the relationship between money supply and CPI inflation for the United States and the United Kingdom and found decisive evidence in favour of 'inflation is always and everywhere a monetary phenomenon'(AEMP). Abizadeh and Yousefi (1989) analyzed inflationary effects of deficits in US economy and found that government deficit is not

contributing significantly to rise in inflation. Spittaller (1978) empirically analyzed the determinants of inflation in the case of seven major industrial countries and found the changes in money supply, demand pressure and import prices affecting the rate of inflation in most of the sample countries.

Further, Blejer (1977) analyzed the short-run behavior of prices and the balance of payments of Mexico, and found that the disequilibrium in the money market, in the short-run, affects balance of payments as well as the internal level of prices through the relative prices of non-traded to traded goods. Lucas (1973) empirically analyzed the real output-inflation tradeoff of eighteen developed countries, and found that the policies that increase nominal income tend to have a large initial effect on real output with a small positive initial effect on the rate of inflation in a stable price country like the United States. In contrast, in a volatile price country like Argentina, nominal income changes are associated with equal, contemporaneous price movements with no marked effect on real output. Gerlach and Svensson (2003), after examining the relationship between inflation, output, money and interest rates in the euro area, using data from 1980 to 2001, found that the gradual decline in inflation can be interpreted as corresponding to a fall in the average (implicit) inflation objective,  $\hat{\pi}_t$ , of the central banks in the euro area where implicit inflation objective influences inflation by affecting inflation expectations.

To sum up the findings about the sources of inflation of the developing countries of Asia, Bhattacharya and Lodh's (1990) survey found inflation to be neither a purely monetarist phenomenon nor a purely structuralist phenomenon in India. They could not find a stable relationship between inflation and output or between inflation and money supply. Pant (1988) analyzed the theory and evidence of sources of inflation in Asian countries like China, India, Philippines and Thailand. He found money supply to be an important source of inflation in India while imported inflation for the Philippines. Panchamukhi and Rao (1992) made a quantitative analysis of different aspects of inflationary

behavior in eighteen Asian countries and concluded that the countries for which domestic factors (both monetary and real) contributing to inflation are not significant, are found to have external factors influencing the behaviour of inflation. Herberger (1963) made a comparative analysis of the validity of monetary and structural explanation of inflation in Chile. He found an equi-proportionate relation between monetary growth and inflation in the long-run. Aghevli and Khan (1978) examined the relationship between the changes in money supply (motivated by financing the deficit of the government) and inflation in four developing countries, and concluded that, in the long run, both government expenditure and revenue would move proportionately with inflation.

Akhtar (1975) empirically examined the inflation problem for India and the Philippines and found that for one period lag money supply is the most powerful monetary variable to explain inflation rather than current money supply in both the countries. Further, his findings strongly suggest the existence of powerful structural influences on inflation in a developing economy. Victor Argy (1970) appraises the contribution of structural elements on inflation in developing countries and found that the introduction of monetary variable to structuralist equation improved the result substantially. It implied that inflation in developing countries is a monetary-cum structural phenomenon. Moser (1995) empirically analyzed the dominant factors influencing inflation in Nigeria and confirmed earlier findings that monetary expansion, driven mainly by expansionary fiscal policies, as well as devaluation of the naira and agro climatic conditions are major factors contributing to inflation in Nigeria. Siklos (1991) made an empirical analysis of the relation between money growth and inflation under the hyperinflation situation experienced by Hungary during the postwar period and found that, in the long-run, there is an equi-proportional relationship between them. Sarma (2003) empirically analyzed the relationship between price, output and money supply in India and found that the lagged effects of a change in M3 on prices

are significant over three years. Rami and Deva (2004) made an econometric investigation of the determinants of inflation in India and found that money supply has no instantaneous effect on inflation. The explanatory power of the monetarist equation increases when real output variable is included in the equation. They found a trade-off between the predictive power and the problem of autocorrelation. However, this trade-off is not found while the percentage change data are used in the regression equation.

In summing up the sources of inflation in Nepal, the Nepal Rastra Bank (2001) empirically examined money-price relation in Nepal, and found that money supply generates impact on prices only after a six months time lag and that impact lasts up to the third quarter. M1 has relatively stronger relationship than M2. Though money and price have a positive relationship, it is not found to be strong and robust. Khatiwada (1994) investigated the magnitude and stability of the relationship between money supply and inflation and concluded that an introduction of structural variables into monetary model contributed to the explanatory power of the model. Pandey (2005) found variables like M1, IWPI and exchange rate (NRs/IRs) as important determinants of inflation in Nepal. He further emphasized several qualitative factors along with quantitative variables of the model.

Moreover, the Institute for Sustainable Development empirically analyzed the relationship between inflation and its determinants under the monetarist and the structuralist framework in Nepal. It found that the growth of money supply in excess of real output growth influences inflation. Chowdhary and Dowling (1982) found that the impact of money supply is felt on the changes in inflation in the long-run. Sharma (1992) investigated the causative factors of inflation in Nepal in terms of both their internal and external origin. He found money supply, including its lagged level, income and world prices affecting inflation. Money supply is found to be a prominent cause of inflation in Nepal where prices take time to respond to money supply. Mathema (1998) empirically



analyzed wage inflation. He found the wage for the carpenter and agricultural labour exerting pressure on the movement of prices in Nepal.

## **5. APPROACH TO THIS STUDY**

This study examines the factors and determinants of inflation with clear demarcation in terms of the approaches Classical, Keynesian, Monetarist and Structural models to explain the trend of inflation in Nepal. The factors and determinants of inflation in the context of a developed economy, where the prices and quantity variables are determined by demand and supply forces in the market, may not be applicable in the context of a developing country like ours because of the economies characterized by lack of competition, fragmented market, structural bottlenecks, etc. However, the literature review in this study about developed countries gives some guidelines for understanding the possible factors and determinants of inflation and for a systematic analysis to find the relationship between inflation and its determinations. Most studies based on Asian and other developing countries have, in one way or another, failed to provide a comprehensive analysis of inflation and its determinants. These findings relate to past periods that need to be updated and their different testing criterion lacks robustness and stability.

This study is supposed to identify the best forecasting model of inflation in the context of the central bank seeking to achieve certain targets of inflation. The central bank needs to forecast inflation and adjust its policy in response to forecasted deviations of inflation from the target. If inflation forecast happens to rise above the target level in future, policymakers might need to take action immediately to tighten the current stance of monetary policy, so that, it helps to reduce inflation to the target level.

This study is different from those mentioned above, particularly of Nepalese inflation in various forms. It is different from Khatiwada's study in two

respects. First, the coefficients of the variables under this study are thought to be more updated in the changing context of the Nepalese economy with liberalization policies adopted by the government. The estimated parameters of the inflation models are thought to be robust and stable in the present context because this study is utilizing latest available information in estimation. Second, additional econometric techniques are adopted in this study, to test the stability and robustness of the inflation model. It differs from the Nepal Rastra Bank (2001) in terms of the search for additional factors and determinants of inflation which is thought to be stronger and robust. This study is different from Pandey's (2005) in terms of clear demarcation of determinants of inflation, in terms of different theoretical models and testing the stability of the ECM. This has extended the framework covering all the inflation models for empirical validity in Nepal and brought the estimates update.