CHAPTER - IV

MONEY SUPPLY AND PRICE LEVEL IN INDIA OVER THE PERIOD 1950 - 92.

4.1 INTRODUCTION :

Indian economy has been witnessing spate of rising prices over the last few decades. As a matter of fact, price rise is not a strange phenomenon in India. Spate of price rise can be traced as far back 1950 when the first five Year Plan formally came to play. Since then Indian economy has been experiencing such price rise and inflation, has been a house hold phenomenon.

4.1.1 Graphical presentation of the phenomenon :

An idea about the nature of price variation over the period 1950 - 92 can be obtained from the Figure(4.1) which presents the time plot of price level (P_t). It is observed from the time plot that —

(i) Price level delineates an over all rising pattern since 1950 with occassional fall in some years. Almost an exponential price rise is noticed since the later part of 1970 till the end of the period of study. The time series P_t plotted in Figure 4.1 is, however, non - stationary[1]; on the other hand, the Figure 4.2 presents the time plot of stationary[2] data set for P_t. This figure shows that —

(i) a distinctive rise in price level (over the corresponding previous year price level) is visible over the period 1961 - 1966, 1968 - 74, 1977 - 80, 1982 - 84 and 1986 - 92.

ii) a small declining trend and occasional respite exist between 1952-55, 1956-60, 1967, 1975-76 and 1981-85.

(iii) price variation proceeded with occassional jumps. The fluctuations in price level became noticeable since 1970's.

---

1. Non - stationarity is identified from the coefficient in the AR(1) process of series. The coefficient exceeding 1 indicates non - stationarity in the dataset.

2. Stationarity is ensured through first order differencing of the data set.
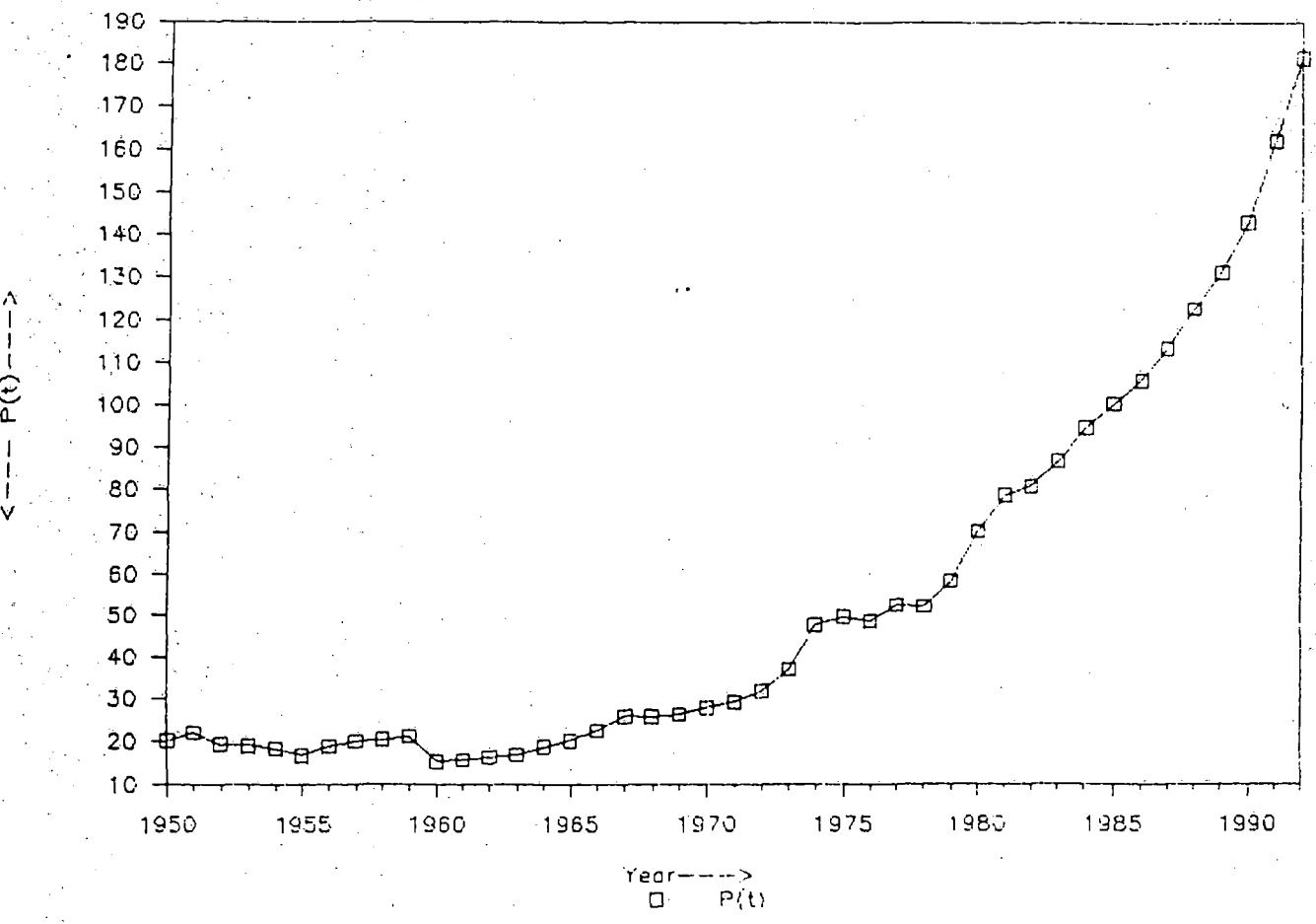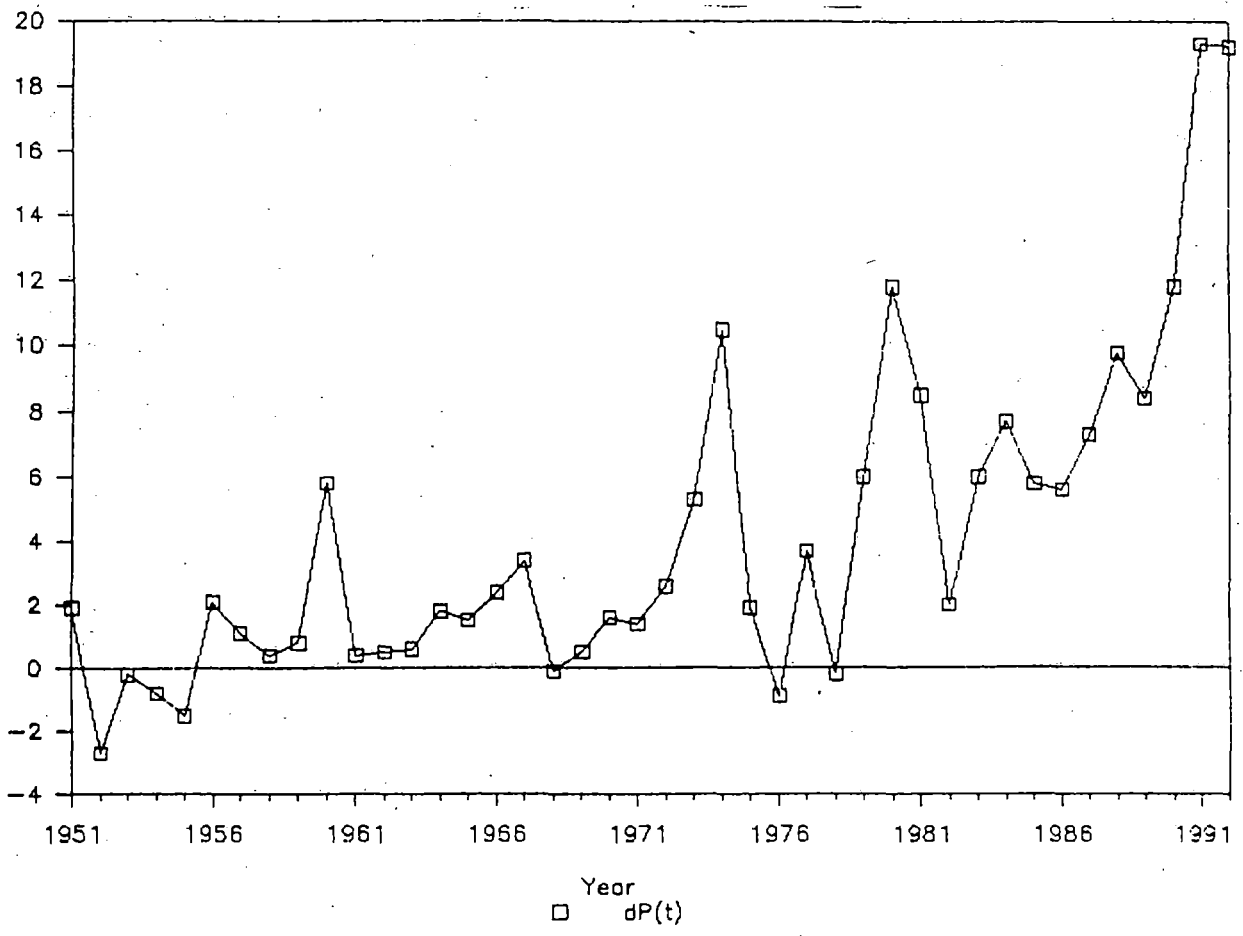
Fig. 4.1 : Time Plot of Price level, P_t

Fig. 4.2 : Time Plot of Price Level, dP$_t$

4.1.2 Economists' view behind the general price rise :

Economists have sought to identify factors behind such price variation in the period of study.Studies[3] undertaken to this effect identify several factors responsible for price rise at different occasions. Fuel price-rise arising out of rise in import price for fuel, increasing indirect taxes in successive years and bad monsoons along with subsequent crops failure etc. have been considered to be the supporting factors behind such price rise in India.

However, it is largely believed that unwarranted rise in money stock has primarily manifested itself into price rise. Other factors have just accentuated such price rise occasionally.

4.2 Objective of Study :

The objective of the study, in this present chapter, is to examine whether price variation in India is related any way to that in money supply[4] over the period 1950-92.This study is devoted to explore the relationship if any, between price level and money supply.We are aware of the fact that money supply may, at times, be modified by the monetary authorities taking clue from price movement.In such case,price level enters into the argument vector for money.Consequently,the analysis involves system approach.

However, in the present study, we concentrate ourselves only on variational association between price level and money supply where our concern is to see, how far the variation in money supply could explain the variation in price level over the period under study.This is in conformity with Friedman,Phelp and other monetarist researchers.Consequently,in this approach money enters into the argument vector for price only.No independent equation for money figures in the analysis.This makes money supply an exogenous variable.

----

3. According to Ashok Mitra,Prabhat Patnaik and a few other economists,Agricultural Price Policy of the govt. has been a major contributory factor to the inflationary price rise in the past.
Ashok Mitra Stabilisation and Growth : Some Preliminary Notes(Mimeo);
Probhat Patnaik, Current Inflation in India,social scientist,Jan.-Feb. 1977,pp 34-35.

4. We are aware of the fact that money supply may,at times,be modified by the monetary authorities taking signal from price movements.This present study is not concerned with such situation,but it only considers the variation in price level following variation in money supply and seek to ventilate underlying relationship over the period 1950-92.

4.3 Price level and money supply :

Graphical Examination :

Figure 4.3 presents the time plot of price level (P_t) and money supply (M_{2t}) simultaneously. It is observed from the time plot of two non. stationary series that —

(i) Price level displayed positive variation following that in money supply until 1965. During this period (1950 - 65) both the series displayed rise over time with very little difference in fluctuation.

(ii) Since 1965 both the series displayed overall rise over time. Money Supply exhibited almost exponential rise while price level displayed rise at a lower rate.

(iii) In order to gain better insight into the joint movement of these variables we consider the figure 4.4. The stationarity of this figure is attained through first differencing of the series concerned. So each point in the series represents the variation of the variable over the last period concerned.

It is observed that —

(i) Variation in both the series were largely positive over the period concerned.

(ii) the differences in the rate of variations of these two series were very insignificant until 1968.

(iii) the rate of variation in money supply exceeded that in price level since 1969. Since 1979 money supply displayed noticeable varia tion in glaring contrast with that in price level.

These Figures, therefore, seem to represent the presence of significant association between the variations in the variables concerned. However, these figures give us a tentative idea of the association between money supply and price rise in India over the period concerned.

Any conclusive and precise analysis in this direction needs a study with quantitative cxamination of the data set for the variables concerned. The present study in this chapter is an attempt in this direction.

Fig. 4.3: Time Plot of Price Level (P_t)
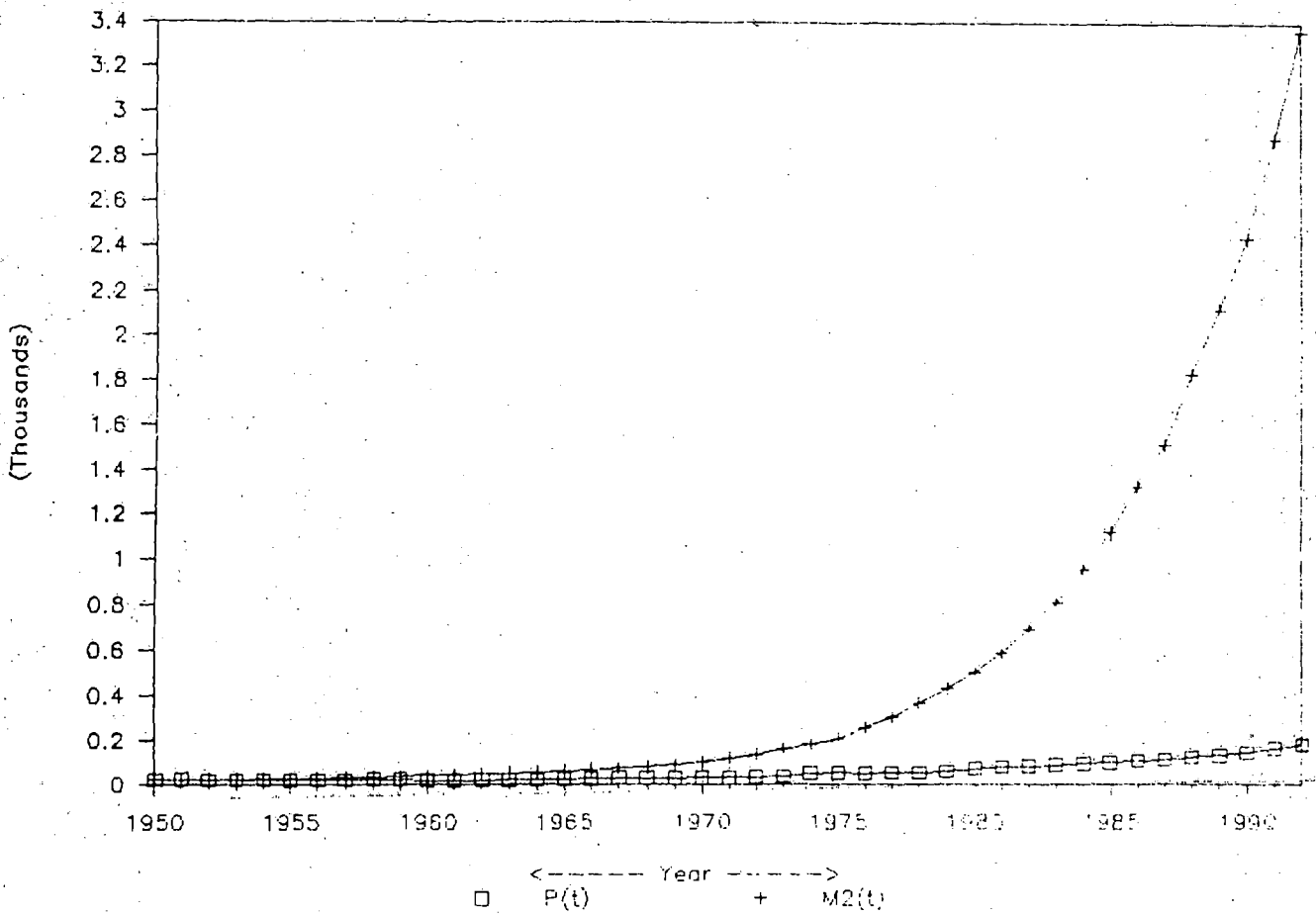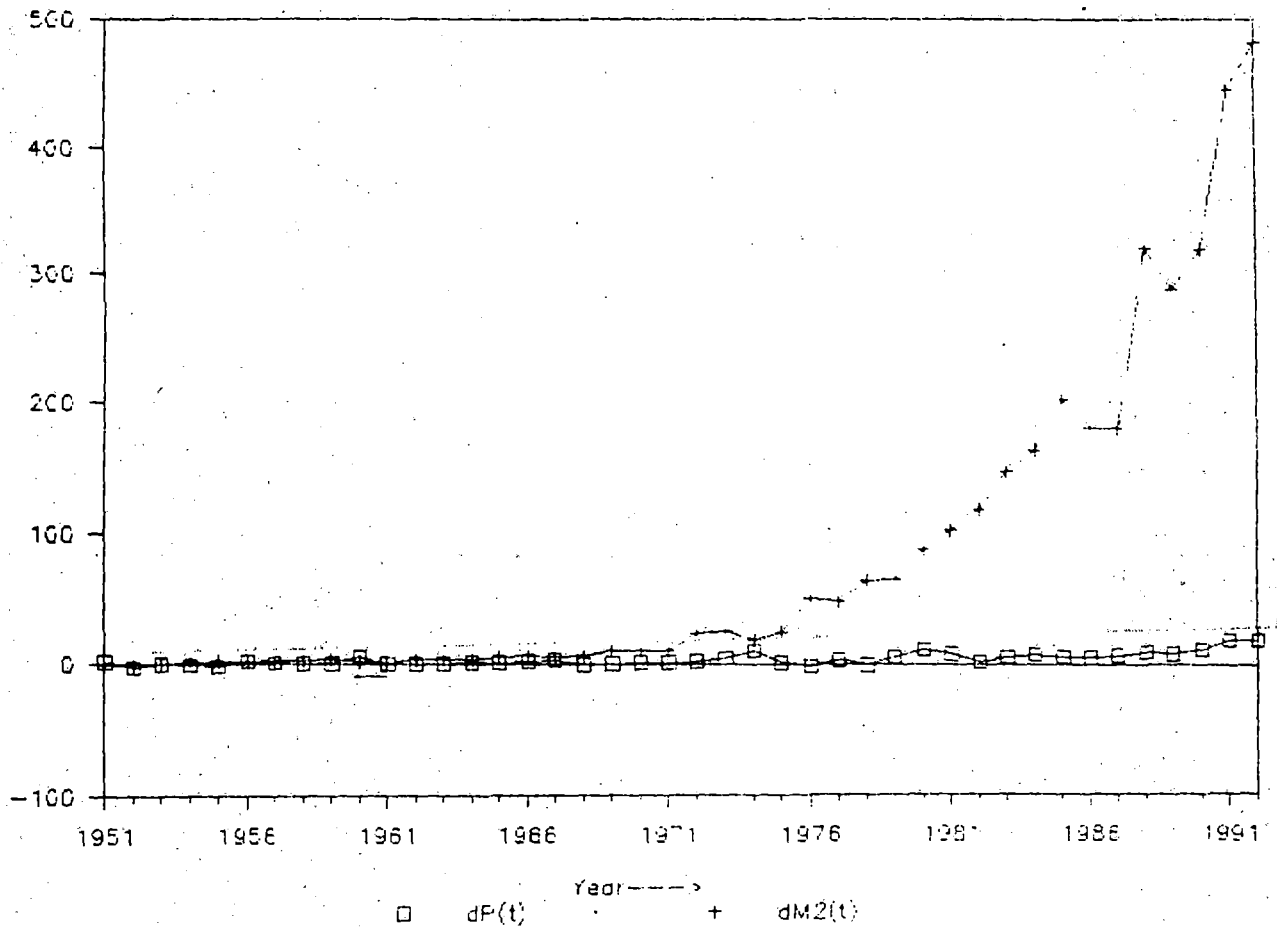and Money Supply (M_{2t})

(Thousands)

□   P(t)   +   M2(t)

<----- Year ----->

Fig. 4.4: Time Plot of Price Level (dP$_t$)
and Money Supply (dM$_{2t}$)

4.4 THE MODEL :

The quantitative analysis presupposes the existence of a theoretical model which is later subjected to estimation. In this case we, therefore . need a model where price level is expressed as a function of money supply.

Several[5] mathematical models for price (as dependent variable) have been developed and estimated by economists for different purposes. In some models, price has been expressed as a function of excess demand. In other models, price has been shown to be related to cost of production. In monetarists' model, price is found to be related to money supply. In Rational Expectationists' model, price has been expressed as function of both anticipated and unanticipated part of money supply. The Rational Expectationists' started with aggregate demand function :

$$M_t + V = P_t + Y_t \quad \dots\dots\dots 4.1$$

Where M_t = log of money supply

V = log of constant velocity of money

P_t = log of price level

and Y_t = log of real output

With the Lucas' supply function

$$Y_t = Y_p + \beta (P_t - {}_{t-1} P_t) + \varepsilon_t \quad \dots\dots\dots 4.2$$

Where Y_p = Capacity / full employment output

and money supply rule

$$M_t = \alpha M_{t-1} + \varepsilon_t \quad \dots\dots 4.3$$

Where $E (\varepsilon_t / I_{t-1}) = 0$ along wtih

$_{t-1} P_t = E (P_t / I_{t-1})$

it is derived that

$$P_t = \alpha M_{t-1} + V - Y_p + \varepsilon_t / (1 + \beta) \quad \dots\dots\dots 4.4$$

Given Y_p and V constant, P_t becomes a function of both anticipated and unanticipated (αM_{t-1}) and ε_t part of money supply respectively. More precisely, $P_t=f(M_t)$ i.e. price is a function of total money supply, M_t.

The model seems to be appropriate in our analysis where we are interested in estimating the variation in price level following variation in money supply over the period concerned. Consequently, the model for our estimation is

$$P_t = \alpha + \beta M_{2t} + u_t \quad \dots\dots 4.5$$

V. C. Shah, Unpublished Doctoral Dessertation submitted to Columbia University , New York, P - 265.

J. M. Keynes, The General Theory of Employment, Interest, and Money, Macmillan & Co. Ltd. New York, St. Martin's Press, 1957, PP - 292 - 309.

4.5 Rationality behind the choice of the Model :

System approach has been set aside by the Keynesian and Monetarists on the ground that the model becomes "Under-identified" in most of the cases. Friedman points out that the essential problem of the Keynesian and the classical approach is the problem of a "Missing Equation". The "Missing Equation" problem notifies that in those models number of equations are fewer than number of variables. There are n-1 equations for n variables. Consequently, one variable must be taken as exogenous one, otherwise, the systems remain indeterminate.

Under these circumstances, system approach would indicate "Under- identification" . However, "Rational Expectationists" proceeded with structural system, with more equations and fewer variables. Sometimes, the variables are "Instrumental Variables" without bearing any proper physical and economic explanations. Consequently, the models are "Over -identified" This problem is termed as the problem of "Observational Equivalence".

It may, however, be noted that classical structural model where number of equations being fewer than number of variables and the Neoclassical structural model (i.e Rational Expectationists) model where number of equations exceed number of variables establish "Neutrality of Money" where monetary shock falls on price level entirely.

Monetarists , therefore, stress upon single -equation approach without incorporating "Two Way Linkage" among the variables in order to look for any effect on output level of changes in money supply . This has been taken up by researchers like Dornbusch, Fischer and Johnson etc.. The model in this present study is being chosen following this practice.

4. 6 Estimation and findings :

The model 4 5 has been estimated with GLS method[6]. The estimated model is [7,8]

$$\hat{P}_t = 1.3905 + 0.034355 M_{2t} \quad \dots\dots\dots\dots\dots \qquad 4.6.1$$
$$(0.5099) \quad (0.0035023)$$
$$[2.7271] \quad [9.8094]$$

$R^2 = 0.7063668 \qquad n = 42$

$F^* = 96.244 \qquad D.W = 1.73$

$D.F = 1, 40$

---

6. The OLS estimated model is

$$\hat{P}t = 25.355 + 0.052095\ M_2 t \qquad \dots\dots\dots\dots\dots \qquad 4.62$$
$$(2.0192) \quad (0.0020457)$$
$$[12.557] \quad [25.466]$$

$R^2 = 0.94$, $F^* = 648.52$, $D.W = 0.1007$

$n = 43$, $D.F = 1,41$.

The estimated model suffers from auto correlation , so the model has been estimated with GLS method.

7. The estimated model 46 is free from auto-correlation. For the test of auto-correlation, we have

Ho : $\rho = 0$

Against $\rho \neq 0$

du at 1% level of significance with $K' = 1$ and $n_2 = 42$ is 1.36

du $= 1.36 < d^* = 1.73$

So the null hypothesis is accepted.

8. The overall significance test is conducted by F - test

where Ho : $\alpha = \beta = 0$. Against H_1 not all parameters are zero.

Here $F = \dfrac{R^2/(k-1)}{(1-R^2)(N-k)}$

Where $N = 42$, and $K = 2$

$F^* > F^{1,40}$ and $F_{0.01}^{1,40}$

So, the Ho is rejected and the equation 4.5.1 is overall significant.

4.6.1 It is observed that $\beta > 0$ and significant at 5% level. It, therefore, appears that price level, over the period concerned, was related to money supply significantly. Price level displayed upward variation following increase in money supply. Thus, price level delieates a positive association with money supply. As money supply displayed noticeable increase during the period of study, so also price level registered and upward movement over time.

Again, $R^2 = 0.71$ indicates that 71% of variation in price level is explained by that in money. This indicates that about 30% of variation in price level remains unexplained by the estimated relationship. This further seems to indicate that besides money supply, there were some other non-monetary factors which could explain this unexplained part of variation in price level.

4.6.2 The extend of the variation in price level, following variation in money supply, may better be explained by the following log linear estimation [9, 10, 11].

$$\ln P_t = 0.008021 + 0.5864 \ln M_{2t}$$

$$(0.014052) \quad (0.2462)$$

$$[0.57091] \quad [2.3821]$$

$$R^2 = 0.524 \qquad \qquad D\text{-}W = 1.87$$

$$F^* = 5.67 \qquad \qquad D F = 4 2$$

---

9. The log linear equation is presented as a supplement to the findings of the estimated model (4.6)

10. The estimated log linear equation with equal degree of freedom contains lower R^2. So, we have used the model (4.6) initially for our study.

11. The log linear equation

$$\ln P_t = \alpha_1 + \beta_1 \ln M_{2t} + V_t$$

and the estimated equation is

$$\ln P_t = \alpha_1 + \beta_1 \ln M_{2t}$$

Here $\beta_1 = d \ln P_t / d \ln M_{2t}$ basically represents the elasticity of price level with respect to money supply. It is expected to show how price level displayed variation in response to small change in money supply over the period concerned.

It is observed from the estimation that the estimator $\hat{\beta} = 0.5864$ is significant at 5% level and it is less than unity. This indicates that variation in price level is less than proportional[12] following change in money supply.

4:7 Further verification of the findings :

The possible association of the variation in price level with that in money supply has further been verified in the line suggested by sims'[13]

The model for estimation is

$$P_t = Q_1 + \bar{\Lambda}_1 P_{t-1} + \bar{\Lambda}_2 M_{2t} + W_t$$

The GLS estimation of the model is

$$\hat{P}_t = 0.3322 + 0.04249\ P_{t-1} + 0.1409\ M_{2t}$$

$$(1.1978) \quad (0.147925) \quad (0.0700159)$$

$$[0.2774] \quad [\ 2.8724\ ] \quad [\ 2.0124\ ] \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\quad (\ 4.7\ )$$

$$R^v = 0.7534,\ F^{\cdot} = 662.0012,\ n = 42$$

$$DF = 40,\quad \text{and}\quad D\text{-}w = 1.84$$

It is observed that the estimatedequation that $\bar{\Lambda}_1 > o$ and $\bar{\Lambda}_2 > o$.

These estimators are significant at 5% level.

---

12. That $\beta \angle 1$ has been tested by t - test at $\alpha = 0.05$ where

Ho : $\beta = 1$

Agains t $H_A : \beta \angle 1$

Here $t^{\cdot} = \dfrac{\hat{\beta} - \beta}{s\,\hat{\beta}} = \dfrac{\hat{\beta} - 1}{s\,\hat{\beta}}$

13. Instead of taking infinite lag structure in the vector of explanatory variables, only one period lag P_{t-1} has been used in the model. The data set is stationary and it is a yearly data set. So the AR(1) process for P_t seems to be more relevant in view of the facts that ARIMA model used for price fore cast in exhibited randon walk process in many economic studies.

Now'

(i) $\overline{\Lambda}_1$, > o indicates that price level varied positively with variation in previous period (year) price level.

(ii) $\overline{\Lambda}_2$, > o indicates that even in the presence of one period lag (P_{t-1}) price level in the argument vector for P_t, M_{2t} has a significant coefficient in the estimated equation. So price level displayed significant variation following change in current perid money supply.

(iii) $\overline{\Lambda}_2$, > o even in the presence of $\overline{\Lambda}$, > o is a pointer, though implicit, to the possibility that money supply might have "Granger Caused" Price level variation. This needs further confirmation through the inclusion of extended lags (in $.y_6$)[14] into the set of explanatory variables.

4.8 SUMMARY AND CONCLUSION :

It is observed from the findings in previous section (4.6 and 4.7 that

(i) Price level, over the period of our study, displayed significant positive association with money supply. Price level was found to vary positively with changes in money supply.

(ii) Variation in price level is less than proportionate to that in money supply.

(iii) Price variation was not entirely a monetary phenomenon. Variation in money supply could at best explain 71% variation in price level.

(iv) Money supply appears to be a very significant variable for explaining inflation in the presence of other significant variables. The estimated equation (4.7) shows that money supply affects price level significantly even in the presence P_{t-1} (One period lag price level) in the set of regressors. This seems to be a pointer to the possibility that money supply might have Granger Caused price level over the period concerned.

(v) Money supply failed to affect price level to the fullest extent possible. Its effects might have been dissipated into an output effect. Output might have undergone a rise following rise in money supply.

_ _

14. Granger.Sims' causality Test in its stronger form, requires that leads and lags of price level be introduced along with money supply (Current and lagged into the set of explanatory variables).

Following Friedman, One can reasonably expect that a part of monetary shocks might have gone to explain variation in output level.

The findings tacitly indicates that money supply might have produced favourable impact in output level along with its favourable immediate offect on purchasing capacity of individuals in the economy. As money supply increases the purchasing capacity of the people as a whole, this might have manifested in the rise in price level $\beta > 0$. However, again it has failed to generate proprtional rise in price level ($\beta < 1$) since, supply of output might have increased in response to rise in money supply.

These findings, therefore, tacitly hint at the possibility of simultaneous variations in output level following change in money supply. This possibility needs proper attention and verification .It becomes pertinent on our part to find if such a possibility really exists. Our study in the following chapter is devoted to this direction. The investigation on the relation between variation in output level and that in money supply constitutes the case of our study in the following chapter.