# CHAPTER - V

## MONEY SUPPLY AND OUTPUT LEVEL IN INDIA OVER THE PERIOD (1950 - 1991)

### 5.1 INTRODUCTION :

India, since independence, has been trying to achieve industrial development and self sufficiency in agriculture. In order to usher in a systematic development in different economic fronts, several economic plans have been undertaken since 1951. These plans have been executed with varying degrees of success. As a result thereof, at the end of the twentieth century, India has emerged as a noticeable economic power in the world with outstanding industrial infrastructures and spectacular achievement in agriculture. National Income (GNP) has been found to be growing over the last few decades, though at various rates.[1] An examination of the time plot of GNP is a pointer to this issue.

In figure 5.1 presents the time plot of output level (GNP) over the period 1951-91. The plot delineate a rising pattern of GNP though at a very lower rate since 1951 to 1972. With a sudden jump in 1985 GNP describes a pattern of steep rise in the following years.

It may, however, be noted that the figure 5.1 presents the time plot of non-stationary[2] series of GNP. Consequently, a better picture of the movement in GNP may be obtained from the time plot of stationary[3] series of GNP as given in figure 5.2.

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1. The actual growth rates were 3.6, 3.9, 2.3, 3.3, 4.9, 5.2 and 5 percent during the 1st to 7th plan period respectively.
   Ref. Misra and Puri , Indian Economy ; Himalayan Publishing House, 8th Revised Edition, 1990. pp. 369-70 and 387.

2. Estimated AR(1) process for GNP shows that co-efficient Q of lagged GNP (Yt-1) exceeds 1. So, the process is non-stationary.

3. The non-stationary series in GNP (yt) has been subject to first order differencing in order to ensure stationarity in the data set. The stationary series, therefore, indicates the data set for $y_t$-$y_{t-1}$) i.e. the variation in $y_t$ over the previous period.

Fig. 5.1: Time Plot of Output Level ($Y_t$)

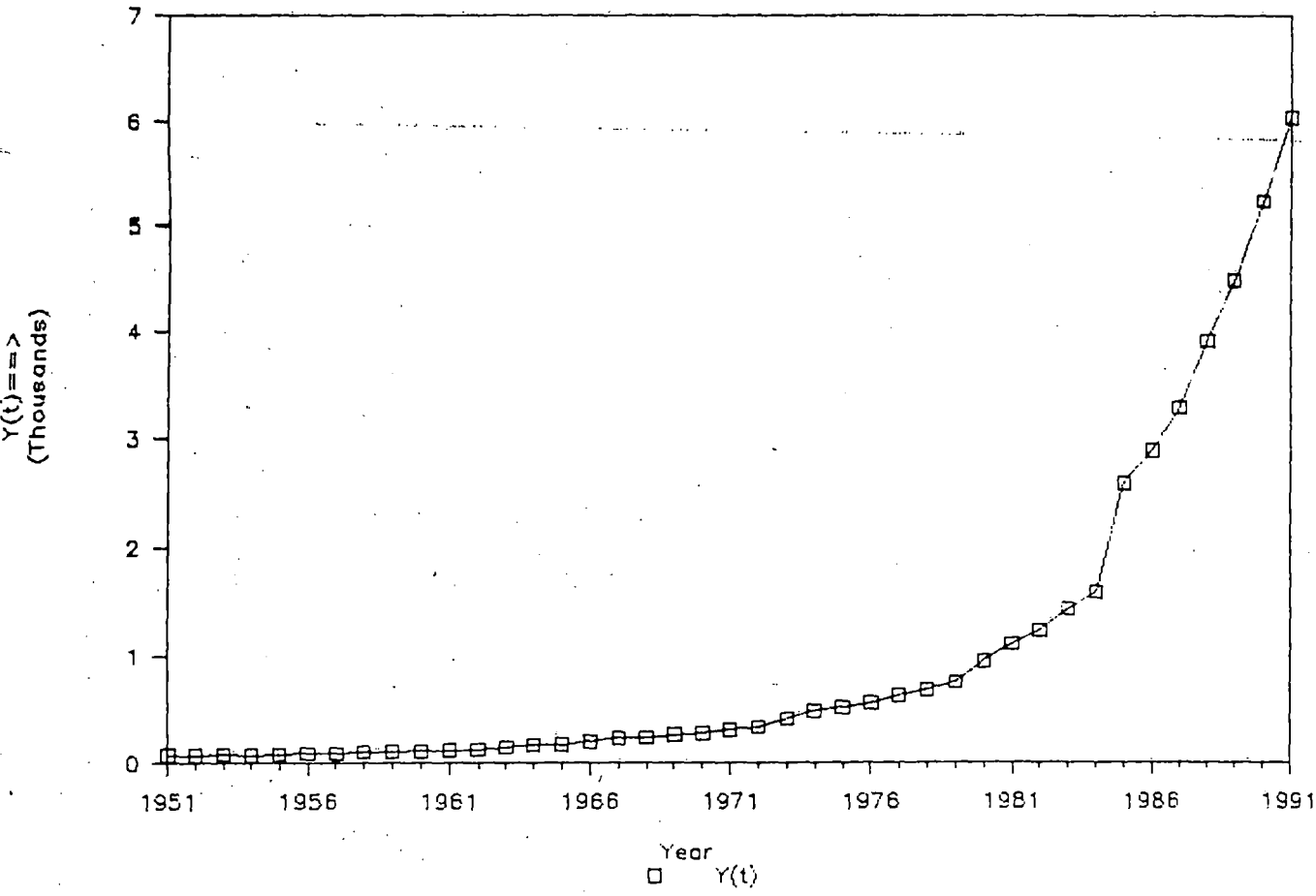
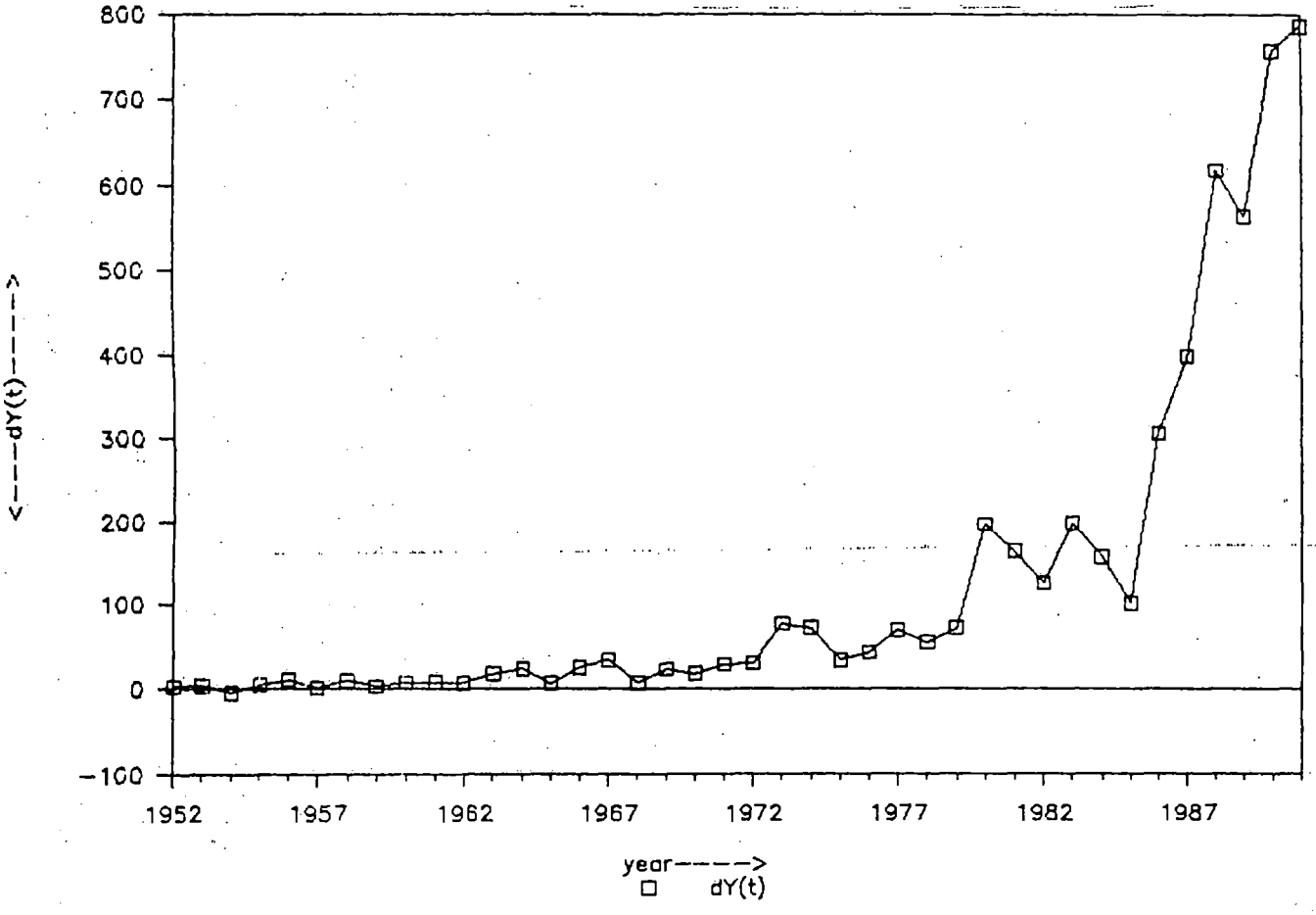


Fig. 5.2: Time Plot of Output level ($dY_t$)



It is observed from the figure 5.2 that variation in the GNP until 1962 was unnoticeable. Insignificant variation in GNP was visible until 1972. Since 1972 variation became spectacular. GNP displayed significant rise with some occasional ups and downs until 1985. Since then there was a steep rise in GNP for subsequent year (1987-1991) [4]

**5.1.1** Economists are of different opinions regarding GNP growth rate in an economy. While some relates output variation with the variation of capital labour and State of technology, others emphasise[5] on the psychological factors such as expectation in the fluctuation of output. They agree on the point that the growth of the economy over the long period depends on the availability of resources, industrial organisation the growth of knowledge and skill, the growth of population, the accumulation of capital and so on[6].

Economists have also recognised the role played by money in the determination of output level. In the short run, the monetarists assign to money supply significant role in the variation of output level.[7] The following (5.1.2) section is the graphical examination of the output variation and money supply variation considered together in the time plot graph of the concerned variables.

**5.1.2** Another important feature of the Indian economy over the period 1951-1991 is that of its growing monetization. India which was largely a barter economy initially in 1951. Later on, this barter economy gave birth to an exchange economy with the growing monetization. During the process of transition, money assumed progressively very important role in economic activities. Cheap money policy[8] followed by monetary authority in the very early phase of economic development reduced interest rates and stimulated investment. This helped the output level grow. On the other hand, with the rise in money supply, purchasing power grew.

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4. A very little fall was observed in 1989.

5. J.M.Keynese, The General Theory of Employment Interest and Money, Macmillan & Co. Ltd., London, 1957, pp 46-51.

6. Friedman, The Optimum Quantity of Money and Other Essays, Macmillan Reprinted 1970, London Basingstoke, p.182.

7. M. Friedman, Studies in the Quantity Theory of Money, Chicago, University of Chicago Press, 1956, p.3.

8. Monetary authority followed cheap money policy in the first plan (1951-56) and controlled expansion policy in the second plan (1956-62).

This supported the growth of output level. Thus, expansion of money supply is usually considered to be stimulating output level over the past few decades. None the less, whether income growth has really been related to the growth of money supply still remains an issue of debate.

An idea about the nature of association between output level (Yt) and money supply ($M_{2t}$) can be obtained from the examination of the time plots of GNP and lagged[9] money supply ($M_{2t-1}$) as given in figure 5.3.

Figure 5.3 presents the time plots of non-stationary series of output level and lagged money supply. It appears that -

(i) Lagged money supply ($M_{2t-1}$) and therefore, money supply ($M_{2t}$) describe an exponentially rising pattern over the period 1951-91.

(ii) Exponential rise in output level over the period exhibits a positive association between $Y_t$ and $M_{2t-1}$. It may, however, be noted that $Y_t$ registered a steeper rise than $M_{2t-1}$ since 1985.

Figure 5.4 presents the time plots of stationary series for $Y_t$ and $M_{2t-1}$. Some interesting features of the association between these two variables are as follows :

i) there exists very high and positive degree of association between these variables until 1979.

ii) since 1980 output level exhibits higher variation than that in lagged money supply until 1984.

iii) since 1986, the variation in output level is far more spectacular than that in the lagged money supply.

It may also be noted that variation in these variables discern somewhat different pattern over time. Consequently, the association between Yt and $M_{2t-1}$ seems to be weak over the period 1986-91.

These graphical analysis give only a tentative idea about the relation between these macro-economic variables. For precise and conclusive idea about the relationship between output level and money supply, we need further investigation with bivariate data set. An attempt in this direction has been undertaken. The

9. Exertion of monetary influence on output level is a time-lag phenomenon. This issue has been fairly dealt with in section 5.4.

Fig 5.3: Time Plot of Output Level ($Y_t$) and Money Supply ($M_{2t-1}$)

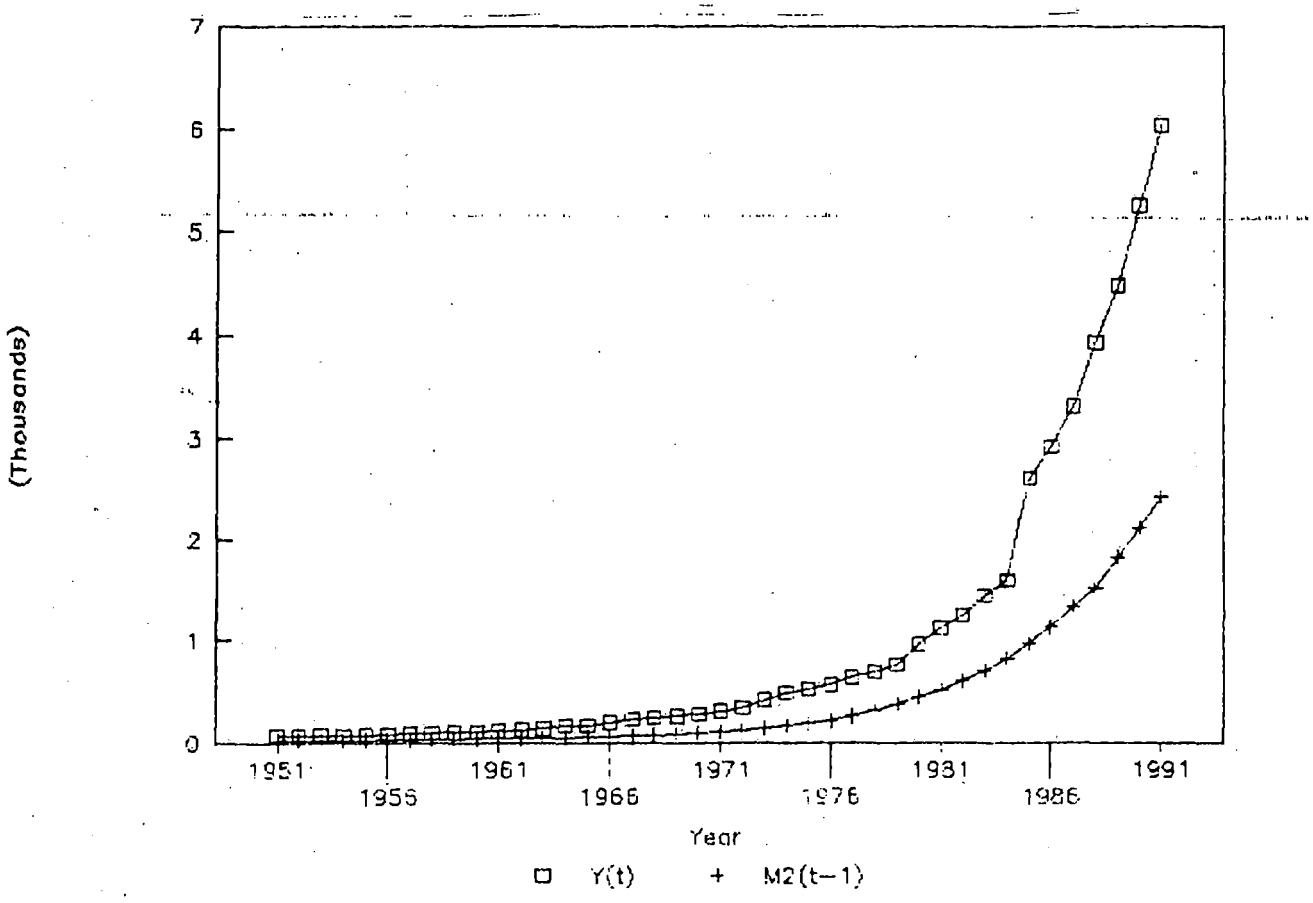
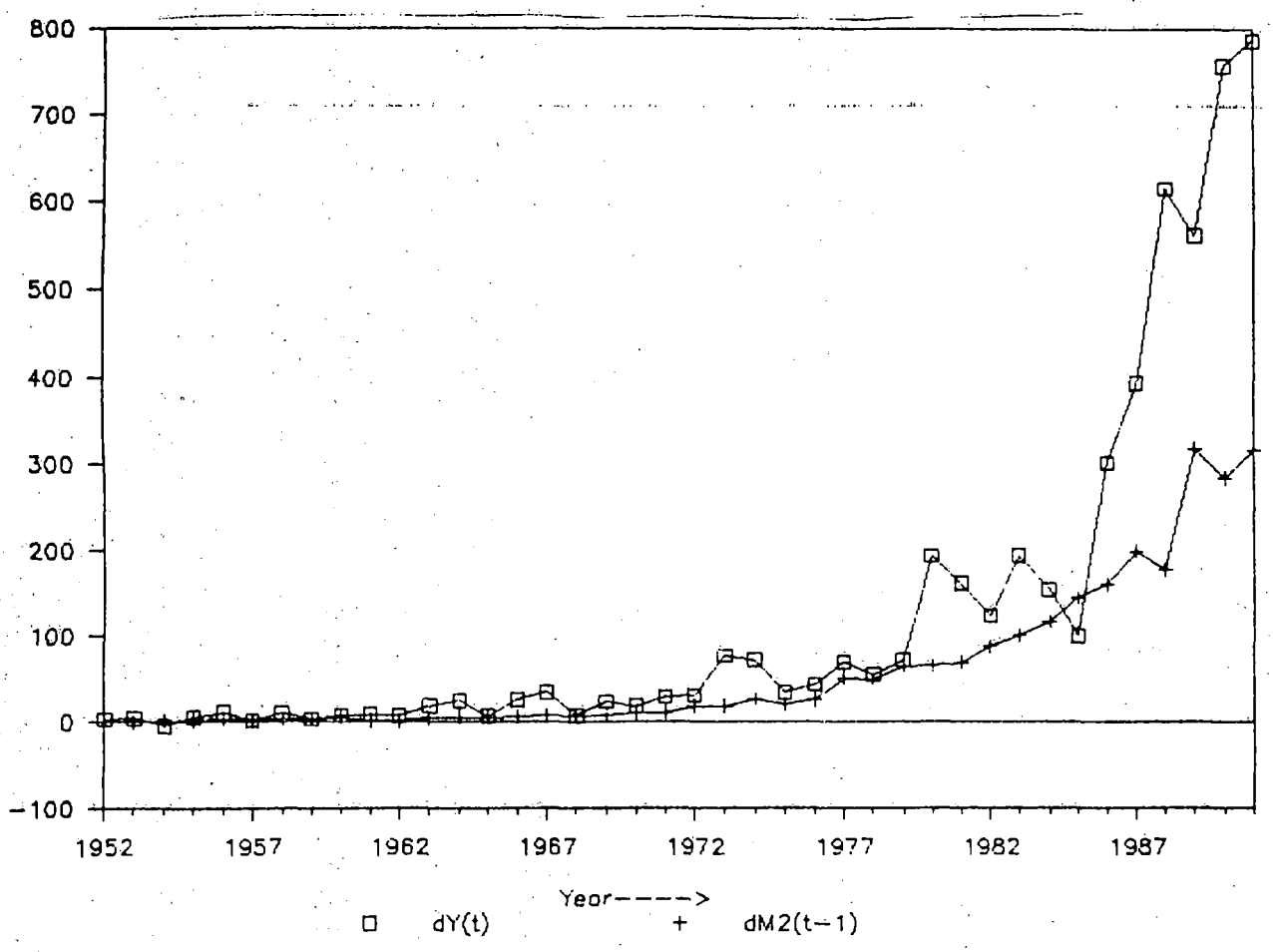


Fig. 5.4 : Time Plot of Output Level ($dY_t$) and Money Supply ($dM_{2t-1}$)



model and the corresponding estimation together with findings are given below.

**5.2 Objective of Study :** The objective of the present chapter is to evaluate the effect of money supply on output level in India over the period 1950-91. The reflex and feedback effect of economic condition[10] on money supply are ignored and the study takes into account only the variation in the output level following a variation in money supply.

**5.3 The Model :** Different economists use different models relating output level to money supply. Difference in the model originate from the differences in the basic approach to the problems. It may be noted that Friedman Phelp approach rests on the exogeneity of expectations while rational expectationists stress upon endogeneity of expectation. The basic difference leads to differences in the structure of the respective model.

It may, however, be noted that the basic theme underlying these various models, inspite of differences in their structures is to examine if variation in output level in any way is related to variation in money supply. Consequently, the approaches involves the determination of variational association between output level and money supply in the economy.

In these models money enters into the argument vector for output level indirectly. Initially, output level is associated with price level or expected inflation rate in the aggregate supply function. Again the aggregate demand function , related expected inflation rate to money supply. Consequently, an equilibrium equation related output level to money supply.

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10. We know that money supply is affected by three proximate determinants high power money, the deposit reserve ratio and deposit currency ratio which are again influenced by contemporaneous cyclical fluctuation in economic activity that is output level.

M. Friedman, The Optimum Quantity of Money and Other Essays. Macmillan Reprinted 1970, London & Bisingstoke , pp. 267-268.

**5.3.1** For example, rational expectationists take the Lucas' supply function to begin with ,

$$Y_t = Y_{t-1} + \beta ( P_t - {}_{t-1} P_t ) + \varepsilon_t \quad \text{.....(5.3.1)}$$

Here, variation in output level over that in the previous period is a function of the variation in current price level over the expected price level.

The price equation, comes into the model, in the form of aggregate demand function.

Where $P_t = - \alpha ( Y_t - {}_{t-1} Y_t ) + M_t + \mu_t$ .....(5.3.2)

The expected output level , ${}_{t-1} Y_t$ derived from the aggregate supply function is

$${}_{t-1} Y_t = Y_{t-1} + \beta ( {}_{t-1} P_t - {}_{t-1} P_t ) \quad \text{.....(5.3.3)}$$

The rational expectationists assume expectation of the random error term i.e. ${}_{t-1} e_t = 0$ . This leads to

$${}_{t-1} Y_t = Y_{t-1} \quad \text{..... (5.3.4)}$$

Again, the expected price level, derived from the price equation is

$${}_{t-1} P_t = - \alpha ( {}_{t-1} Y_t - {}_{t-1} Y_t ) + {}_{t-1} M_t \quad \text{.....(5.3.5)}$$

Which leads * ( after cancellation of the terms within the bracket )

$${}_{t-1} P_t = {}_{t-1} M_t \quad \text{.....(5.3.6)}$$

This means that, expected price level in period, t , viewed at the end of period t-1 depends on the expected money supply in period, t, viewed at the end of period, t-1.

Now, setting $P_t = - \alpha ( Y_t - {}_{t-1} Y_t ) + M_t + \mu_t$

and ${}_{t-1} P_t = {}_{t-1} M_t$ into the supply function gives

$$Y_t = Y_{t-1} + \beta / ( 1 + \alpha\beta ) [ M_t - {}_{t-1} M_t ] + ( \beta \mu_t + \varepsilon_t ) / ( 1 + \alpha \beta ) \quad \text{.....(5.3.7)}$$

Thus, equation ( 5.3.7 ), describes a relationship between output level and money supply.

**5.3.2** It, therefore, appears that money supply usually enters in the output equation indirectly. We seek to follow this practice following Friedman-Phelp. Again, study in transmission mechanism usually indicates that money supply fails to affect real output level instantly. There exists a time lag within which money changes capital stock which implies variation in investment and so variation in output level as a result thereof.

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* William H. Branson, Macroeconomic Theory and Policy, Third edition, Harper & Row Publishers, Singapore, pp-214-215.

Consequently, the relation[11] may be taken as

$$Y_t = \delta + \gamma M_{2t-1} + V_t \quad \ldots\ldots\ldots\ldots\ldots \quad (5.3.6)$$

where Yt = output level at period t
t = time, ranging from 1950-91
$\delta$ = Regression constant
$\gamma$ = Regression co-efficient of $Y_t$ on $M_{2t-1}$.
$M_{2t-1}$ = Money Supply at period t-1.
Vt = Effect of random variable on output level, where
Vt ~ II d N ( o $\delta$ $v^2$)

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11. This model indicates no causal relation between output and money supply. More specifically, it shows that our study does not aim at finding if money supply 'Granger Caused' output level variation in India.

However, implicit causal relation underlies the relation in view of the fact that the study seeks to examine if variation in money supply explains variation in output level over that in the previous period. Thus, the relation becomes

$$Y_t = \delta + \beta y_{t-1} + \gamma M_{2t-1} + V_t \ldots\ldots\ldots\ldots\ldots \quad (5.3.7)$$

Here, significance of $\gamma$ is studied in the presence of the lag in $Y_t$ ( i.e $Y_{t-1}$)
Again, in GLS estimation $\beta$ is pegged to 1 such that the model becomes

$$(Y_t - Y_{t-1}) = \delta + \gamma M_{2t-1} + V_t \quad \ldots\ldots\ldots\ldots\ldots \quad (5.3.8)$$

The data set $(Y_t - Y_{t-1})$ actually represents the stationary data set for $y_t$ where stationarity is ensured through First differencing.

## 5.4 Estimation and Findings :

The model 5.3.6 has been estimated with GLS method.[12] The estimated model is [13,14]

$$\hat{Y}_t = 2.1794 + 2.4385 M_{2t-1} \quad \ldots\ldots\ldots\ldots\ldots (5.4.1)$$
$$(23.529) \quad (0.2194)$$
$$[0.092624] \quad [11.12]$$

$R^2 = 0.7646762$, $F^* = 123.48$
D.F. = 38, and D.W. = 2.16.

**5.4.1** The positive and significant $\gamma$ indicates that output was positively and significantly related to money supply. Output level exhibited upward trend following an increase in money supply. In other words, increased money supply influenced output level favourably over the period concerned. With the increase in money supply , output level registered a rise over the period 1950-1990.

## 5.5 Implication of the Findings :

The findings have the following implication :

5.5.1 $\gamma$ implies that output level displayed positive response following in money supply variation in the previous period. If money supply increases in period t, output level rises in the following period t+1 [t=1950.... 1991].

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12. The OLS estimation of the model entails auto-correlation at 5% level of significance.
The OLS estimation is

$$Y_t = 4.3143 + 2.4509 M_{2t-1} \quad \ldots\ldots\ldots\ldots\ldots (5.4.2)$$
$$(22.242) \quad (0.030121)$$
$$[0.194] \quad [81.37]$$

R2 = 0.9941441 ; F* = 6621
DF = 39, D.W. = 1.3928
So, the GLS method has been applied for the estimation.

13. The estimation is free from auto-correlation at 5% level and significant since d* = 2.16 and F* = 123.48 respectively.

14. The estimation of the log linear model has also been done.

**5.5.2** $R^2 = 0.76$ indicates that only 76% variation in income is explained by the variation in lagged money supply. Thus, almost 24% variation in income still be remained unexplained by variation in money supply. This unexplained part of the variation in income may be explained by some non-monetary factors.

**5.5.3** This 5.5.2 tacitly implies that the variation in income following variation in money supply is less than proportional.[15] This becomes explicit when the results of the log linear estimation is considered.

The estimated log linear equation is

$$\ln Y_t = \alpha + \beta \ln M_{2t-1}$$

where $\ln Yt = 0.019105 + 0.6157 \ln M_{2t-1}$

$(0.01178) \quad (0.2091)$

$[1.6218] \quad [2.9449]$

$R^2 = 0.6858 \qquad F^* = 18.6724$

$DF = 38 \qquad D.W. = 2.23$

Here $\hat{\beta} = d\ln Y_t/(d\ln M_{2t-1})$ indicates elasticity of output level with respect to lagged money supply. $\hat{\beta} < 1$ implies that output level changed less than proportionately[16] following change in money supply.

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15. In macro economic studies with output level and money supply, usually log linear estimations are presented. Yt and Mt-1 data sets are usually replaced with logYt and logMt-1 data sets. This is done with a specific objectives.

First, such log transformation of the data set ensures homoscedasticity error term in the estimation.

Second, the coefficient represents elasticity of output with respect to money supply variation. So, the estimator has understandable meaning.

Third, log linear estimation is usually supposed to help avoid any non-linear relationship between the variables concerned. The idea of non-linearity flows from the Fisherian equation -

$MV = PT$

Such that $\ln T = \ln M + \ln V - \ln P$.

This shows that when the argument vector for Y includes both Money supply and price level, non-linearity may arise. However, such non-linearity may not arise if price level is kept out of the argument vector for Y.

16. That output varied less than proportionately following change in money supply ($M_{t-1}$) be tested at $\alpha = 0.05$ where

Ho : $\beta = 1$ against

HA $\beta < 1$

$t^* = (\hat{\beta} - 1)/s\hat{\beta}$ , suggests the rejection of Ho at $\alpha = 0.05$ .

## 5.6 Further Verification of the Findings :

The positive association of the variation in output level with that in money supply has further been verified in the line suggested by Sims.[17] The model is

$$Y_t = \theta + \gamma_1 Y_{t-1} + \gamma_2 M_{2\,t-1} + V_t \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (5.3.8)$$

The GLS estimation of the model is[18]

$$\hat{Y}_t = 1.356 + 0.5145 Y_{t-1} + 1.3303 M_{2t-1}$$
$$(19.123) \quad (0.1361) \quad (0.2881)$$
$$[0.07091] \quad [3.7793] \quad [4.7902]$$

$R^2 = 0.7758$ $\qquad$ $F^* = 412.63$

D.F = 37 $\qquad$ D.W = 2.12

It is observed from the estimated equation that

$\hat{\gamma}_1 > 0$ and $\hat{\gamma}_2 > 0$ and both are significant at 5% level.

(ii) Now, $\hat{\gamma}_1 > 0$ indicates that output level varied positively with variation in previous period output level ($Y_{t-1}$)

(iii) $\hat{\gamma}_2 > 0$ indicates that even in the presence of one period lag (Yt-1) in the argument vector for $Y_t$, $M_{2t-1}$ has a significant co-efficient in the estimated equation. So, output level displayed significant variation following change in money supply in the previous period.

(iv) $\hat{\gamma}_2 > 0$ even in the presence of $\hat{\gamma}_1 > 0$ is a pointer though implicit, to the possibility that money supply might have Granger Caused output variation. This needs further confirmation through the inclusion of extended lags in (in $Y_t$) into the set of explanatory variables[19].

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17. Instead of taking infinite lag structure in the vector of explanatory variables only one period lag (Yt-1) has used in the model. The data set is stationary and it is a yearly data set. So AR(1) process for Yt seems to be more relevant.

18. The estimated equation is free from auto correlation.

19. Granger - Sim's Causality tests in its stronger form requires that lead and lags of the output level be introduced along with Money supply to the set of explanatory variables.

## 5.7 Summary & Conclusion

Findings presented in the previous section of the chapter indicate that

(i) Output level displayed significant variation following changes in previous period money supply over the period 1950-1991.

(ii) Output and money supply variation was found to be positive ($\hat{\gamma} > 0$) .

(iii) Output variation, though positive, was less than proportional to changes in money supply. Elasticity of output level in respect to money supply variation was found to be less than unity.

(iv) Money supply could explain only 76% of the variation in output level. Consequently, output variation was found to be not completely a monetary phenomenon.

(v) Money supply was found to explain output variation significantly $\hat{\gamma}_2 > 0$ even in the presence of lagged output level in the vector of explanatory variables. This tacitly, implies that money might have Granger Caused output variation over the period concerned.

It, therefore, appears that output variation over the period of study was associated with that in money supply in a positive and non-proportional manner. Moreover, output variation was not found to be completely monetary phenomenon. Effect of money supply over the period concerned, might have gone dissipated. A part of money supply might have gone to affect price level.