Chapter II

CHAPTER-II

Money - Money Income Relationship & Tests of Causality

II.1 Money and Income- Theoretical Survey,

Variation in the quantity of money have important influence on the money income, real income and other crucial variables of the economic system. This chapter is devoted to the analysis of the theoretical development in the field of money-income relationship in historical perspective. The oldest classical quantity theory was the first one of the systematic attempts made in this direction. In what follows we give gist of classical approach to income determination. The quantity theory of money comes out exactly as a theory of money income (Y) determination when we analyse the equilibrium of the money market with the help of the Cambridge cash balance equation[1].

$M=KPy, 0<K<1$

Where K is assumed to be a behavioural constant and p stand for average price level and y stand for real output. This is how alternative formulation of QTM has been provided by the Cambridge economist Marshall in form of the cash balance equation. Let us recall that by definition, $Py=Y$, so that equation $M=KPy$ can be alternatively written as (i) $M=KY$ and money demand as (ii) $M_d=KY$. The distinction between these similar looking equations should be kept in mind, Equation, $M=KY$ provides equilibrium condition for money market. And equation $M_d = KY$ gives the Cambridge demand function for money. Obviously, these relations are possible to represent diagrammatically in the Figure. no.1

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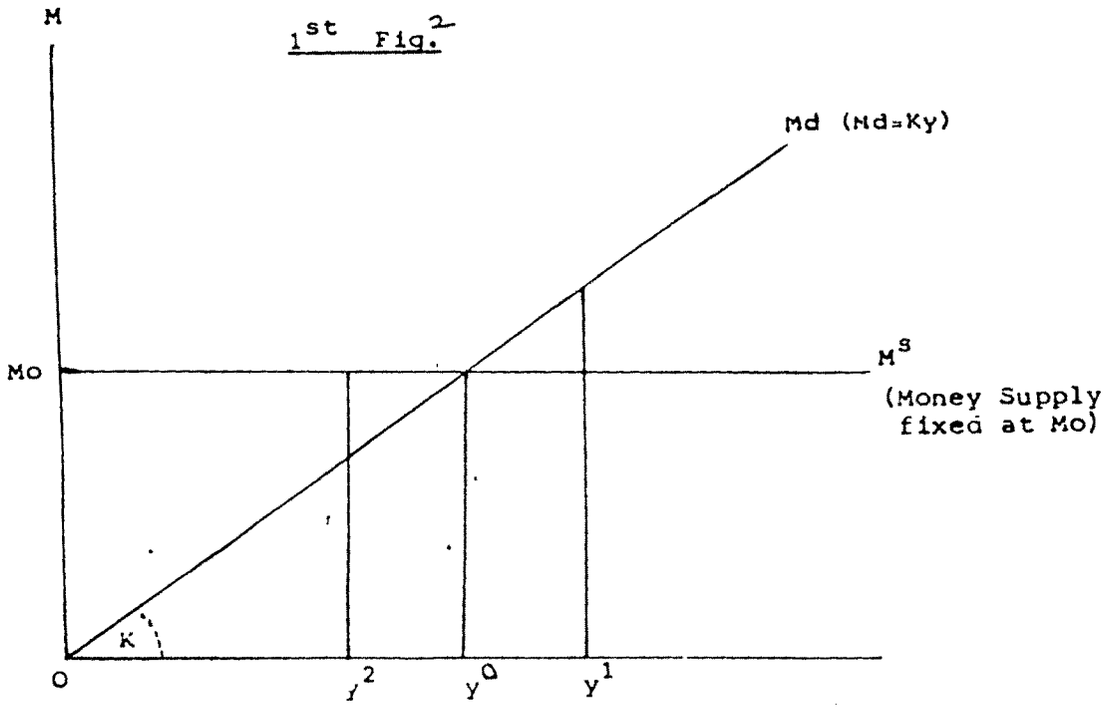
1. See Gupta S B Monetary Economics. Institution, Theory and Policy P.223. S.Chand and company (pvt) LTD. New Delhi. 1988.



The determination of y-QTM approach

2.see. Gupta.S.B. "Monetary Economics Institutions, Theory and policy. Chap-12 P-223 S.Chand and Company (Pvt) Ltd. New Delhi. (1988)

In this figure the demand for money will be equal to the supply of money at only on the level of Y, i.e. yo. Thus, given the M_d function and Mo. Yo is the equilibrium level of Y in the sense that it is only at yo that money market will be in equilibrium. This makes Y purely a function of quantity of money. Algebraically using equation, M=KY we can solve for Y to get,

$$Y = \frac{1}{K} M$$

which, recalling that 1/K = v can also be written as

Y = V.M. given the value of V

This says that Y is determined by M. and Money supply is policy determined. Three points need to be specifically noted about the money-income relationship, given above.

1) That at the aggregate level, the public, by assumption, has no authority to change money supply (Ms) to bring it into equilibrium with their aggregate demand (M_d) But the effort of individual members of the public to adjust their individual cash balances to their desired values have the indirect effect of changing the flows of money expenditure and money income and in turn, adjusting the aggregate demand for money to the given quantity of money.

II) That the choice posited before the public is that between money and commodities, so that in the event of excess money supply (M_s) public try to purchase more commodities. In other words, the margin of substitution considered in the classical literature is that between money and commodities It is here that Keynes differed completely.

III) That it is only in equilibrium that equation $M_D = KY$ holds true.

We can now explain equilibrium effects of change in the quantity of money on money income under classical proposition. Under the QTM, the effect of ΔM is , in the first instance and entirely on the level of money expenditure or money income (y)

Thus $\Delta Y = V. \Delta M$ where Δ indicate change in the variable immediately following it, This shows that ΔY results in response to ΔM. Knowing the slope of M_D function to be equal to K, it can be seen that $\Delta Y = 1/K \Delta M$. Since the reciprocal of K is the same thing as V, the equilibrium effects of M on Y is given by equation.

$$\Delta Y = 1/K \Delta M.$$

It is in the form of this quation that Friedman M. and Meiselmann specified their test of equation for the QTM against the first equation derived from Keynes income expenditure theory.[3]

$\Delta Y = K \Delta A$ where A = Autonomous expenditure and K is the Keynesian multiplier.

This classical approach of money income determination, has been objected by Keynes and his followers on the ground that range of substitution should be wider than suggested here and interest rate or rates should form and integral part of transmission process. keynesian have argued that velocity function is much more unstable than expenditure mulitplier.

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3. See Friedman.M. and Meiselmann(1963). "The relative stability of monetary velocity and investment multiplier in United States 1897-1958 in Commission Money and Credit, Substitution, prentice-Hall, Eglewood cliffs.

It is further argued that QTM approach assumed explicitly that real out put (y)is determined by the real sector forces of factor supply side-that this supply creates its own demand (Says Law)[4] Keynes in (1936)has[5] revolted against this notion and expressed the importance of Aggregate Demand in determination of real income (y) in a world where the real and monetary forces interact with each other. This point is generally well taken now,even by the so-called monetarists.

In what follows I would like to present the gist of money and income relationship in keynesian system.The key proposition of keynesian monetary theory is that changes in the demand or supply of money operate on the level of economic activity not directly (as in QTM)but indirectly through changes in real investment in the economy.[6]

Key propositions in keynesian system about the money and income relationship are:

1 that rate of interest is determined by Md and Ms which is policy variable and Md is determined by public preference.

(2) that r (rate of interest) determines (investment) I via the investment demand function.

(3) that (I) influence income (y) via the multiplier.

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4. "Political economy" Book published by Say J.B its summary prepared by Mill.J.S and Marshall in the economic of industry (published in 1881) and J.S.Mill 1948.

5. Hansen. Alvin ' A Guide to keynes' chapt.3 pp 67-86 Cambridge,Mass Feb, 1953

6. Macroeconomic by Crouch.Robert.L.chapt.15 pp 364-72

(4) that Y determines the level of employment via aggregate production function.

(5) that given the aggregate production function and stock of capital, employment of labour will given value of MPL; and given wage, MPL will determine price level via the equilibrium condition MPL= W/P.

Thus any exogenous changes in money stock can enhence aggregate monetary demand through consumption and investment expenditure. Investment has been assigned a crucial role in income determination assuming consumption function to be stable one, many keynesian have used following equation to determine income

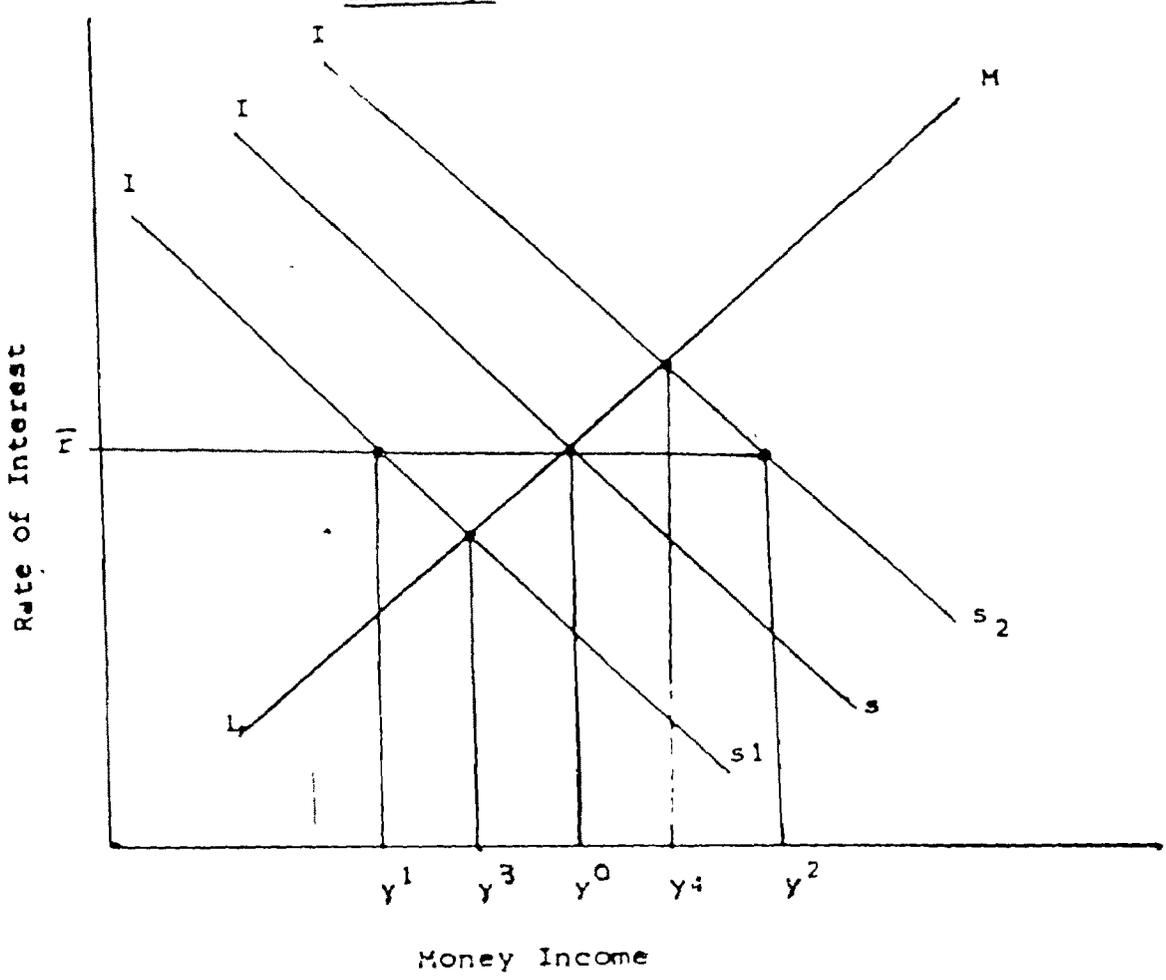
$\Delta Y = K \Delta I$ where Δ = change and Y for income and K stand for Keynesian multiplier and I=autonomous investment: They have expressed faith in relatively greater stability in expenditure function.

The basic weakness of Keynesian approach lies in considering money demand to be unstable function and expenditure function to be stable one, In fact empirical varifications neither support keynes nor classical.

In post Keynesian period further development has taken place in the spears of Money-Income relationship. M.Friedman reviewed classical and neb-classical tradition. To him money supply which is exogenously determined can cause direct variation in the income.[7] M.Friedman hypothesised that changes in quantity of money , given the income velocity of money, as stable functions, can cause direct and positive changes in income level. Though the relationship is direct and positive the time lag is uncertain.

7.See Buttler E. Friedman."A guide to his economic thought" Chap. 2 p.35 Gower Publishing Company Limited.

2nd Fig.



Using IS and L.M.(Hicksian frame work) framework[8] money and income relationship can be shown as under

If money supply is policy controlled and M_d is stable function than,money income can be determined at Yo level But any attempt to stabilise rate of interst at r level will cause wider fluctuations in Income between y1 and y2.

Monetary management will permit income fluctuations in a narrow range between y3 and y4 . Thus, to monetarists money supply is the proximate determinate and more reliable policy variable to influence Income and Interest rate as policy target will cause wider fluctuations. Empirical evidences is now generated favours Friedman,much more than Keynesians.

Milton Friedman stated that changes in the money supply (M) (defined to include time deposits) are the principal cause of changes in money income.(Y) .In his less gaurded and more popular expositions, he comes close to asserting that they are the unique cause[9] .In support of this opinion, M.Friedman and his associate and followers put forward imposing volume of evidence of different kinds.Historical case studies are one kind of evidence.For example in their Monumental Monetary History of the United States 1867-1960 , Friedman and Anna Schwartz carefully analyze and interpret the role of money and monetary policy in the important

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8. Macroeconomic by Crouch Robert L. Chapter 13. pp 299-300

9. See, Friedman M columan in Newyork,Jan 30,1967 p.86 Higher Taxes? No".

episodes of American economic history since the civil war.[10] Summary regressions of time series of economic aggregates are another evidence. In study with David Meiselmann",[11] Friedman concluded that his monetary explantion of variation in money income fits the data better than a simple Keynesian multiplier model. More recent studies in the same vein claim that monetary policy does better than fiscal policy in explaning post war fluctuations of money income.[12] A another kind of evidence related to timing, specifically to leads and lags at cylindrical turning points.Much of the work of Friedman and his associates at the National Bureau of Economic Research has been devoted to this subject.[13] Turning points in the rate of change of money supply,M,shows a long leads and turning points in the Money stock, M, itself (relative to trend) a shorter

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10. See Tobin James Essays in Economics Vol 1 ,Macroeconomics,chap 24.p.297 North-Holland Publishing Company Amesterdam. London.

11.Friedman.& Meiselmann (1964) "Reply to Donald Hester", Review Of Economics and Statistics,46 supp,Feb pp369-77

12. See Anderrson Leonall and Jordan Jerry" Monetary and Fiscal Actions: " A test of their relative importance in Economic stabilization Federal Reserve Bank of St. Louis Review (Nov. 1968)

13. See Friedman "The lag in the Effects of Monetary policy", Journal of political Economy 69 (Oct,1961)pp 447-66:Friedman and Schwartz Money and Business Cycles" Review of economics and statistics,Feb,1963 supplement pp 32-64.

lead, over turning points in money income, y[14] A great deal of the popular and semiprofessional appeal of the modern quantity theory can be related to these often repeated facts.[15]

But, however controversy between Keynesian and Monetarists, on causality between Money and Income persist even now. Each group emphasizing,once own point of view. In recent literature it has been emphasized that exact relationship between money and income and its predictability is not a theoretical issue but is essentially an empirical one. How strong are they related depends on estimated time lag and relative stablity of velocity function and expenditure function.In conclusion remark,one can state that, since Monetary changes are always preceding to income changes and same set of relationship is observed in not only developed but also in developing economy, it is reasonably well to hypothesised that income variation are caused by exogenous changes in money stock which precedes it. In this context significance contribution made by M.Friedman in his "Monetary History of United State", is a land-mark .Further light can be thrown on this vital area of Money-Income relationship and causality,only when more empirical evidence can generated. We have made modest attempt in this direction, the details of which would follow in the subsequent chapter II.2. But, before we start causality test between Money and Income ,it is worth while to study "The quantity Theory of money A Restatement" by Milton Friedman in money Income form.

14.See Tobin James "Essays in economics"vol.1,Macroeconomic chap.24 p 497

15.See Fridman.M columan in New York,Jan 30 1967 p81

Restatement of The QTM by M.Friedman emphasized that 'QTM' is in the first instance a theory of demand for money.[16] Money is demanded by economic agents and they are ultimate wealth holders. They hold an asset portfolio of definite size and composition. The ultimate wealth owning units maximise utility by arranging the composition of the asset portfolio.

Demand for money is an integral part of the theory of capital , Stock of total wealth act as budgetary constraint.

The wealth holder, like consumer is price taker. Relative prices or rates of interest on assets including money, determines the composition of the assets portfolio. The taste for assets is also definite. But, theory of choice deal with complicated choices making process of various assets. This is for the reason that each asset has two dimensions. Each assets has a 'stock and a 'flow' dimensions, Asset choice is guided by both dimensions. It cannot ignore the inter-temporal marginal rates of substitutions between assets. There consideration makes choice making difficult. M.Friedman has used a device by wnich the stock quantity (w) can be translated into income (Y). The rate of interest translates the capitalised value into income y=wr. The relative assets price ratio guide the choice making.

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(16) Studies in the quantity Theory of Money edited by Friedman Milton. chap. 1. p4. The University of Chicago press, Chicago and London, 1967.

Now we construct the demand function for money following M. Friedman. According to him real money demand M/P depends on several factors, Such as (1) permanent income y^1 various rates of interest on assests such as securities, bonds and real assets are considered. Rate of price rise represent the rate of return on real assest Thus, Friedman has widened the range of asset substitution he also used human capital as an independent argument in the demand function. But due to the fact that there are no recorded rates of return available on human capital, the ratio form i.e. $\frac{NHW}{HW}$ is preferred.

Thus demand function for money can be written as

(I) $M=F(P, rb, re, (1/P)(dp/dt), Y, W, U)$

This is the demand function in nominal term and real demand can be expressed as

II

$$\frac{M}{P} = F\ (rb, re, (1/P)(dp/dt), Y/p1\ W, U)$$

Quantity Theory and Equations

Equation (I) gives the demand function for money. It can be transformed in to the QT equation. The same exercise will be conducted on the Cambridge version of QT equation first.

The simpliest of Cambridge equation is $M=KY$ and $K=\frac{M}{Y}$ Which can be written as,

$$\frac{M}{Y} = F\text{-}(rb, re(1/P), (dp/dt), (P/Y, W, U)$$

Since $M/Y=K$ and $1/K=V$ hence the determinants of the money income, ratio can be also be written as

$$M/Y = \frac{1}{v(rb, re, (1/P)(dp/dt), Y/P1\ W, U)}$$

The inverse of money income ratio (Y/M=V) is the income velocity of money ,which if put in the standard quantity theory equation form $Y=\bar{V}M$ would read as:

$Y=V\ (rb, re, (1/P)(dp/dt), V/p\ W, U)\ M$

Above equation is significant to the monetary theory But this equation is nothing but Cambridge equation redone. It is redone in terms of asset portfolio balance approach to monetary theory (patinkin, 1969)

The analytical framework of restated QT is same as that of Cambridge equation. M Friedman has accepted the criticism Nonetheless, the revised emphasizes of the rate of money in economic activity will have to be brought out afresh. We have in above equation the determinants of the "Size" and "Composition" of assets portfolio. The portfolio will be in equlibrium when the actual size of the portfolio is exactly equate to its desired size. It also implies that the actual portfolio mix should be the same as the desired mix. Any descrepancy between desired and actual values of portfolio, set in motion forces inducing in the economic activity. The economic agent would attempt the restore portfolio equlibrium The process of adjustment is reflected in a change in the level and composition of expenditure in the economy. This change would obviously affect the income velocity of money. This mechanism provides a direct linkage between variables (Y)and(M). It was therefore (V)was interpreted as a functional (V) not a constant. This brings to the fore the most outstanding contribution of M.Friedman. The functional (V) or its inverse the demand function for money is a highly stable function. It is this which distinguishes Quantity Theorists from Non-Quantity Theorists. It should be noted that M.Friedman's contribution does

not lie in constructing the demand function for money.It lies in exposing one of the basic property of the demand function The demand function is characterized by the property of "Stability"which refers to highly stable functional relationship between the amount of money demanded and the variables which determines it.This shift the attention of the monetary theorists from numerical constancy (classical),and highly unstable (keynesian),to a high degree of stability of the income velocity function.M.Friedman pointed out that the stablity of demand function is an 'empirical'and not theoretical proposition.

Thus,M.Friedman through his restatement of QTM,provided a model which can be used to determine functional relationship between money and money income.The model used by him and empirical test was formulated using following equation.

$$M = KPy$$

SYMBOLS USED IN EQUATIONS.

1) W = wealth

2) r = Rate of interest

3) 1/P = permanent Income

4) P = Price level

5) rb = Rate on Bonds

6) re = Rate on equity

7) (Y/P) (dp/dt) = Change in price

8) dt = Change over time OR.Time derivative of price level

9) NHW = Non - Human Wealth

10) HW = Human Wealth OR Human Capital.

11) U = Tast and preference of money holder.

(12)W = Ratio of $\frac{NH}{HW}$

II.2 Empirical Tests of Causality between Money Stock both (M1 & M3) and Money Income, in India.

Tests for causality:

Economic theory is ambiguous as to whether money causes income of vice-versa, or whether there is a two-way causation. Empirical tests have been designed to render help in such situations. The most popular ones are those given by Granger (1969)[17] and Sims (1972).[18]

The Granger test involves fitting the following two equations:

$$Y_t = a + \sum_{i=1}^{K_1} b_i Y_{t-i} + \sum_{i=1}^{K_2} C_i M_{t-i} \quad \ldots(1)$$

$$M_t = \alpha + \sum_{i=1}^{K_2} \beta_i M_{t-i} + \sum_{i=1}^{K_1} r_i Y_{t-i} \quad \ldots(2)$$

where a, b_i, c_i, α_i, β_i, r_i, are parameters to be estimated and Y and M are the variables between which the direction of causality is under testing. According to the test, unidirectional causation from M to Y is implied if the coefficient γ_i s as a group in equation 4 are insignificant while the coefficients c_i s as a group in equation 3 are significant. The conclusion would be reversed.

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17. Granger C.W.J. (1969) "Investigating causal relationships by economic models and cross spectral methods", Econometrica, 37(3), 424-38

18. Sims, C.A. (1972) "Money Income and causality "American Economic Review, 82 (September), 540-52

(i.e. Y causes M) if the findings on significance are the opposite. The two way causation (feedback) is implied if both these coefficients'groups are significant and no causation is established if neither of these two coefficients group is significant.the significance of a group of coefficients could be tested thhough the F-test (Gujarati 1978, pp. 132-3) . For example, to test the significance of the coefficient of Y variables (i.e.b_i's) as a group in equation 3, compute the F-statistic as follows:

$$F^{k_1}_{n-k_1-k_2} = \frac{(Q_2 - Q_1)/k_1}{Q_3/n-k_1-k_2} \quad \ldots\ldots(3)$$

where Q_1 = explained sum of squares by the variant of 1 equation which includes all y variables but none of the M variabies as repressors.

Q_2 = explained sum of squares by equation 1

Q_3 = residual sum of squares of equation 1

k_1 = number of M variables in equation 1

k_2 = number of Y variables in equation 1

n = number of observations used in estimating equation. 1

If the computed F value is significant, the group of coefficients under testing are significantly dirrerent from zero, otherwise not.

The Sims test is somewhat different.To perform this, one needs to estimate the following functions :

$$Y_t = a + \sum_{i=-K_1}^{K_2} b_i M_{t-i} \qquad \ldots.(4)$$

$$M_t = + \sum_{i=-K_1}^{K_2} \beta_i Y_{t-i} \qquad \ldots.(5)$$

Where a, b_i, α_i and β_i are parameters, and Y and M are variables between whom the causality is under testing. According to the test, M causes Y if the coefficient of future M (M_{t+1}, M_{t+2}....M_{t+k_1}) as a group in equation (4) are insignificant while those of future Y (Y_{t+1}, Y_{t+2},....Y_{t+k_1}) as a group in equation (5) are significant. The reverse causation (i.e.from Y to M) is implied if the findings on significance are the opposite. The two-way causation follows if both the groups of coefficients are significant and no causation holds if neither of them is significant.

Equations (1),(2),(4) and (5) were estimated not on the levels of the variables but on their first differences. This was because the tests require that the values of the variables should exihibit the properties of stationarity , i.e. their means and variances should be invariant over time. The causation tests were appliad to test the causation direction between Money stock (both M_1 and M_3) and Money income proxied by GNP at current prices in India . We first report the estimated equations :

(Estimated equations in the cotext of Granger test)

(I)

M1t = f (3 past M1t, Yt and 3 past Yt)

M1t = f (M1t-1,M1t-2,M1t-3,Yt,Yt-1,Yt-2,Yt-3)

M1t = f (18.69+.156M1t-1+338M1t-2 - 0.494M1t-3+205Yt+0.338Yt-1)

(0.135) (1.56) (2.88) (-0.40) (0.99) (1.20)

+0.576yt-2+0.881yt-3)

(2.22) (3.17)

$R = 0.925$

$R^2 = 0.856$

$\bar{R} = 0.80$

D.W. = 1.76

(II)

M1t = f (3 past M1t)

M1t = f (M1t-1 , M1t-2 , M1t-3)

M1t = f (291.17+299M1t-1+601 M1t-2+0.555M1t-3)

(1.70) (2.31) (5.18) (0.465)

$R = 0.818$

$R^2 = 0.669$

$\bar{R} = 0.629$

D.W. = 1.22

(III)

Yt = f (M1t,3 past M1t and 3 past Yt)

Yt = f (M1t,M1t-1,M1t-2,M1t-3,Yt-1,Yt-2,Yt-3)

Yt = f (965+2.19M1t-.733M1t-1+306M1t-2 - 1.56M1t-3 - .506Yt-1

(0.68) (0.99) (0.68) (2.4) (-1.28) (-1.82)

0.355Yt - 2 +0.285Yt-3)

(1.23) (0.83)

$R = .87$

$R^2 = .76$

$\bar{R} = .69$

D.W. = 1.78

(IV)

Yt = f (3 past Yt)

Yt = f (Yt-1,Yt-2,Yt-3)

Yt = f (2022.54+.539,Yt-1+5.26 Yt-2 - 2.72 Yt-3)

(1.18) (0.455) (5.56) (-2.50)

$R = .763$

$R^2 = .582$

$\bar{R} = .532$

D.W. = 1.60

(V)

M3t = f (3 past M3t, Yt and 3 past Yt)

M3t = f (M3t-1, M3t-2, M3t-3, Yt, Yt-1, Yt-2, Yt-3)

M3t = f(-65.87+0.738M3t-1+0.483M3t-2-0.369M3t-3+0.423Yt-0.468Yt-1
(-0.397) (3.48) (1.34) (-1.20) (1.75) (-0.151)
+0.678Yt-2+0.737Yt-3)
(1.87) (1.97)

R = 0.985

R^2 = 0.972

$\bar{R}$ = 0.962

D.W. = 2.14

(VI)

M3t = f (3 past M3t)

M3t = f (M3t-1, M3t-2, M3t-3)

M3t = f (157.95+0.472M3t-1+0.998M3t-2-0.350M3t-3)
(0.908) (2.26) (3.19) (-1.07)

R = 0.973

R^2 = 0.947

$\bar{R}$ = 0.941

D.W. = 1.76

(VII)

Yt = f (M3t,3 past M3t and 3 past Yt)

Yt = f (M3t,M3t-1,M3t-2,M3t-3,Yt-1,Yt-2,Yt-3)

Yt = f (1880+3.01M1t3-5.12M3t-1+7.14M3t-2-3-3.78M3t-3 -0.547Yt-1-0.562Yt-2

(0.135) (1.56) (2.88) (-0.40) (0.996) (1.20) (2.22)

+0247Yt-3)

(3.17)

$R = 0.925$

$R^2 = 0.856$

$\bar{R} = 0.808$

D.W. = 1.76

(VIII)

Yt = f (3past Yt)

Yt = f (Yt-1, Yt-2, Yt-3)

Yt = (2022.54 + .539 Yt-1 + 5.26 Yt-2 - 2.72 Yt-3)

(1.18) (0.455) (5.56) (-2.50)

$R = .763$

$R^2 = .582$

$\bar{R} = .532$

D.W = 1.60

Estimated Equations in the context of Sims test:

(I)

M1t = f (Yt, 3 past Yt and 3 future Yt)

M1t = f (Yt, Yt-1, Yt-2, Yt-3, Yt+1, Yt+2, Yt+3)

M1t = f (49.68+0.586Yt+0.531Yt-1+0.51Yt-2+0.749Yt-3+0.138Yt+1

(0.326) (3.29) (2.00) (1.63) (2.28) (1.04)

+0.233Yt+2 - 0.899Yt+3)

(1.777) (-0.653)

R = 0.906

R^2 = 0.821

$\bar{R}$ = 0.761

D.W. = 0.97

(II)

M1t = f (Yt, 3 past Yt)

M1t = f (Yt, Yt-1, Yt-2, Yt-3)

M1t = f (48.50+0.589Yt+0.685Yt-1+0.715Yt-2+0.873Yt-3)

(0.307) (3.57) (2.81) (2.17) (2.83)

R = 0.882

R^2 = 0.778

$\bar{R}$ = 0.741

D.W. = 1.37

(III)

Yt = f (M1t, 3 past M1t and 3 future M1t)

Yt = f (M1t, M1t-1, M1t-2, M1t-3, M1t+1, M1t+2, M1t+3)

Yt = f (-311.42-0.745M1t-1.189M1t-1+5.33M1t-2-3.71M1t-3)

(-0278) (-0.443) (-1.34) (4.63) (-4.61)

+3.33M1t+1 to.484M1t+2+0.538M1t+3)

(3.69) (0.748) (0.790)

$R = 0.918$

$R^2 = 0.843$

$\bar{R} = 0.791$

D.W. = 2.44

(IV)

Yt = f (M1t, 3 past M1t)

Yt = f (M1t, M1t-1, M1t-2 , M1t-3)

Yt = f (574.39+4.38M1t-0.773M1t-1+2.62M1t-2-2.96M1t-3)

(0.389) (2.88) (-0.662) (2.02) (-3.02)

$R = 0.823$

$R^2 = 0.678$

$\bar{R} = 0.625$

D.W. = 2.12

(V)

M3t = f (Yt, 3 past Yt and 3 Future Yt)

M3t = f (Yt, Yt-1, Yt-2, Yt-3, Yt+1, Yt+2, Yt+3)

M3t = f (-456.64+0.116Yt+0.110Yt-1+0.102Yt-2+0.976Yt-3+0.774Yt+1

(-1.53) (3.36) (2.12) (1.67) (1.52) (2.96)

+0.851Yt+2+0.532Yt+3)

(3.31) (1.98)

R = 0.951

R^2 = 0.906

$\bar{R}$ = 0.874

D.W. = 0.808

(VI)

M3t = f (Yt, 3 past Yt)

M3t = f (Yt, Yt-1, Yt-2, Yt-3)

M3t = f (-375.22+0.132Yt+0.198Yt-1+0.261Yt-2+0.216Yt-3)

(-0.948) (3.20) (3.24) (3.95) (2.80)

R = 0.899

R^2 = 0.808

$\bar{R}$ = 0.776

D.W = 0.707

(VII)

Yt = f (M3t, 3 past M3t and 3 Future M3t)

Yt = f (M3t,M3t-1,M3t-2,M3t-3,M3+1,M3+2,M3+3)

Yt = f (451.76+4.79M3t-9.28M3t-1+9.08M3t-3+0.428M3t+1

(0.355) (2.69) (-4.85) (3.11) (-2.08) (0.264)

-2.30M3t+2+3.01M3t+3)

(1.39) (1.87)

R = 0.871

R^2 = 0.680

$\bar{R}$ = 0.625

D.W. = 2.632

(VIII)

Yt = f (M3t , 3 past M3t)

Yt = f (M3t,M3t-1,M3t-2,M3t-3)

Yt = f (906.67+4,63M3t-7.44M3t-1+7.03M3-2-3.25M3t-1)

(0.721) (3.25) (-4.56) (2.66) (1.37)

R = 0.847

R^2 = 0.718

$\bar{R}$ = 0.671

D.W = 2.58

On methodological grounds, it is more appropriate to evaluate the significance of the coefficents as a group. for this prupose, F statistic have to be used. We have made use of Anova Table (Analysis of Variance Table) and computed F statistics in table 2.1,2.2 and 2.3 for the relevant regressions.

TABLE :II.1

Regression Results for causality Test between

Money and Money income in India.

Granger Test

Equation. no	Sample Period	Dependent Variable	Independent Variables	Ess	Rss
1	1956-57 to 1984-85	M1t ---	3 past values of M1t, GNpt and 3 past GNpt	29000300	4875680
2	1956-57 to 1984-85	M1t ---	3 Past values of M1t	22684000	11192000
3	1956-57 to 1984-85	GNPt ----	M1t, 3 past M1t, 3 Past Yt	1721570000	518658000
4	1956-57 to 1984-85	GNPt ---	----------	1093370000	1146860000
5	1956-57 to 1984-85	M3t ----	3 Past M3t, GNPt, 3 Past GNPt	239438000	6869040
6	1956-57 to 1984-85	M3t ----	3 Past M3t ----------	178960000	67346800
7	1956-57 to 1984-85	GNPt ----	3 Past GNPt, M3t 3 Past M3t	1752360000	487871000
8	1956-57 to 1984-85	GNPt ----	3 Past GNPt ----------	1093370000	1146860000

TABLE : II.2

Regression Result For Causality Test Between

Money And Money Income In India

Sims Test:

Equation No	Sample Period	Dependent Vabiable	Independent Variables	Ess	Rss
1	1956-57 to 1984-85	M1t ----	GNPt,3 Past GNPt,3 Future GNPt.	27815900	6060030
2	1956-57 to 1984-85	M1t ----	GNPt.3 Past GNPt	26383600	7492330
3	1956-57 to 1984-85	GNPt ----	M1t,3 Past M1t,3 Future M1t	1889640000	350595000
4	1956-57 to	GNPt	M1t,3 past M1t	1520990000	719239000
5	1956-57 to 1984-85	M3t ---- ----	GNPt,3 Past GNPt 3 Future GNPt	223183000	23124600
6	1956-57 to 1984-85	M3t ----	GNPt,3 Past GNPt ----------	199143000	47164700
7	1956-57 to 1984-85	GNPt ----	M3t,3 Past M3t 3 Future M3t	1702580000	537653000
8	1956-57 to 1984-85	GNPt ----	M3t 3 Past M3t	1610010000	630225000

NOTE:-

Ess refers to explained sum of squares of the relevant regression and R S S refers to residual sum of squares.

TABLE :-II.3
F.Statistics for Causality Test

Granger Test

M1 and GNP (1956-57 to 1984-85)

Table. No	Equation. No	F.Values	Degrees of Freedom		Result
			Numerator	Denominator	
2.2	1&2	8.63 *	3	20	GNP Causes M1
2.2	3&4	8.07	3	20	M1 Causes GNP
M3 and GNP					
2.2	5&6	88.93	3	20	GNP Causes M3
2.2	7&8	9.00	3	20	M3 Causes GNP
M1 and GNP- Sims Test:-					
2.3	1&2	1.18	4	20	M1 is not significant in causing GNP
2.3	3&4	5.25	4	20	GNP Causes M1
2.3	5&6	5.20	4	20	M3 Causes GNP
2.3	7&8	14.30	4	20	GNP Causes M3

* F value of 8.63 was obtained as follows :

$$F = \frac{29000300 - 22684000/3}{4675680/20} = \frac{2105433.3}{243784} = 8.63$$

AS clearly brought out - by Tables II.1, II.2, and II.3 the causality between money stock and money income has turned out to be bidirectional using either the Granger test or Sims Test. Except in the case of Sims test (TABLE II.3; equations 1 & 2), in all the reported empirical results, F values level have been found to be significant at 1 % level and thus strongly indicate that money stock and money income are endogenous to each other.

Thus from estimated equations, it is clear that future coefficients are significant in all regressions. In all regressions, the value of F statistic is significant at the 1% level of significance. Instead of testing significance of individual coefficients, we have tested the significance of coefficients on future variables taking them as a group. This is merely to avoid the multicollinearity problem that usually arises, and which often results into spurious regression. Since future values of M1, M3 and Y all are significant as a group in the relevant regressions, it strongly suggests the existence of bidirectional causality between monetary aggregates (M_1 & M_3) and money income. Both money stock and money income seem to be endogenous to each other. Interesting enough, the effects of money income on money stock and that of money stock on money income seem to extend upto one or two years. This observed lag structure seem to be consistent with the theoretical implications of the asset approach to the balance of payments since the money supply affects nominal GNP and/or national income in the short run (in one or two years in evidence) while GNP or NI effects the money supply in the long run (in two years in evidence) under the fixed exchange rate regime.

This bidirectional causality between money stock and money income seem to be partly due to the policy of deficit financing in India.Owing the deficit financing,changes in money supply have increasingly become dependent upon the budget deficits.In view of the substantial magnitude of deficit financing and functional dependence of money stock on budgetary policy implies that money stock is endogenised. Further more a fixed exchange rate system in which one country services as the reserve currency country has important asymmetrical proporties. Indeed, only the reserve currency country can control its money supply. From this,several implications for concerning direction of causality follow. Control of money supply results in the ability to infulence price level and thus nominal income in the reserve currency country. These changes in prices an nominal income in the reserve currency country will simultaneously affect conditions in world market. Individuals in other countries reacting to these changes, adjust their portfolios.This adjustment process prompts simultaneous changes in prices nominal income and the money stock in non-reserve currency countries. It is also interesting to note that in so far as the authorities primarily aim to regulate structure of interest rates,movements in money stock can be expected to respond to movements in nominal income. (Williams, Goodhrd and Cowland). Besides,GNP /or nominal income can be a cause of the money supply in a reverse direction if monetary policy is conducted so as to stabilise the rate of change in GNP, reducing the rate of change in the money supply when GNP grows too fast and increasing it when GNP slows down.All this is to emphasise that the observed empirical evidence for causality is justified and is consistent with prevalent features of Indian economy.The major implication

is that form and direction of causal relationship do depend on the institutional context and that C.A. Sim's results do not have general validity.

Conclusion and Implications for Monetary Policy :

The objective of this chapter has been to examine the substantive question whether there is statistical evidence that money is "Exogenous" in some sense in the money income relationship for the Indian Economy.The evidence from this exercise strongly suggests that the money supply changes do not seem to be independent of nominal income changes and hence denies the existence of unidirectional causality from money stock to money income.Existence of feedback clearly suggests that money and income are simulteneously determined. This also implies that neither money nor money income can be treated as strictly exogenous in their distributed lag regressions and failure to do so would lead to spurious statistical relationships and would render the estimated coefficients and ambiguous interpretation.

More importantly, the study contends that the studies of the simple statistical relationship between movements in money stock and in money incomes can by themselves provide very little information about the strength of monetary policy.The statistical relationship could be quite close,but this might reflect to a very large extent the accomodation of movements in the money supply to autonomous changes in money incomes (given the authorities policy aims and operational techniques). If the authorities make an abrupt change in their operations, the established relationships or regularities might cease to apply. In such situation, attempts to measure the effects of monetary policy by correlating changes in the money stock with changes in

money incomes probably greatly overestimate the strength of monetary policy. The overestimation occurs owing to the existence of a two-way relationship between money stock and money income.

Our results of a bidirectional causality between money stock and money incomes could be rationalised by three major reasons : it is probable that in an attempt to peg the interest rates on financial assets, the Reserve Bank has allowed the money supply to vary in order to offset changes in the demand for money as incomevaried. In this context, the money supply ceases to be exogenous andcorrelation between M and Y represents a possible direction of causation from Y to M. Secondly the Indian Economy being an open economy, the money supply can easily be altered by substantial changes in the flow funds from abroad (short run monetary movements). To the extent that greater capital inflows are attracted during times of high income and demand for money, which raise the rate of interest, a correlation between changes in M and changes in income will be observed which is not indicative of monetary changes causing the level of income. Thirdly, due to the policy of large scale deficit financing, chaanges in money supply have increasingly been dependent upon the budget deficit .In view of the substantial magnitude of deficit financing it would be very difficult to discriminate between the effects of the changes in nominal stock of money and the changes in autonomous expenditure.The functional dependence of money stock an budgetary policy necessitates a model in which nominal stock of money is also endogenised. However more important is the fact that the actions of the authorities in financial markets which will directly affect the money supply,will usually be strongly influenced by current and

expected future developments in the economy and any attempts to disentangle this two way interaction by considering the lead/lag relationship reinforce the view that the monetary policy has some causal impact on money income, but do not allow this to be clearly isolated and quantified.

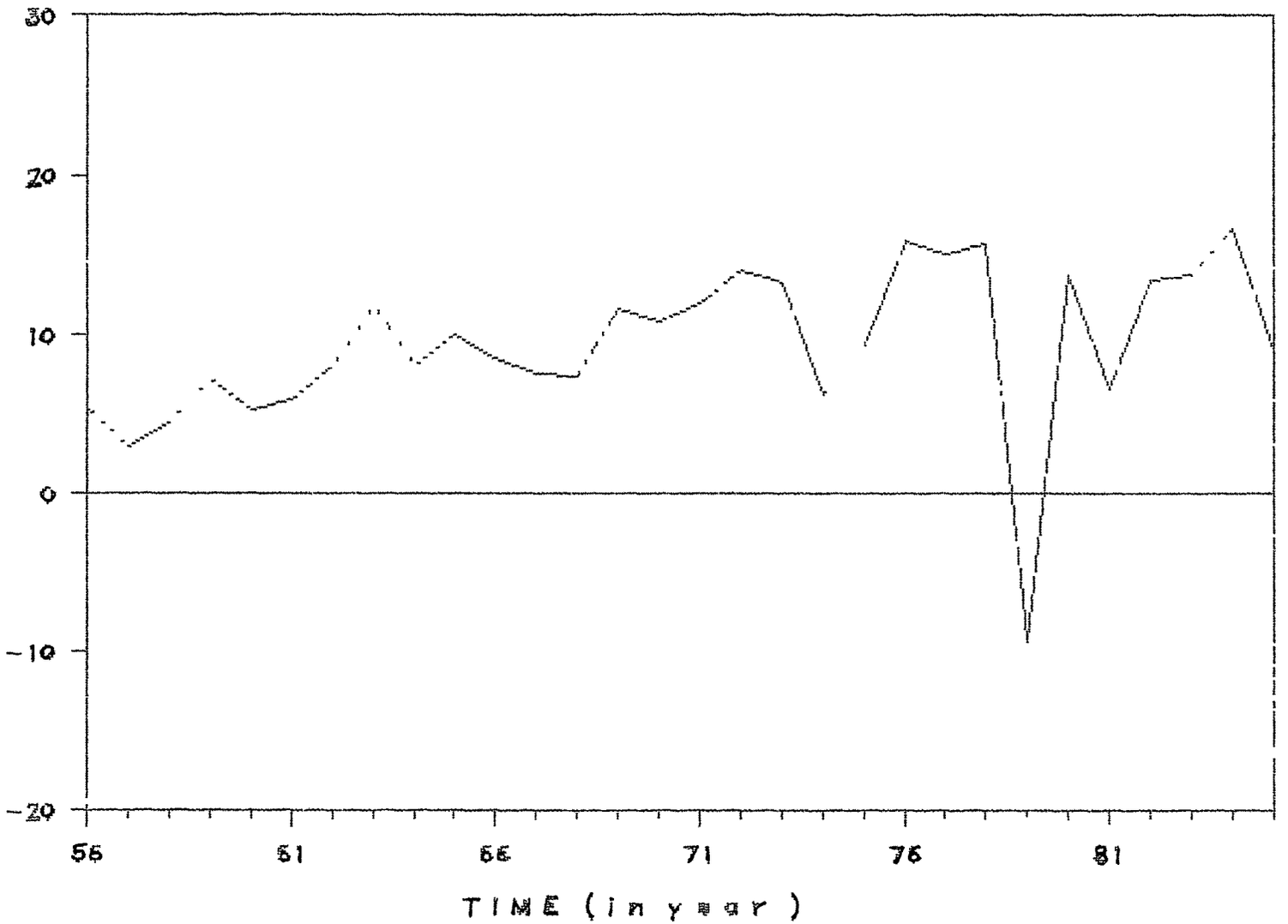
We reiterate our conclusion on an alternative interpretation that with the existance of bidirectional causality, money stock as well as money income contain an efficient assessment of each other in as much as that movements of money (or money income) provide advance information to the movements, of money income (money stock) . In this sense predictable movements of money stock cause movements in money income or other way round.

The graphs II.1 to II.8 depict the growth rates of money supply and GNP. The positive relationship between money supply (M1 & M3) and money income (GNP at current prices) is very well demonstrated in these graphs.

GRAPH NO : II.1

% GROWTH RATE OF M1

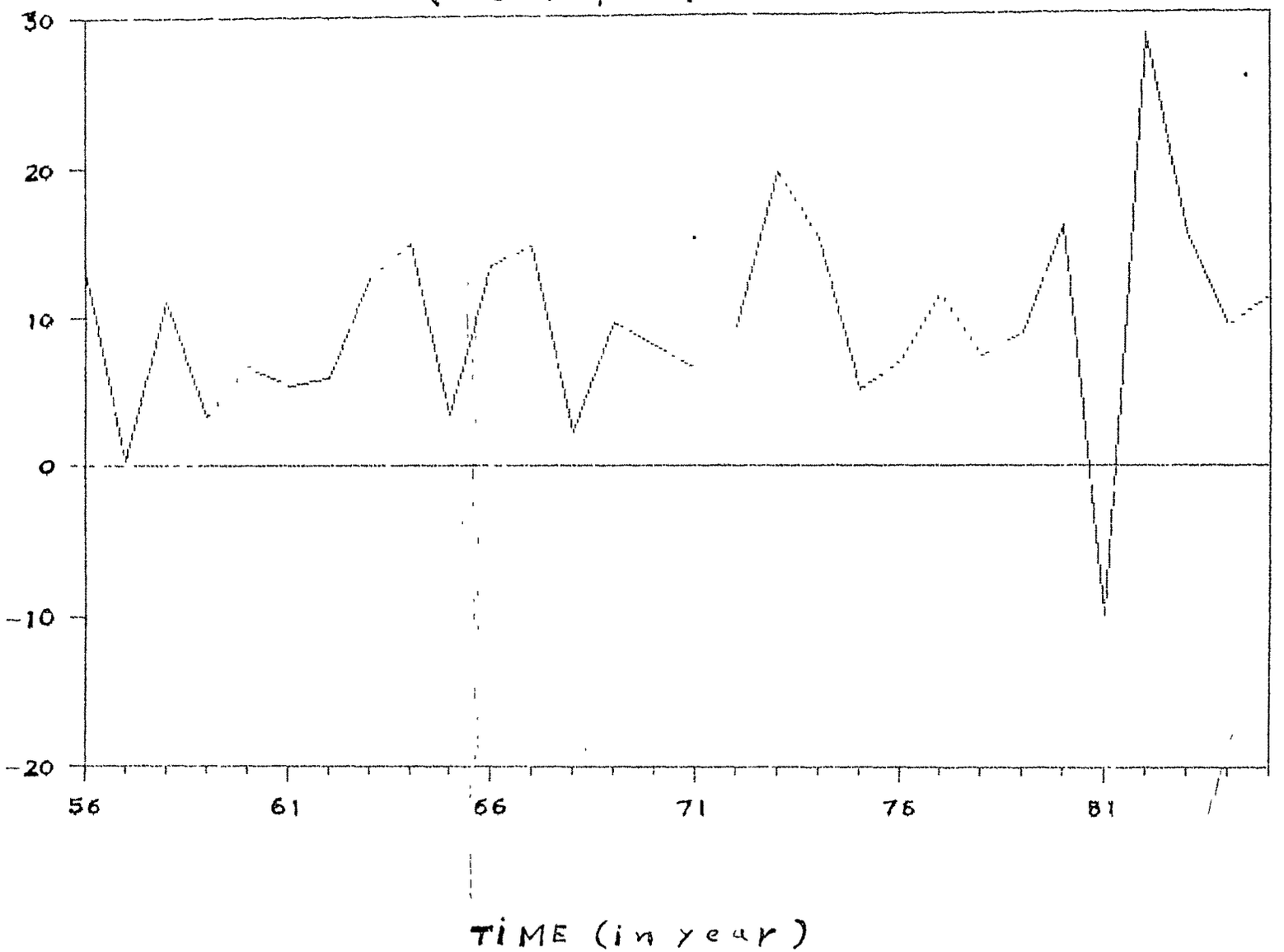
1956-85



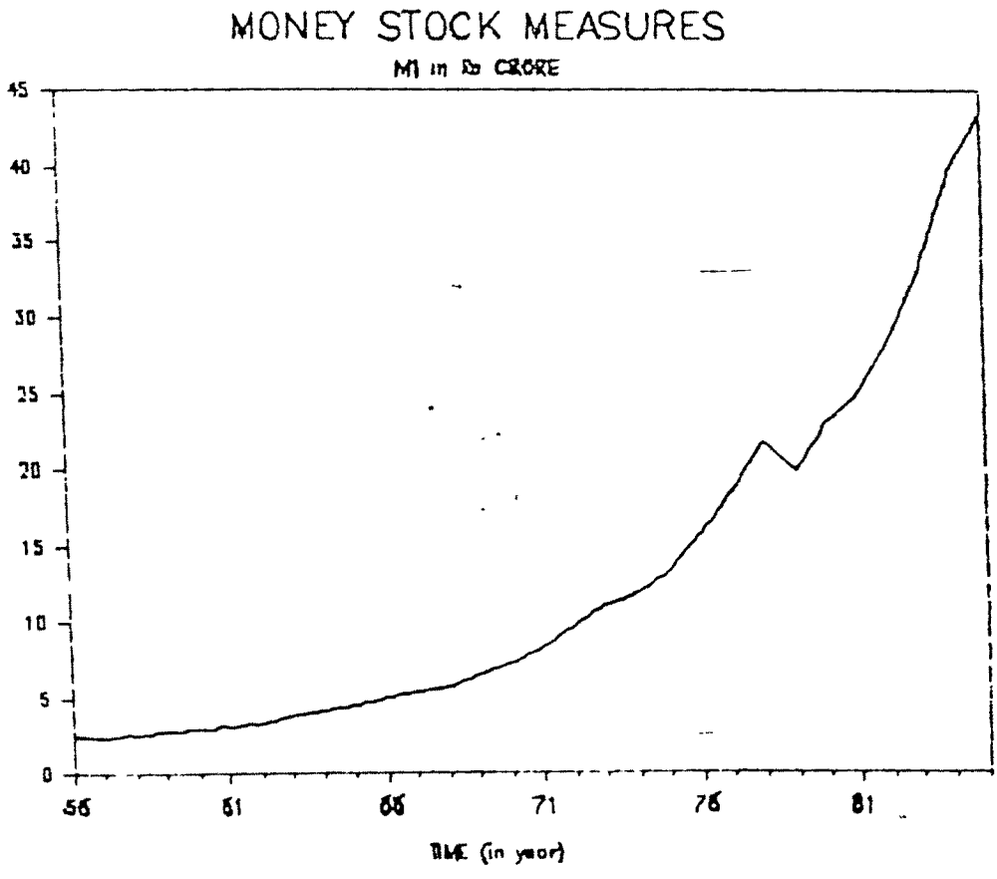
GRAPH NO : II-2

% GROWTH RATE OF GNP

(at current prices) 1955–85



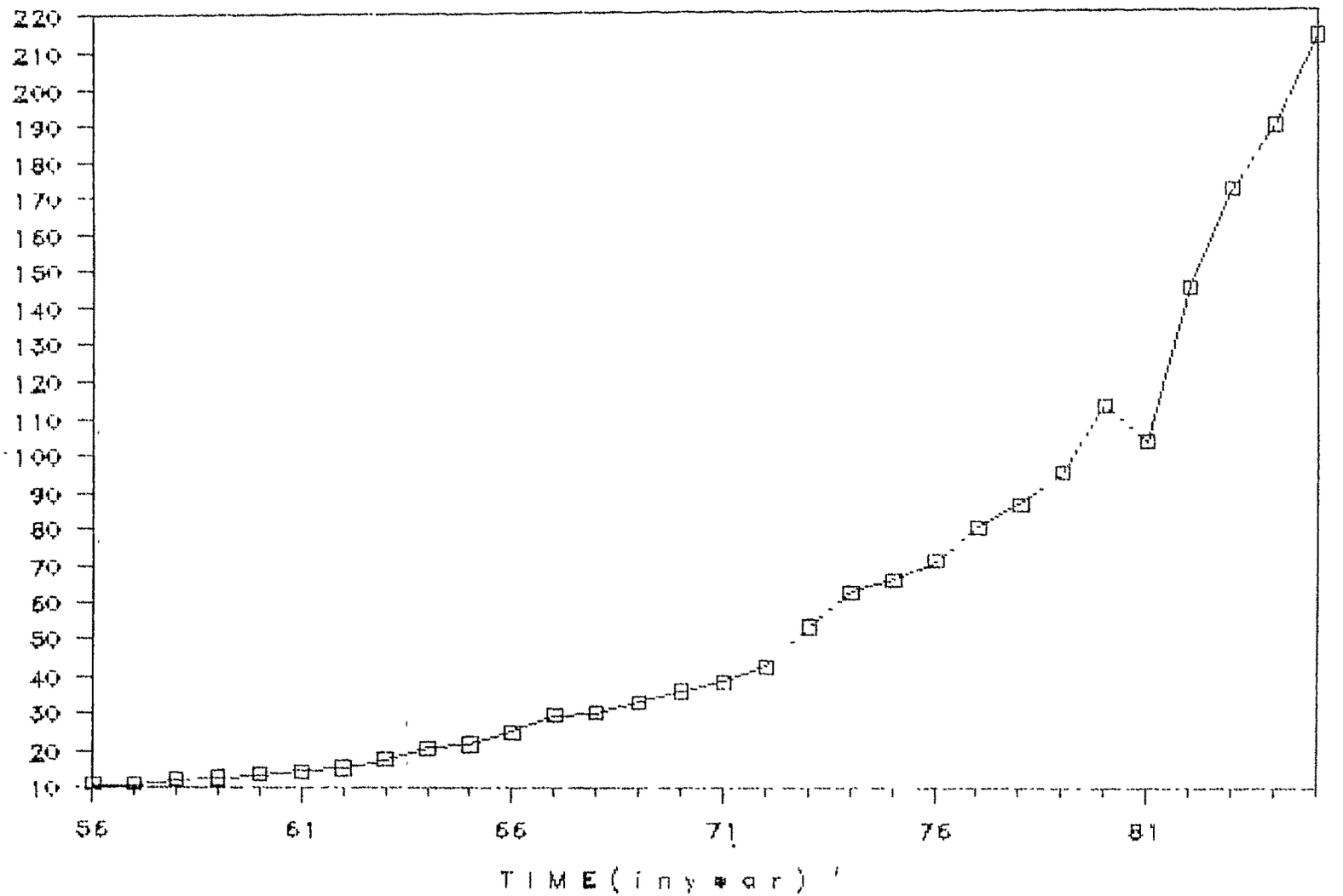
Graph no : II·3


MONEY STOCK MEASURES
M1 in Rs CRORE
45
40
35
30
25
20
15
10
5
0
56
61
66
71
76
81
TIME (in year)

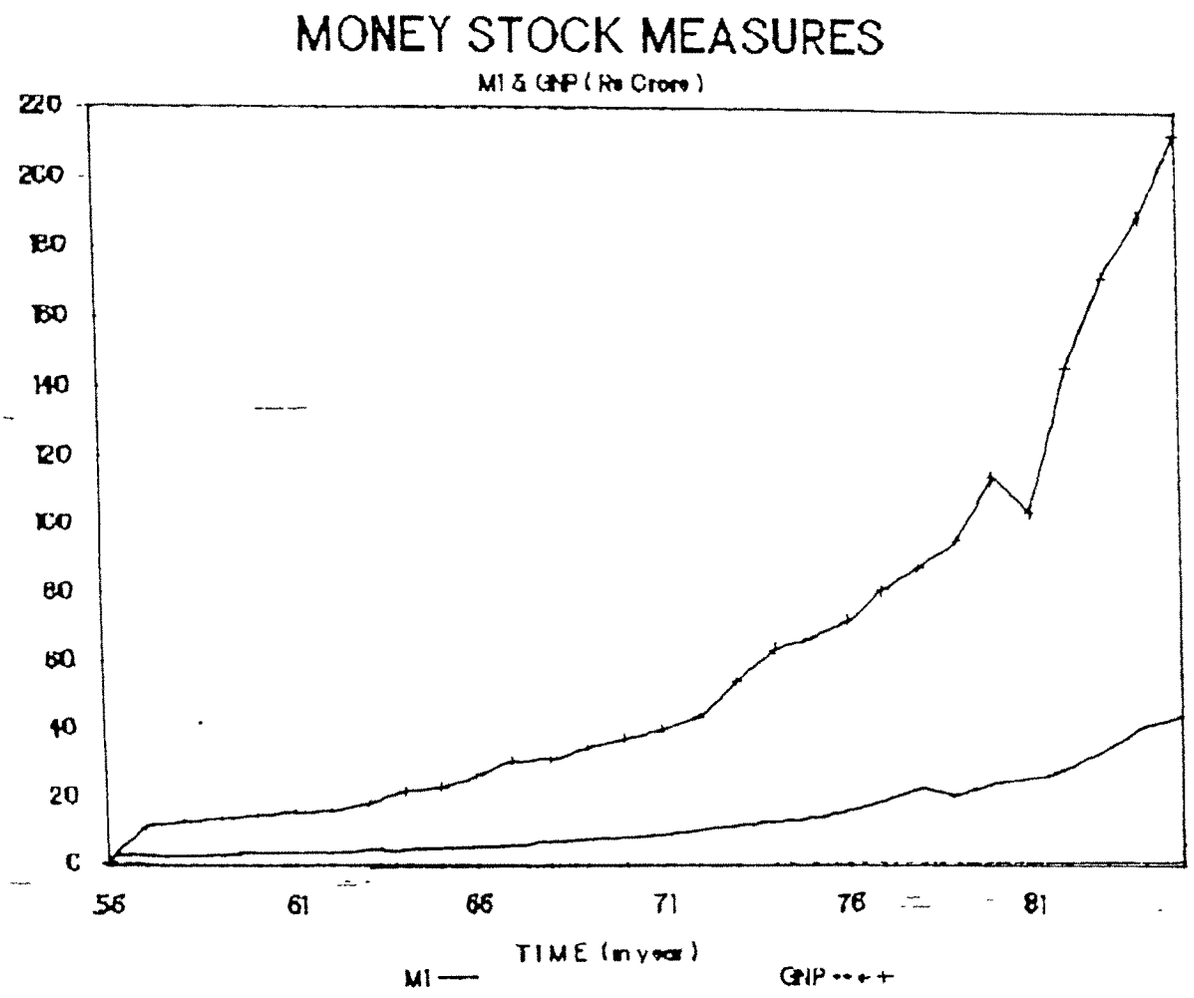
Graph no: II.4

GNP (at current prices)in Rs. crore

1955-85



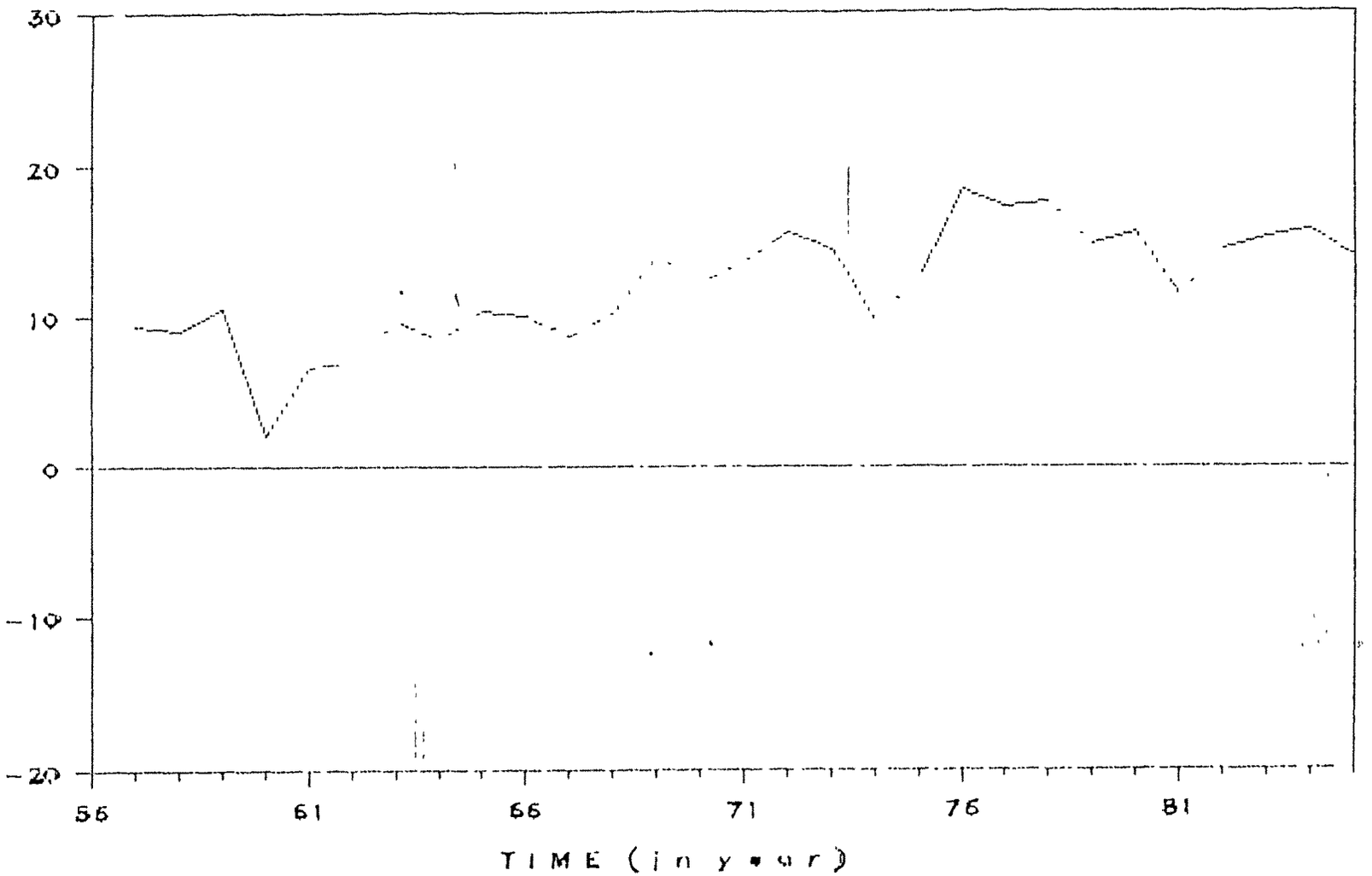
Graph no : II·5


MONEY STOCK MEASURES
M1 & GNP (Rs Crore)
220
200
180
160
140
120
100
80
60
40
20
0
56
61
66
71
76
81
TIME (in year)
M1
GNP

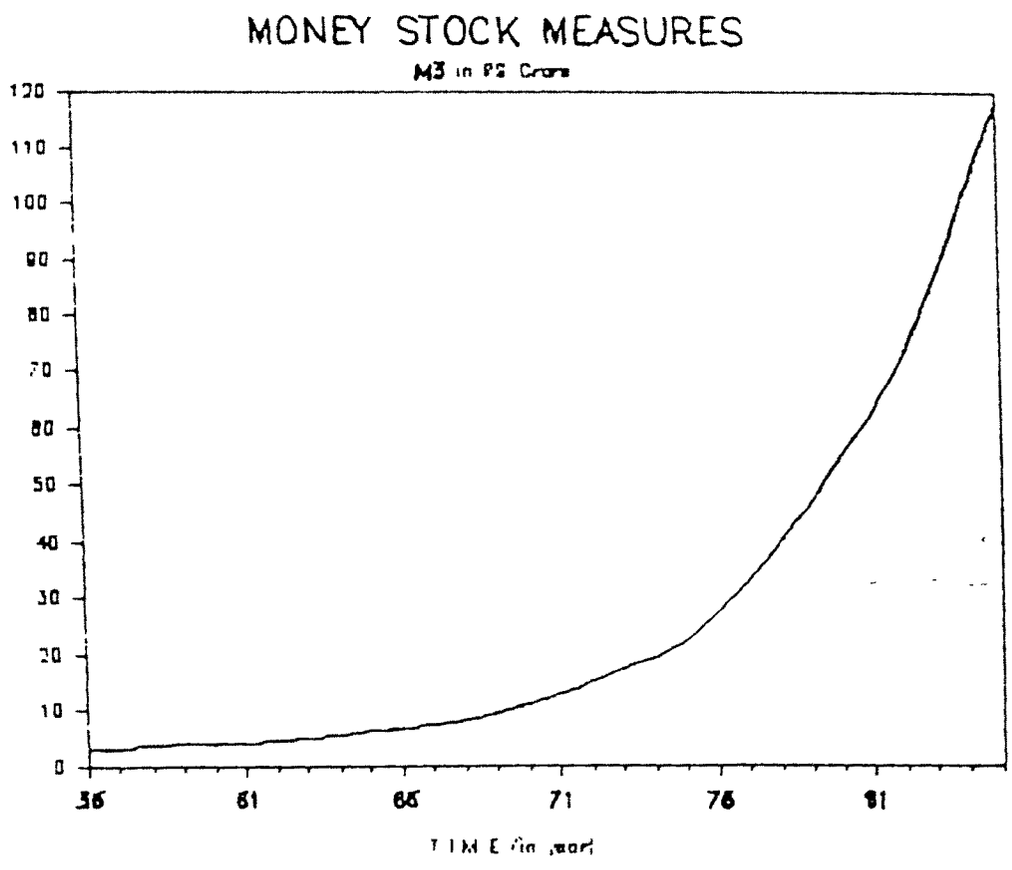
GRAPH NO : II:6

% GROWTH RATE OF M3

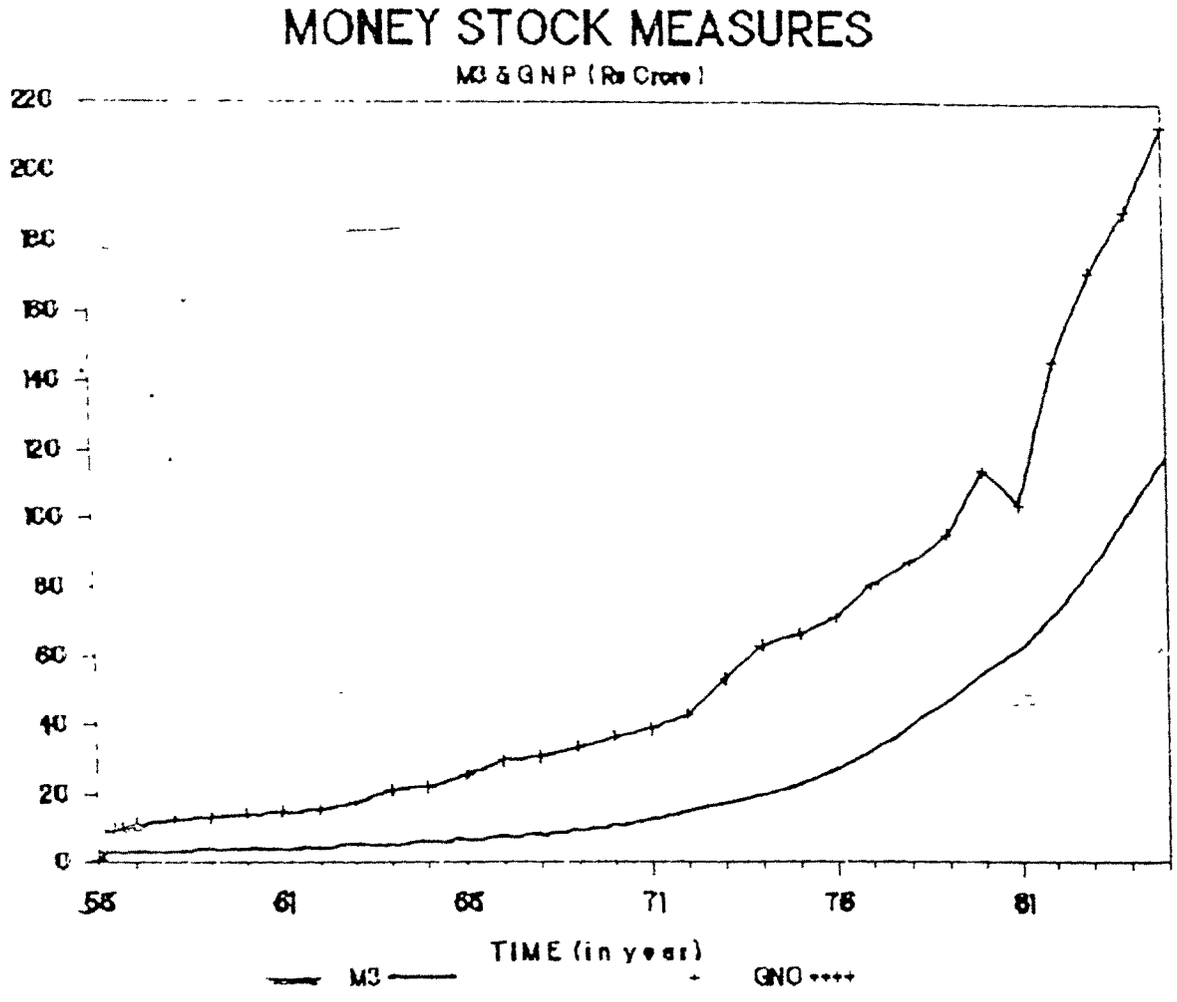
1956-85



Graph no : II.7


MONEY STOCK MEASURES
M3 in RS Crore
120
110
100
90
80
70
60
50
40
30
20
10
0
56
61
66
71
76
81

Graph no : II·8


MONEY STOCK MEASURES
M3 & G N P (Rs Crore)
220
200
180
160
140
120
100
80
60
40
20
0
55
61
65
71
76
81
TIME (in year)
M3
GNO