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UNITED NATIONS

HAS MONETARISM FAILED IN INDIA? THE CASE OF MISSING INFLATION

by

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INTRODUCTION

Policy makers tend to assess the veracity of economic theories by their simplicity and their applicability in practice. Perhaps realizing this, monetarists have stressed the simplicity of their message: "inflation is always and everywhere a monetary phenomenon". More specifically, to a monetarist the steady state inflation rate is equal to the rate of growth of money supply less the rate of growth of real gross national product (see Johnson (1972a, 1972b), Laidler and Parkin (1975), Meiselman (1975) and Gordon (1977)).

The faith placed on such a characterization of the process of inflaton in India, both by Indian policy makers and several academic economists, was severely undermined in the second half of the 1970s when the straightforward relation between the rate of inflation and the rate of growth of money per unit of real income seemed to break down: the actual rate of inflation was much lower than the simple monetarist model would have predicted.

This paper addresses this problem of "missing inflation" in the second half of the 1970s. It attempts to answer the questions: what explains the phenomenon of too much money but too little inflation during the second half of the 1970s? Can this be explained by certain modifications to the traditional monetarist model or should we abandon monetarism altogether as an aid to understanding the problem of inflation in India?

A. MONEY SUPPLY, REAL GDP AND INFLATION: THE RECORD

On a yearly basis, the traditional monetarist model performed poorly for the Indian economy. The yearly rate of inflation had very little relationship with the rate of growth of money supply and the rate of growth of real GDP (see table I).

To a monetarist, this is only to be expected in the short run because outside a steady state, changes in the expected inflation rate (which is normally assumed to be formed adaptively) and the presence of adjustment lags in the demand for money tend to violate the equality between the rate of inflation and the rate of growth of money per unit of real income.[1]

The five yearly average growth rates of money, GDP and prices (see table II) indicated that the basic long-run proportionality suggested by the monetarist model worked extremely well for the period 1960 - 1975 and from 1980-1985.[2]

However, even this long-run relationship failed notably in the five-year period 1975-1980 as inflation was actually 10 per cent lower than the traditional monetarist model would have predicted. As a mirror image of this, the income velocity of money has been consistently lower during these years than in the rest of the period: averaging 2.7 between 1975-1980 compared to 3.7 in the 1960-1975 period.

In this paper we explore two possible explanations for this anomaly. First, following Chetty (1969), Barnett (1980), Barnett and Spindt (1982), Barnett, Offenbacher and Spindt (1984), we examine the possibility that traditionally constructed monetary aggregates such as M3, are extremely inaccurate measures of money supply because they treat all substitutes for cash as perfect. A more defensible aggregation procedure would weight various components of M3 such as demand and time deposits, according to their degree of "moneyness" or their

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[1] Gordon (1984b) has also stressed the importance of the gradual adjustment of prices to their equilibrium levels in determining the time span in which the monetarist model adjusts to achieve proportionality.

[2] A similar result is obtained if three-year moving averages of growth rates of money, income and prices are used.

Table I. Performance of the monetarist model in India

Year	Money supply growth ($\dot{M3}$)	GDP growth ($\dot{GDP}$)	Predicted inflation ($\dot{M3}$-$\dot{GDP}=\hat{P}$)	Actual inflation[a] ($\dot{P}$)	Difference ($\hat{P}$ - $\dot{P}$)
1960/1961	6.7	6.9	−0.2	0.4	−0.6
1961/1962	2.5	3.6	−1.1	2.2	−3.3
1962/1963	9.8	2.1	7.7	4.1	3.6
1963/1964	9.1	5.1	4.0	8.7	−4.7
1964/1965	10.0	7.9	2.1	8.9	−6.8
1965/1966	10.2	−5.2	15.4	9.3	6.1
1966/1967	11.3	1.0	10.3	14.5	−4.2
1967/1968	9.0	8.7	2.3	7.8	−5.5
1968/1969	10.7	2.7	8.0	−0.4	8.4
1969/1970	13.4	6.4	7.0	4.0	3.0
1970/1971	16.8	5.6	11.2	3.0	8.2
1971/1972	14.5	1.6	12.9	5.2	7.7
1972/1973	16.4	−1.1	17.5	11.3	6.2
1973/1974	19.8	4.7	15.1	18.8	−3.7
1974/1975	13.6	0.9	12.7	16.7	−4.0
1975/1976	12.1	9.5	2.6	−4.2	6.8
1976/1977	20.1	0.7	19.4	6.9	12.5
1977/1978	19.8	8.8	11.0	3.7	7.3
1978/1979	20.8	5.8	15.0	2.0	13.0
1979/1980	20.2	−5.3	25.5	15.2	10.3
1980/1981	16.5	7.8	8.7	11.1	−2.4
1981/1982	17.3	5.4	11.9	9.3	2.6
1982/1983	14.3	1.8	12.5	8.3	4.2
1983/1984	17.2	7.6	9.6	11.8	−2.2
1984/1985	16.7	3.5	13.2	10.4	2.8

[a] The GDP deflator for 1983/84 and 1984/85 is provisional and estimated, respectively.

Table II. Performance of the monetarist model: a long-run view

Five-year period From April	To March	Average money supply growth (M3)	Average GDP growth	Predicted inflation	Actual inflation	Difference (predicted—actual)
1960	1965	7.6	5.1	2.5	4.8	−2.3
1965	1970	10.9	2.7	8.2	7.0	1.2
1970	1975	16.2	2.3	13.9	11.0	2.9
1975	1980	18.6	3.9	14.7	4.6	10.1
1980	1985	16.4	5.2	11.2	10.2	1.0

degree of substitutability for currency. In section B we check whether the phenomenon of missing inflation during 1975-1980 is merely a result of faulty aggregation. In sections C and D we analyse the monetarist argument that the missing inflation could be explained in terms of shifts in the money demand function. In particular we focus on possible reasons for this shift during these years. In this analysis we draw extensively on evidence from similar monetary episodes in the United States of America: the well-known Goldfeld puzzle of "missing money" in 1974 and 1976, and the relatively lesser known case of 1981-1983 of too little inflation (Goldfeld (1976), Laider (1980), Judd and Scadding (1982), Barnett and others (1984), and Gordon (1984b)).

The conclusions of the paper are presented in section E.

B. DISAGGREGATION OF MONETARY AGGREGATES

Barnett and others (1984) argue that the large post sample prediction errors of conventional money demand functions reported by Goldfeld (1976) could be due to the use of simple monetary sums. They also show that these prediction errors are much smaller for money demand functions with properly weighted monetary aggregates. In the Indian context we notice that the various components of money supply have exhibited very different growth rates (see table III). The more distant substitutes for currency - fixed and savings deposits - have tended to grow much faster than near-money components.

Although the commonly used measures of money supply distinguish conceptually between the liquidity

Table III. Rates of growth of components of money supply

From April	To March	M3	Currency with the public	Current deposits with banks	Saving deposits with banks	Fixed deposits with banks
1960	1965	8.3	7.7	7.6	19.3	9.2
1965	1970	12.2	7.9	13.7	17.3	16.0
1970	1975	15.3	9.6	16.9	19.7	20.5
1975	1980	19.4	13.7	19.3	24.0	22.9

of alternative monetary assets (M1 which includes currency and demand deposits is more liquid than M3 which also includes time deposits) both M1 and M3 are simple arithmetic sums of their respective components. Accepting Barnett's and others arguments we have attempted to work out growth rates in monetary aggregates by applying weights to their components before applying such growth rates for prediction purposes.

In order to devise a suitable weighting scheme we followed Chetty (1969) and attempted to estimate empirically the degree of substitution between currency, C, the most readily convertible of all monetary assets, and each of the other assets: current deposits, D, savings deposits, S, and fixed deposits, F.

Assume a CES (constant elasticity of substitution) utility function:

$$U = (\beta_0 C^{-\rho} + \beta_1 D^{-\rho 1} + \beta_2 S^{-\rho 2} + \beta_3 F^{-\rho 3})^{1/\rho} \quad (1)$$

Maximizing U with respect to the consumer's budget constraint:

$$M = f(Y, r_D, r_S, r_F)$$

$$= C + \frac{D}{1+r_D} + \frac{S}{1+r_S} + \frac{F}{1+r_F} \quad (2)$$

where Y is income and r_D, r_S, and r_F represent respectively the annual rates of return on current deposits, savings deposits and fixed deposits of the current period.

We get (see Chetty (1969))

$$\log X_j = -\frac{1}{\rho_j + 1} \log \frac{\beta\rho}{\beta_j \rho_j} - \frac{1}{\rho_j + 1} \log \frac{1}{1 + r_j} + \frac{\rho + 1}{\rho_j + 1} \log C \quad (3)$$

where j = D, S, F

and

$$\log C = \alpha_0 + \alpha_1 \log (1 + r_D) + \alpha_2 \log (1 + r_S) + \alpha_3 \log (1 + r_F) + \alpha_4 \log Y \quad (4)$$

By estimating the above set of equations we can obtain estimates of ρ, ρ_1, ρ_2 and ρ_3. The adjusted monetary aggregate is then given by:

$$M' = C^{-\rho} + \beta_D D^{-\rho_1} + \beta_S S^{-\rho_2} + \beta_F F^{-\rho_3} \quad (5)$$

where β_D, β_S, and β_F are derived from (3) by using an appropriate normalization rule.

The estimated set of equations (3) were as follows :

$$\log D = \underset{(8.97)}{-3.166} - \underset{(1.70)}{11.768} \log \frac{1}{1 + r_D} + \underset{(19.10)}{1.217} \log C$$

$$\log S = \underset{(32.91)}{-8.300} - \underset{(2.82)}{4.887} \log \frac{1}{1 + r_S} + \underset{(41.48)}{1.824} \log C$$

$$\log F = \underset{(13.70)}{-7.839} - \underset{(0.22)}{0.653} \log \frac{1}{1 + r_F} + \underset{(19.43)}{1.899} \log C$$

The weights derived from these equations are unreasonable and cannot be used in any aggregation procedure. While the method suggested by Chetty (1969) is intuitively very appealing and theoretically sound, since it is based on OLS regression coefficients it gives unreliable results - which may be one reason why this method has not been widely implemented. Moreover, as Barnett (1982) says "while in principle, (the utility function) could be specified and estimated, aggregates depending on estimated parameters are usually regarded as inappropriate for publication by government agencies".

In the search for an appropriate index for money supply growth, Divisia indices of monetary aggregates have been developed for the United States, United Kingdom of Great Britain and Northern Ireland and other countries (Barnett and Spindt (1982), Barnett and others (1984)). In these cases, the Divisia has been shown to have a number of desirable properties and to provide a more satisfactory explanation of the historical movement of various related monetary variables.

A Divisia index merely defines the growth rate of M3 in any period as a weighted sum of the growth rates of the various components of M3. The weights are carefully constructed value shares computed with the "user cost" of each component as prices. The user cost of a monetary component essentially represents the interest forgone and hence the opportunity cost of holding the component (i) during a period (t):

the current period user cost, ρ_{it} is:

$$\rho_{it} = \frac{P_t^* (R_t - r_{it})}{1 + R_t}$$

where R_t = maximum available yield in the economy on any monetary asset.

r_{it} = own rate or return of monetary asset i.

P_t^* = true cost of living index.

A major problem encountered in computing the user cost in the Indian context is the non-availability of data on interest rates, particularly on the maximum available yield (R_t). We selected the call money rate as a proxy for R_t as it is perhaps the least regulated amongst the rates of interest in the organized sector. With regard to the own rate of return on monetary components, continuous time series data are available only on one-year fixed deposits with banks. The rate of interest on post office saving deposits is used as a proxy for the own rate of return on saving deposits with banks.

While banks do not pay explicit interest on current account deposits, there is an implicit return on these deposits. We use the familiar Klein (1974) procedure to estimate the implicit rate of interest on current deposits.

In the computation of user costs, all the interest rates used must relate to the same holding period. Since the call money rate (R_t) applies to loans of 15-day holding periods, the one-year fixed deposit rate was converted to a 15-day holding period basis by using the estimated yield curves on government securities.

Using the procedure adopted by Heller and Khan (1979) we estimated yearly yield curves from government securities for the period 1960 to 1983 using the following specification:

$$r_i = \delta_0 + \delta_1 T_i + \delta_2 T_i^2$$

where r_i = interest rate on the ith government security.

T_i = maturity period for the ith government security.

The estimated parameters of the yield curve are given in annex 1.

The Fisher ideal cost of living index, P_t^*, is computed as the geometric mean of the Paasche and Laspeyres price indices of private consumption expenditure. The Paasche index is nothing but the implicit price deflator for private consumption expenditure; a corresponding Laspeyres' index was constructed by using commodity-wise deflators and fixed weights at the 1970/71 base level.

Given the user cost for each component of money supply, the growth rate of the Divisia monetary aggregate is computed as:

$$\log M_t^* - \log M_{t-1}^* = \sum_i \tfrac{1}{2} (s_{it} + s_{it-1})$$

$$(\log m_{it} - \log m_{it-1})$$

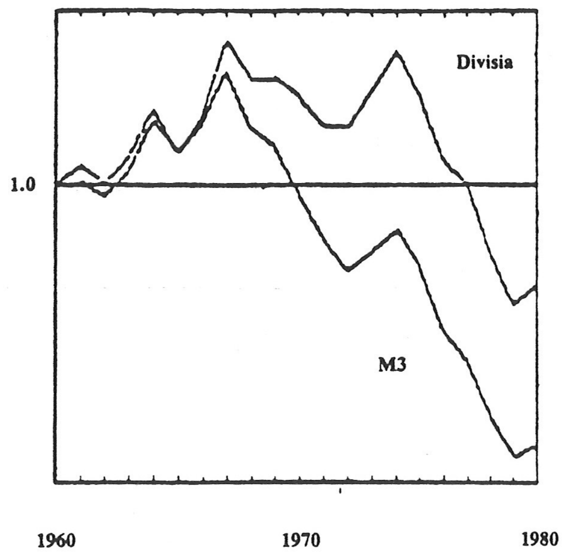
where

$$s_{it} = \rho_{it} \cdot m_{it} / \sum_j \rho_{jt} \cdot m_{jt}$$

and m_{jt} = the amount of jth component of money supply.

A normalized Divisia money supply series is derived by setting a base year (1960) = 1.0 and applying the yearly growth rate as computed above in a cumulative manner.

Figure 1. Normalized income velocity of M3 and Divisia



The income velocity of the Divisia monetary aggregate is presented in figure 1 along with the income velocity of conventional M3. The income velocity of money with Divisia monetary aggregate is lower and more stable than that of the conventional M3. However, the "missing inflation" of the second half of the 1970s could hardly be attributed to the faulty monetary aggregation involved in M3. This is quite clear from table IV.

Table IV. Monetary aggregates - average annual growth rates

From April		*To March*	*Divisia M3*	*M3 Simple sum*
1960	–	1965	7.8	8.3
1965	–	1970	9.3	12.2
1970	–	1975	12.8	15.3
1975	–	1980	17.9	19.4

The average rate of growth of Divisia money supply during the 1975-1980 period is only marginally lower than that of the conventional M3.

C. THE MONETARIST MODEL: A MODIFICATION

In the previous section, we have seen that replacing the simple monetary sum M3 with the Divisia monetary aggregate in the monetarist model could explain only a negligible part of the missing inflation of the 1975-1980 years. A fuller explanation of the puzzle thus requires a search for other plausible modifications to the conventional monetarist model.

The typical monetarist model of inflation could be derived from the following equations:

$$\log (M/P)^* = \alpha_0 + \alpha_1 \log Y + \alpha_2 r \qquad (6)$$

$$\log (M/P) = \lambda \log (M/P)^* + (1 - \lambda) \log (M/P)_{-1}$$

$$0 < \lambda \leqslant 1 \qquad (7)$$

$$r = i + \Pi^e \qquad (8)$$

Equation 6 is the standard long - run or the desired demand for real balances. It gives the "desired" demand for real balances from the public $(M/P)^*$ as a function of real GDP, Y, and the nominal rate of interest, r. However, because of portfolio adjustment costs, actual money balances (M/P), are not always equal to the desired amount. Only a portion (λ) of the gap between desired and actual real balances is closed in a single discrete time period, say, a year or a quarter. This is the familiar partial adjustment hypothesis that underlies equation (7). Equation (8) is the well-known Fisherian hypothesis that the nominal rate of interest, r is equal to the real rate, i, plus the expected inflation rate, Π^e.

Following Friedman (1970), if we resort to the "as if" assumption that the real rate of interest is constant over time (i.e., $i = \bar{i}$) equations 6 through 8 can be combined to yield:

$$\log P = \alpha_0' + \log M - \lambda\alpha_1 \log Y - \lambda\alpha_2 \Pi^e - (1 - \lambda) \log (M/P)_{-1} \quad (9)$$

where

$$\alpha_0' = -\lambda (\alpha_0 + \alpha_2 \bar{i})$$

In the long run, equation 9 reduces to:

$$\log P = \alpha_0^{*} + \log M - \alpha_1 \log Y - \alpha_2 \Pi^e \quad (10)$$

where

$$\alpha_0^{*} = -(\alpha_0 + \alpha_2 \bar{i})$$

or

$$(\log P - \log P_{-1}) = (\log M - \log M_{-1}) - \alpha_1 (\log Y - \log Y_{-1}) - \alpha_2 (\Pi^e - \Pi^e_{-1}) \quad (11)$$

If we further assume that the income elasticity of demand for money, α_1 is unity and that inflation expectations are formed "adaptively", it can be shown from equation (11) that the steady state inflation rate is equal to the rate of growth of money supply minus the rate of growth of real income. This is the familiar long-run relationship between inflation on the one hand and money supply and real GDP on the other stressed by the monetarist - a relationship which held reasonably well till 1975 but failed during the next five years.

The two important assumptions required for the monetarist result just mentioned are: (a) the real rate of interest is approximately constant over time, and (b) inflation expectations are formed adaptively. It is possible that the failure of the conventional monetarist model during the post-1975 years has something to do with these assumptions.

In a typical classical framework, the real rate of interest is determined by the equality of savings and investment (see Patinkin (1972)). Most, if not all, monetarists would adhere to such a classical view of interest rate determination. It is, in general, consistent with the monetarist model of aggregate economic activity that treats the real rate of interest as exogenous to the process of nominal income determination (see Friedman (1970)). A "rock-bottom" version of such a model of interest rate determination could be specified as:

$$s = s_0 + s_1 . i \qquad s_1 > 0 \quad (12)$$

$$h = h_0 + h_1 . i \qquad h_1 < 0 \quad (13)$$

$$s = h \quad (14)$$

where

s = the savings rate

h = the investment rate.

Equations 12 and 13 are the savings and the investment functions of the "rock-bottom" model, where s_0 and h_0 give the "autonomous"[3] components of the savings and investment rates, respectively. Equation 14 is the equilibrium condition - the well-known equality between savings and investment. Solving for i from equations 11 through 14, we have:

$$i = (h_0 - s_0)\, 1/\Delta \quad (15)$$

where

$$\Delta = (s_1 - h_1) > 0$$

Equation 15 yields a very appealing result: the real rate of interest is a positively sloped function of the autonomous investment rate less the autonomous savings rate. So long as the difference between the autonomous investment and savings rates remains approximately constant over time, the real rate would also remain constant over time. In the Indian context, this result throws some light on an important phenomenon: the perceptible increase in the savings rate since the mid-1970s and its possible relevance for the missing inflation puzzle. The savings rate which stood at about 15 per cent in the first half of the 1960s slowly increased to around 19 per cent during the first half of the 1970s. It then jumped to around 25 per cent in the mid-1970s.

Such a sudden and substantial shift in the savings rate might have caused a considerable drop in ($h_0 - s_0$), resulting in a substantial fall in the real rate of interest. The fall in the real rate would have led to

[3] Autonomous in the sense that they are independent of the rate of interest.

an increase in the money demand per unit of real GDP, thus leading to a lower rate of inflation per given rate of growth of money per unit real GDP. If this is true, the monetarist model needs to be modified to take account of the changes in the real rate of interest.

A straightforward way of incorporating this modification is to include the market rate of interest in the money demand function, instead of including the real rate and the expected rate of inflation as proxies for it. In the Indian context, such an amendment of the conventional monetarist model is ruled out since we do not have data on proper market rates of interest. Almost all the published interest rates relate to the organized segment of the capital market and are pegged at artificial levels by the government. Hence, these rates do not reflect the demand-supply pressures in the capital market.[4]

In the absence of data on a proper market rate of interest, a possible way of incorporating changes in the real rate of interest in the conventional monetarist model is to substitute the expression for i from 15 in equation 8. Empirically, however, it is difficult to disentangle the autonomous components, s_0 and h_0 from the observed investment and the savings rates, h and s . However, if we assume that the autonomous investment rate, h_0 has not changed drastically from year to year and that the interest-induced yearly changes in the savings rate is a small proportion of the average savings rate, equation 15 can be approximated by :

$$i = \Phi_0 + 1/\Delta\, s \qquad (16)$$

where

Φ_0 is a constant which is approximately equal to (h_0/Δ).

Since s is observable, equation 16 can be substituted in equation 8 and the resulting price equation can be estimated. With this modification equations 9 and 10 respectively can be rewritten as:

$$\begin{aligned} \log P = & -(\lambda\alpha_0 + \alpha_2\phi_0) + \log M - \lambda\alpha_1 \log Y \\ & - \alpha_2\lambda\Pi^e \qquad (17) \\ & - (\alpha_2\lambda/\Delta)\, s - (1 - \lambda) \log (M/P)_{-1} \end{aligned}$$

and

$$\begin{aligned} \log P = & -(\alpha_0 + \alpha_2\phi_0) + \log M - \alpha_1 \log Y \\ & - \alpha_2\Pi^e - (\alpha_2/\Delta)\, s \qquad (18) \end{aligned}$$

We still have an unobservable variable in equations 17 and 18, i.e., the expected inflation rate, Π^e. The typical monetarist specification that Π^e is formed through the adaptive expectations model may not be a good approximation to Indian situations where inflation has been intermittent. Inflation in India had a typically "stop-go" cyclical path with two-to-three years of high (double-digit) inflation followed by a two-to-three-year period of moderate inflation rates. Under such an inflationary experience, "adaptively" formed inflation expectations are bound to be off the mark most of the time, especially if the length of the "stop-go" cycle is highly variable across cycles. Thus, it is only reasonable on the part of the public to look for relevant information other than just the past rates of inflation while forming expectations. Other relevant information would include the values of the variables which the public "perceives" to be the determinants of inflation.

Thus, one alternative to the adaptive expectation formation hypothesis is to assume that the expected inflation rate is equal to the inflation rate predicted from the model itself - the assumption that expectations are rational. However, as Fair (1984) states:

> The assumption that expectations are rational is not necessarily a good approximation to the way that expectations are actually formed. The assumption implies that agents know the model and this may not be realistic for many agents. In order to test assumptions that are in between the simple assumption that expectations of a variable are a function of its current and past values and the assumption that expectations are rational, one possibility is to assume that expectations of a variable are a function of not only its current and past values but also other variables' current and past values..... One could estimate a small model of how expectations are formed before estimating the basic model. Expectations are not rational in this case because they are not predictions from the basic model, but are based on more information than merely the current and past values of one variable.

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[4] The only interest rate that has some semblance of a market-determined rate (see Acharya and Madhur (1983 and 1984)) is the bazaar bill rate - perhaps the only rate that has yielded a significant negative interest elasticity of money-demand in India (see Ahluwalia (1979)). Unfortunately, the Reserve Bank of India stopped publishing this rate since the mid-1970s.

Following this line of reasoning, we specify the following sub-model for the expected inflation rate:

$$\Pi^e_t = \beta_0 + \sum_{i=1}^{n} \beta_{t-i} \Pi_{t-i} + \sum_{j=1}^{k} r_j Z_j \qquad (19)$$

where

Π_t is the inflation rate ($\log P - \log P_{-1}$) and the Z_j's are variables other than the lagged inflation rates which the public perceives to be the determinants of inflation.

In equation 19, Π^e is not observable. One possible way of computing a series on Π^e is to estimate equation 19 with the actual inflation rate as the dependent variable by using data till the $t-1^{th}$ year and get a post-sample forecast of the dependent variable for the t^{th} year. If we repeat this process for a number of years, we will have a time series of the expected inflation rate, Π^e- which is nothing but the post-sample forecasts of the actual inflation rate from an estimate of the public's expectation formation equation - equation 19.

Methodologically, such a procedure of generating the expected inflation rate is similar to that of generating the "anticipated" component of the growth in money supply used by Barro (1977 and 1978). It is also very similar to the method of computing the "systematic" component of a variable used by Sargent (1976).

The Z_j's we considered in estimating equation 19 are: the government's budget deficit planned for in the budget, union excise tax rate (ratio of budgeted union excise revenue to one year lagged nominal GDP), and the per capita food stocks with government and the real foreign exchange reserves with the government, the last two variables lagged by a year. The hypothesis here is that a higher budget deficit and the excise tax rate planned for in the budget make the public revise the expected inflation rate upwards and higher food and foreign exchange stocks with the government cause a downward revision in the expected inflation rate. However, the budget deficit and the foreign exchange reserves were dropped from the final estimating equation owing to their counter-intuitive coefficients. The expectation formation equation which is finally retained has as its arguments twice lagged inflation rate, the excise tax rate and the lagged per capita food stocks with the government.

Table V indicates the relation between the savings rate, the expected inflation rate (derived from an estimate of equation 19 according to the procedure outlined above) and the problem of missing inflation.

It is noted that the level of missing inflation is in general positively related to the savings rate and is negatively related to the expected inflation rate. In particular, the sharp increase in the 1975-1980 years is associated with the steep increase in the savings rate and the virtual halving of the expected inflation rate from around 6.4 per cent to 3.7 per cent. However, to what extent changes in the savings rate and the expected inflation rate explain the missing inflation puzzle of the second half of the 1970s depends on the effect of a unit change in the savings rate and the expected inflation rate. A measure of this effect can be obtained if we estimate the modified monetarist model - equation 17. This is done in the next section.

Table V. Savings, expectations and missing inflation

From April		*To March*	*Savings rate (S)*	*Expected inflation rate*[a]	*Missing inflation (from table II)*
1960	—	1965	14.9	3.5	−2.3
1965	—	1970	16.6	7.8	1.2
1970	—	1975	19.3	6.4	2.9
1975	—	1980	25.2	3.7	10.1
1980	—	1983	25.5	7.3	1.0

[a] Computed from estimated equation 19 - the expectations sub-model.

D. THE MONETARIST MODEL: ESTIMATES

The OLS estimate of equation 17 is not meaningful unless there is unidirectional causality from the independent variables to the dependent variables. If there is a two-way causation between the independent and the dependent variables, the parameter estimates could suffer from simultaneity bias. It is sometimes argued that the relationship between the supply of money and the price level could be bi-directional rather than unidirectional as is assumed by the monetarist model. Similarly, real GDP, Y, may not be completely exogenous to P if the aggregate supply function has a positive price elasticity.

To check for the causality between money supply and the general price level, we applied the causality test developed by Granger, using monthly data on the broader concept of money, M3 and the general price level (represented by the wholesale price index for all commodities). The F-statistics of this test applicable for alternative lags are presented in table VI. In general (except for the case with the lag length of 18 months), the hypothesis that P does not cause M3 is not rejected at the 1 per cent level - most of the F-values in column 2 of table VI are not significant at the 1 per cent level. On the other hand, the hypothesis that M3 does not cause P is rejected unequivocally at the 1 per cent level.

From the results of table VI, it seems unlikely that P would have caused M3 though the results are somewhat sensitive to the selection of the lag length. However, it is clear that the hypothesis that $\dot{M}3$ does not cause $\dot{P}$ is rejected irrespective of the lag length chosen. If we had monthly or even quarterly data on Y, similar causality tests could have been performed between P and Y. In the absence of such data, we simply proceed on the assumption that Y is exogenous to P.

Table VII presents the OLS estimates of equation 17 for alternative sample periods starting from 1961/62. Since the partial derivative of log M is unity in equation 17, in the regressions of table VII, the coefficient of log M is constrained to unity.

The parameter which is most important to us is the coefficient of the savings rate, S. This coefficient is statistically significant in almost all the regressions; its significance is higher during the post-1974 years than during the pre-1974 years. The short-run and the long-run effects of a percentage point increase in the savings rate is to reduce the inflation rate by around 1.5 and 3 per cent, respectively.

The expected inflation rate Π^e, computed from the expectation-formation submodel, has a significant effect on the actual inflation rate. In the short run, a 1 per cent increase in the expected inflation rate leads to an around 0.6 per cent increase in the inflation rate. The corresponding long-run effect is around unity.

The average partial adjustment coefficient (λ) is around 0.5 which implies a mean adjustment lag of around two years. The short-run income elasticity of the money demand function ($\alpha_1 \lambda$) given by these regressions is around 0.65. The long-run income elasticity at around 1.3 is quite close to unity, thereby supporting the monetarist result that in the long run a percentage increase in the real GDP would be accompanied by a percentage decrease in the inflation rate.

Table VI. Results of causality test[a] between $\dot{M}_3$ and $\dot{P}$

Length of the lag in months	*F values for*	
	H_0 : $\dot{P}$ does not cause $\dot{M}3$	*H_0 : $\dot{M}3$ does not cause $\dot{P}$*
6	1.58	3.44
12	1.26	2.66
18	2.02	2.68
24	1.69	2.20
30	1.91	1.99

[a] Total number of observations is 115.

Table VIII presents the estimated regression results of the conventional monetarist model with static price expectations and the assumption that the real rate of interest is constant over time.[5] An important feature of these regressions is the consistently large coefficient of the lagged real money supply and hence a small coefficient of adjustment of actual money demand to its desired level, (λ). The average λ value is about 0.29 implying an unreasonably long lag in the adjustment of the actual money balances to their desired levels. The mean lag works out to be about 3.35 years.

As a result of the rather small value of λ, the estimate of the long-run income elasticity of money demand works out to be above 2 in most of these regressions. On an average it is 2.2. Such a high value of the income elasticity of demand for money seems rather implausible.

One of the reasons for the rather large coefficient of lagged money supply in the conventional model could be the specification error introduced by the omission of the savings rate. It is possible that the lagged money supply captures part of the effect of this left-out variable and hence introduces upward bias in the estimates of its coefficients.[6]

[5] In Lahiri and others (1984) it is found that the coefficient of adaptive expectation formation in a conventional money demand function for India is not significantly different from unity. This is why we are restricting ourselves to static expectations in these equations.

[6] For arguments of a similar nature that offer "shifts" in the Phillips curve as an explanation of the unreasonably large coefficient of the lagged money supply found in the United States studies, refer to Gordon (1984a).

Table VII. Regression results on the modified monetarist model dependent variable: (log P − log M3)

Sample period	*Constant term*	*Coefficients of variables*				$\bar{R}^2$	*D.W.*
		Log Y	*Log (M3/P)*$_{-1}$	Π^e	*S*		
1961-62 to 1974-75	2.210 (1.75)	−0.701 (3.52)	−0.415 (1.98)	0.723 (1.89)	−1.728 (1.20)	0.9369	1.57
1961-62 to 1975-76	2.181 (1.75)	−0.761 (4.17)	−0.332 (1.83)	0.832 (2.35)	−2.367 (2.00)	0.9714	1.70
1961-62 to 1976-77	2.420 (2.12)	−0.754 (4.27)	−0.375 (2.32)	0.711 (2.52)	−1.874 (2.26)	0.9786	1.85
1961-62 to 1977-78	2.437 (2.24)	−0.757 (4.52)	−0.374 (2.42)	0.725 (2.95)	−1.891 (2.43)	0.9850	1.88
1961-62 to 1978-79	2.339 (2.23)	−0.747 (4.59)	−0.371 (2.47)	0.754 (3.20)	−2.043 (2.83)	0.9892	1.87
1961-62 to 1979-80	2.295 (2.06)	−0.586 (4.23)	−0.559 (5.33)	0.578 (2.59)	−1.562 (2.22)	0.9901	1.80
1961-62 to 1980-81	2.423 (2.28)	−0.575 (4.30)	−0.589 (6.80)	0.548 (2.60)	−1.421 (2.24)	0.9919	1.80
1961-62 to 1981-82	2.687 (2.72)	−0.579 (4.40)	−0.617 (8.00)	0.526 (2.56)	−1.211 (2.15)	0.9931	1.80
1961-62 to 1982-83	2.787 (2.90)	−0.573 (4.44)	−0.637 (9.12)	0.490 (2.52)	−1.104 (2.09)	0.9941	1.77
1961-62 to 1983-84	2.787 (3.13)	−0.573 (4.60)	−0.637 (9.72)	0.490 (2.66)	−1.104 (2.31)	0.9949	1.79

Note: Figures in parenthesis give t-values.

Table VIII. Regression results on the conventional monetarist model dependent variable: (log P - log M3)

Sample period	Constant term	Coefficients of variables: Log Y	Log (M3/P)$_{-1}$	Π_{-1} = (log P_{-1} -log P_{-2})	$\bar{R}^2$	D.W.
1961-62 to 1974-75	3.076 (4.72)	−0.555 (4.79)	−0.711 (8.72)	0.640 (4.30)	0.9841	3.11
1961-62 to 1975-76	3.956 (4.52)	−0.678 (4.23)	−0.667 (5.71)	0.493 (2.38)	0.9727	2.06
1961-62 to 1976-77	3.871 (4.91)	−0.678 (4.40)	−0.658 (6.09)	0.458 (2.90)	0.9800	2.48
1961-62 to 1977-78	4.071 (5.17)	−0.670 (4.26)	−0.689 (6.41)	0.465 (2.89)	0.9840	2.49
1961-62 to 1978-79	4.162 (5.21)	−0.644 (4.06)	−0.729 (6.99)	0.488 (3.00)	0.9875	2.40
1961-62 to 1979-80	4.252 (5.85)	−0.672 (5.18)	−0.707 (9.16)	0.488 (3.08)	0.9904	2.44
1961-62 to 1980-81	4.209 (6.00)	−0.655 (5.44)	−0.721 (10.66)	0.463 (3.24)	0.9922	2.43
1961-62 to 1981-82	4.209 (6.18)	−0.657 (5.65)	−0.719 (11.30)	0.464 (3.37)	0.9936	2.44
1961-62 to 1982-83	4.216 (6.33)	−0.665 (5.89)	−0.711 (11.76)	0.467 (3.47)	0.9945	2.40
1961-62 to 1983-84	4.080 (5.91)	−0.658 (5.59)	−0.704 (11.19)	0.462 (3.29)	0.9946	2.14

Note: Figures in parenthesis give t-values.

To be sure that the upward bias in the coefficient of lagged money supply in the regressions of table VIII is due to the omission of the savings rate rather than due to the static expectation formation hypothesis, we re-estimated the regressions of table VIII with the lagged inflation rate replaced by the expected inflation rate Π^e of table VII. The estimates of λ at around 0.3 found in these equations were very close to those in the regressions of table VIII, thus implying a rather long adjustment lag of about 3 years and an income elasticity of money demand of about 2.

As a further test of the modified monetarist model, we compare its post-sample forecasting accuracy with that of the conventional monetarist model. For this both the modified and the conventional monetarist models were dynamically simulated for the post sample period 1975-1983. The root mean squared error (RMSE) of the inflation rates so predicted is consistently lower for the modified model. For the full post sample period 1975-1983, the RMSE for the modified model (3.7 per cent) is approximately two thirds of that for the conventional model (5.9 per cent). For the problematic subperiod of 1975-1980 also, the RMSE for the modified model at 4.4 per cent is about two thirds of that for the modified model (6.4 per cent).

In order to see to what extent changes in the savings rate and the expected inflation rate contributed to the "missing inflation" of the 1975-1980 years, the modified monetarist model was dynamically simulated for the period 1975-1983 under two counterfactual scenarios assuming that: (a) For the period 1975-1983 the savings rate remained at its pre-1975 level of 0.20; (b) In addition to (a) the expected inflation rate remained at 0.10 per cent - its average value during 1970-1975.

The results of these counterfactual simulations are presented in figures 2 and 3.

It is clear that had the savings rate not risen in the 1975-1980 period, the rate of inflation would have been substantially higher than it actually was (figure 2). The savings rate increased sharply during the 1975-1980 period and then levelled off in the post-1980 period. Since it is the change in the savings rate that affects the rate of inflation, the counterfactual results are not very different from the actual (dynamic simulation) figures for the 1980-1983 period. Figure 3 shows that besides the higher savings rate, the lower expected inflation rate that characterized the 1975-1980 years also had a substantial effect on the rate of inflation. The rate of inflation during the 1975-1980 years would have been approximately 5 per cent higher without the higher savings rate and the lower expected inflation rate that characterized this period.

E. CONCLUSIONS

The traditional monetarist model provides a reasonably good explanation of inflation in the Indian economy between 1960 and 1975 and in the post-1980 period. It, however, appears to completely break down in the 5-year period between 1975 and 1980 during which the actual inflation rate was 10 per cent per annum lower on average than the conventional model would have predicted. Two plausible explanations of this phenomenon of missing inflation are examined.

The 1970s witnessed a more rapid growth in fixed and savings deposits than in the other two components of money supply: currency with the public and current deposits with banks. It is argued that the inflationary effect of a growth in fixed deposits is substantially lower than a growth in currency or current deposits because of the lower degree of "moneyness". Simple sum aggregates like M3, however, do not take into account this difference in the degree of moneyness among its components. Consequently, in this situation a monetarist model which uses M3 would tend to overestimate inflation.

A weighted aggregate, such as a Divisia index, overcomes this aggregation problem. Accordingly a Divisia index of M3 was constructed and its temporal behaviour analysed and compared with that of the simple sum M3. The growth rate in Divisia M3 is,

Figure 2. Savings rate set at pre-1975 levels (20 per cent)

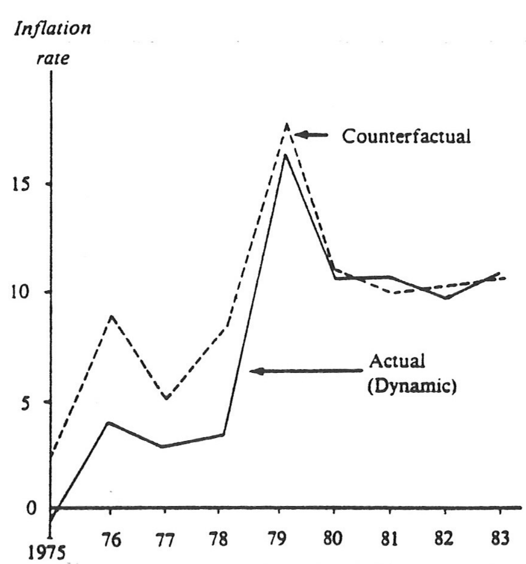
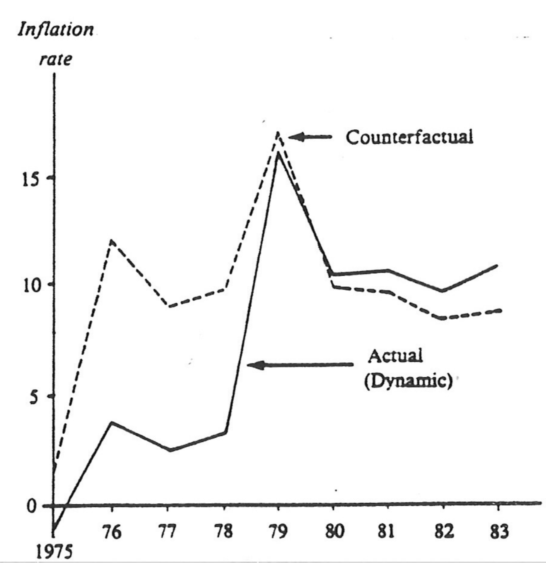


Figure 3. Savings and expected inflation rate set at pre-1975 levels



however, only marginally lower. Hence, replacing simple M3 by a Divisia index in the monetarist model does not explain the inflation puzzle of the late 1970s.

An alternative modification of the conventional monetarist model takes into account the unprecedented increase in the savings rate during the second half of the 1970s. A rise in the savings rate tends to depress the real rate of interest and thereby increases the demand for money. Consequently, an upward shift in the savings schedule implies a reduction in the excess supply of money and lowers the rate of inflation. The monetarist model incorporating this modification explains about half the missing inflation in the 1975 to 1980 period.

Annex I. Estimated parameters of the yield curve on government securities

Yield curve: $r_i = \delta_0 + \delta_1 T_i + \delta_2 T_i^2$

Where r_i = interest rate on ith government security.

T_i = maturity period for the ith government security.

Year	δ_1	δ_2	δ_3
1960-1961	3.23433	0.07569	−0.00182
1961-1962	3.06911	0.11928	−0.00349
1962-1963	3.13065	0.14023	−0.0039
1963-1964	3.30757	0.13209	−0.00386
1964-1965	3.24689	0.14841	−0.00414
1965-1966	3.74793	0.18584	−0.00561
1966-1967	3.99881	0.15763	−0.00444
1967-1968	4.06747	0.119248	−0.00287
1968-1969	3.66637	0.097326	−0.00134
1969-1970	3.67036	0.09148	−0.00103
1970-1971	3.63288	0.11385	−0.00172
1971-1972	3.88365	0.13450	−0.00256
1972-1973	4.14386	0.11689	−0.00206
1973-1974	4.32523	0.08669	−0.00132
1974-1975	4.84402	0.08839	−0.000129
1975-1976	5.05741	0.08477	−0.00133
1976-1977	4.92511	0.09437	−0.00149
1977-1978	4.83596	0.11846	−0.00243
1978-1979	4.91512	0.10709	−0.00171
1979-1980	4.78830	0.14264	−0.00267
1980-1981	4.75007	0.15367	−0.00315

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