MONETARY MANAGEMENT IN INDIA

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The objective of this paper is to analyse the management of the monetary system by the Reserve Bank of India during the period of economic reform measures since 1991 at the back drop of the scenario obtained prior to 1990s. As monetary policy is a crucial weapon in the hands of the central bank, an attempt is made to critically appraise the efficacy of the same in achieving the goals of growth, inflation control or price stability, fiscal stability, exchange rate stability and promotion of foreign exchange reserves.

Maintenance of a sound monetary system is the basic objective of any central bank of a nation as aptly remarked by De kock. The term monetary management involves four major issues. (Rangarajan, 1994). They are (1) price stability (2) control over money supply (3) again control over money stock in the light of reserve money creation due to RBI credit to government and (4) rationalization of administered interest rate.

Overview of the system of monetary management prior to 1990s

Inflation targeting is an accepted goal of monetary policy in many nations. However, there are wide differences among them as regards the choice of inflation rate. Cross-country experiences show that a Monetary Conditions Index (MCI) is used by those nations (Kanagasabathy, 2001) which target short term interest rate as well as exchange rate.[1] Thus in any economy inflation targeting involves use of policy discretion by the central bank. This logically results in the autonomy of the central bank. For instance, how far the RBI could afford to break the nexus between monetary and fiscal authorities? Secondly, how far the RBI could control the interest rates? Thirdly, to what extent the RBI could check monetization of debt and central fiscal deficit?

The pre-1990s time period was characterized by

(a) Existence of a spectrum of interest rates with built in elements of concessionality and cross subsidization to meet the priorities assigned to different sectors.

(b) Rate of return on government securities was fixed and was lower than market rates.

(c) Resolution of deposit rates and borrowing rates to maintain the cost of funds in relation to lending ratio.

(d) Unlimited accommodation through adhoc treasury hills to meet budgetary deficits of the central government

(e) Maintenance of high CRR and SLR of 15 per cent and 38.5 per cent respectively.

(f) Lack of depth in government securities market on account of application of lower than market coupons and

(g) Lack of depth and vibrancy in money market.

Scenario obtained during the period of reforms – The post 1990s

High trajectory growth and macro economic and financial stability seem to be the distinguishing features of India in recent times since the advent of economic reforms. The economy having been opened up, integrated with global financial sector seems to have developed the resilience, particularly in the wake of global shocks, the September 11 incident in US, border tensions, Sanctions imposed after the nuclear tests, political uncertainties and the oil shock.[2]

In the current situation, monetary policy aims at striking a fine balance between high growth rate and price stability. This obviously warrants an optimal allocation of financial resources to productive sectors of the economy. Financial stability has gained greater significance due to opening up of the economy. As rightly observed by Rakesh Mohan, (2007) “strong synergies and complementarities are observed between price stability and financial stability.

At this background, the RBI has resolved to a multiple indicator approach in 1998-99. India cannot afford to follow only inflation targeting in the near future at least. In the wake of supply constraints, inflation targeting may be an excise in futility. The control over inflation that too maintaining at around single digit during the post 1990s', has already brought down the inflation expectations significantly.

The paradigm shift in monetary policy framework consistent with structural changes has facilitated monetary transmission mechanism. The RBI has taken certain vital steps to integrate the Indian economy with the global economy. The development of money market, government securities market, and the foreign exchange market are some of the examples of such steps. In the place of administrated rate of interest, market determined interest rates are allowed. The market biased monetary policy maintained a choice of instruments decisively from direct to more indirect measures. The reduction of SLR from 38.5 per cent (1992) of net demand and time liabilities to 25 per cent in 1997 and the CRR from 15 per cent to 4.5 per cent in 2003 are important steps. Yet another step is discontinuation of automatic monetization of fiscal deficit of GOI since 1997 and freeing of RBI's balance sheet from the burden of exchange guarantees accumulated in the pre-reform era. The enactment of the Fiscal Responsibility and Budget Management Act (2003) has strengthened the institutional mechanism, further from 2006. The RBI is no longer required to subscribe to government securities in the primary market. At the recommendation of the 12th Finance Commission, the central government has stopped to raise resources on behalf of states governments. The state government needs to have direct access to mobilize their resource based on their financial health.

The overall stance of monetary policy during the period 2007-08[3] will be: (RBI financial policy statement for the year 2007-08)

- To reinforce the emphasis on price stability and well-anchored inflation expectations while ensuring a monetary and interest rates environment that supports export and investment demand in the economy so as to enable a continuation of the growth momentum

- To emphasis credit quality and orderly conditions in financial markets for securing macro economic and in particular, financial stability while simultaneously pursuing greater credit penetration and financial inclusion and

- To respond swiftly with all possible measures as appropriate to the evolving global and domestic situation impinging on inflation expectations and the growth momentum.

In brief, between the pre 1990s and post 1990s, in the latter period the formulation and implementation of monetary policy has undergone a marked transformation.[4] (Mridal Sagar, 2006). These changes encompass:

a) A shift in dependence from direct to indirect instruments of monetary control

b) A more transparent way of formulation and implementation, keeping up with time consistency

c) Recognition of the absence of trade-off between inflation and unemployment

SECTION – II

In this section an attempt is made to examine to what extent some of the monetary policy objectives such as control over inflation, promotion of growth rate, control over public expenditure and money supply (NM3) are fulfilled. Besides, the analysis encompass the nexus between GDP growth rate and a host of other variables such as inflation rate, money supply, public expenditure and Net bank credit to government and aggregate exports[5]. A stable relationship between money, output and price is one of the essential conditions to strengthen the effectiveness of monetary policy irrespective of the fact whether money stock is used as an intermediate target variable or as an indicator[6]. For this purpose, the Granger Causality test is performed. Though this experiment of Granger causality among the variables mentioned is no novelty, the difference in this is to understand such causality effectiveness even during the period of reform measures. The relative effectiveness of monetary and fiscal policy in economic stabilization is also hotly debated issue. Empirical studies in this connection with reference to developed economies using St. Louis Equation (Anderson and Jorden 1968[7], Batten and Haffer 1985[8] Choudhary 1988[9], Kamal P. Upadhyaya (1991)[10], Oluwole Owoye et al (1995)[11] bring out mixed results. These studies have considered two or three variables and have examined causality between GDP and monetary and fiscal measures.

The present study is based on the RBI data. (www.rbi.org.in). This work differs from any of the earlier works in respect of the methodology and variables chosen, particularly, with reference to time periods chosen-the period before and after reform period up to the very recent period for which the data are available .In addition, this study focusses on the variables particularly, GDP and the rest of the variables such as monetary aggregate (NM3) public expenditure (sum of central, state and union territory development and non-development expenditures) Net bank credit (credit given to central and state governments) and aggregate Exports. The current emphasis is on high growth and so this study aims at understanding how far these variables influence GDP and vice-versa. The data pertains to the period of over 25 years since 1980-81.

First, the growth rates of variables selected are examined for the entire period and for the sub-periods. The Table 1 shows that the growth rate of inflation measured in terms of WPI, records a negative rate of 5 percent during the period of economic reforms when compared to a positive growth during pre-reform period, though on the whole it records a negative growth rate of around 2 percent. The monetary aggregate, credit to government, Public expenditure in nominal terms all record a smaller growth rate during the period reform period when compared to pre-reform period as well as the overall period. The Liquidity aggregate (L2) also is similar to NM3 as major part of it is accounted by the latter. An encouraging aspect of the table is the appreciable growth rates in GDP, both nominal and real, as well as real exports.

Table 1

Annual Average Growth Rates of Selected Variables
(Figures in Percentage)

Annual Average Growth Rates (%)

Variables		1980-81 to 2005-06	1980-81 to 1993-94	1993-94 to 2005-06
Inflation (WPI)	INF	-2.62	1.05	-5.10
Money Supply	M3	17.06	17.30	16.42
Credit	CREDIT	15.37	18.25	13.31
Public Expenditure	PUBEXP	14.07	15.06	13.34
GDP-Nominal	GDPNOM	13.97	14.67	11.71
Export	EXPORT	10.16	8.14	11.53
GDP-Real	GDPR	5.75	5.43	6.11
Public Expenditure-Real	PUBEXPR	5.83	5.78	7.66
Export-Real	EXPORTR	2.21	-0.57	5.93
Credit-Real	CREDITR	7.05	8.71	7.64
L2	L2	-	-	16.33

Note: Each variable in its log form is regressed on time (ln Yt = a + b. Time)
Growth rate is computed by taking anti-log of Time parameter (b) minus 1.

Source: Computed from www.rbi.org.in

Turning to Table 2 which shows the determinants of inflation, it is observed that when GDP, NM3 and Net Bank Credit to government, public expenditure and exports are entered separately in their log forms, they all influence negatively and also significantly the log of inflation variable at 5 per cent level of significance. (equation 1-5) At the same time, these variables are entered in the log form of inflation, only log net bank credit and log exports turn out to be significant at 5 per cent level of significance. Interestingly, between net bank credit and exports, the elasticity of credit is 2.9 which is greater than the elasticity of exports (1.55) In equation 7, both net bank credit and exports influence inflation positively and also significantly. There exists negative elasticity between inflation and public expenditure. The public expenditure is negatively related to inflation as long as development component of it is huge and does yield return. The elasticity coefficient in respect of public expenditure is largest to the tune of 4.

Table 2

Determinants of Inflation (1980-81 to 2005-06):
Estimation Results of Inflation Equation
Dependent Variable: Log of Inflation

Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
Constant	4.55 (4.446)	4.011 (4.999)	4.012 (4.821)	4.326 (4.706)	4.288 (4.157)	1.1413 (0.181)	7.033 (4.002)
Log GDP-nominal	-0.198 (2.629)	-	-	-	-	0.387 (0.274)	-
Log M3	-	-0.167 (2.684)	-	-	-	-2.662 (1.192)	-
Log Credit	-	-	-0.179 (2.588)	-	-	2.909 (2.084)	2.809 (2.177)
Log Public Expenditure	-	-	-	-0.200 (2.684)	-	-1.702 (0.689)	-4.024 (2.460)
Log Export	-	-	-	-	-0.242 (2.354)	1.552 (2.347)	1.051 (2.032)
R Square [F value]	0.218 [6.698]	0.231 [7.204]	0.218 [6.698]	0.231 [7.203]	0.188 [5.542]	0.437 [3.108]	0.392 [4.726]

Absolute t values are in the parentheses.

To examine the causality relationship between different pair of variables, stationarity test is carried out. As part of this, first, we have examined the unit root properties of the variables under consideration using Augmented Dickey – Fuller (ADF) test. The critical values for the unit root tests presented in the following Table show that

(i) Three variables – GDP, Public Expenditure and Credit in their log forms contain two unit roots or in other words follow I (2) process at 5% level of significance.

(ii) Five variables - inflation (in its original form) and log M3, log public expenditure, log GDP and log Export contains unit root (at 10% level of significance) or follow I(1) process.

The test results are based on the optimal lags selection using Akaike Information criterion.

Table 3

Augmented Dickey-Fuller Unit Root Test

Variables	**X**	**Δ X**	**Δ^2 X**
Inflation (WPI)	-1.9857	-6.5405*	
Money Supply (M3)	3.1218	2.9089	0.7667
Public Expenditure	0.1071	1.3846	-0.8363
GDP (nominal)	2.5724	1.8039	-3.8197*
Credit	0.9444	-1.9145	-2.0464
Export	6.8502	-0.5181	-6.1495*
Log (Inflation)	-3.4115*		
Log (M3)	-1.8013	-3.9628**	
Log (public Expenditure)	-2.4277	-2.6333**	-2.9794*
Log (Credit)	-2.2324	-1.68499	-6.4085*
Log (GDP nominal)	-1.0004	-2.8757**	-7.7944*
Log (export)	1.9185	-3.1894*	

* significant at 5% or 1% level;

Causality Relation between Study Variables:

The empirical investigation of testing for causality relations among the study variables has been carried out for the period 1980-81 to 2005-06. We perform two statistical tests, namely (i) the Granger causality test and (ii) pair wise Granger Causality/Block Exogeneity test. Basically these are useful to see whether a variable (say), x causes another variable (say) y. Both regress y (or x) on its own past values (restricted model) to see how much of the current y (or x) can be explained by its past values and then add lagged terms of x (or y) to see whether they can improve the explanation (unrestricted model). y (or x) is said to Granger caused by x (or y) if x helps in the prediction of y or equivalently if the coefficients on the lagged x (or y) are jointly significant. The former uses the F test. The F test formula is: $F_{(r,\ n-m-k)} = [(ESS_r - ESS_u)/r]/[ESS_u/(n-m-k)]$; where ESS_r and ESS_u are the residual sum of squares from restricted model and unrestricted model respectively. The optimum number of lagged terms to be included in the model is decided using the Akaike Information Criterion (AIC). The latter test uses the χ^2 (Wald) statistics for joint significance of the other lagged variables in that equation. This is highly useful to see whether lagged values many variables (such as x and z) would be jointly and significantly influencing y.

In our exercise the following five variables are considered:

(ii) The second one with five variables which follow I(1) process, namely inflation, log GDP, log public expenditure, log M3 and log Export. (note: they follow I(1) at 10 per cent level of significance)*.

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* However, we also perform the exercise with three I(2) variables, namely log GDP, log public expenditure and log credit. The Granger causality test and Block Exogeneity test results however confirmed that the two variables Government expenditure and credit do not Granger cause the GDP variable. Therefore, it is concluded that at least in the short run, these variables are not influencing GDP.)

Having established that the variables follow the same order of integration, we can test for the causal relationship among these three variables using pair wise Granger causality test. The results of pair wise ***Granger causality tests*** are presented in the following Table.

Table 4

Pairwise Granger Causality Test.

Sample: 1 26
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
LM31 does not Granger Cause INF1	23	1.48104	0.2538
INF1 does not Granger Cause LM31		0.58973	0.5648
LPE1 does not Granger Cause INF1	23	0.22664	0.7995
INF1 does not Granger Cause LPE1		2.64885	0.0981
LGDP1 does not Granger Cause INF1	23	0.11628	0.8909
INF1 does not Granger Cause LGDP1		0.49777	0.6160
LEXPOT1 does not Granger Cause INF1	23	0.84819	0.4446
INF1 does not Granger Cause LEXPOT1		0.51831	0.6042
LPE1 does not Granger Cause LM31	23	0.00983	0.9902
LM31 does not Granger Cause LPE1		0.38546	0.6856
LGDP1 does not Granger Cause LM31	23	1.93447	0.1734
LM31 does not Granger Cause LGDP1		0.27586	0.7621
LEXPOT1 does not Granger Cause LM31	23	0.64296	0.5374
LM31 does not Granger Cause LEXPOT1		0.54265	0.5904
LGDP1 does not Granger Cause LPE1	23	0.53530	0.5945
LPE1 does not Granger Cause LGDP1		0.13278	0.8765
LEXPOT1 does not Granger Cause LPE1	23	3.34544	0.0582
LPE1 does not Granger Cause LEXPOT1		0.64351	0.5371
LEXPOT1 does not Granger Cause LGDP1	23	2.52509	0.1080
LGDP1 does not Granger Cause LEXPOT1		5.59512	0.0129

Since variables under considerations are I(1), we use the first differenced series in the model, i.e., Δ Log GDP(= LGDP1**),** Δ Log PE (= LPE**), and** Δ Log Export expenditure (= LExport1**).** The GDP does not Granger cause any of the other variables except the export variable (with direction of causality running from the former to latter). during the study period 1980-81 to 2005-06 as the computed F values lie below the critical value at 5 per cent level. None of the other variables also Granger causes the GDP. Therefore, we conclude that none of the study variables here Granger causes the GDP.

To confirm our results above, we can now look at the ***block exogeneity test*** results given in Table 5 (A to E).

The ***block exogeneity test*** results (shown in Table below) also indicate that the these four variables and their lags do not influence GDP variable as the estimated χ^2 values are not statistically significant at 5 per cent level. Thus both the Granger causality test and Block Exogeneity test results confirm that these four variables are not influencing GDP.

Table 5A

Granger Causality/Block Exogeneity Wald Tests

Sample: 1 26
Included observations: 23

Dependent variable: LGDP1

Excluded	Chi-sq	df	Prob.
INF1	0.277737	2	0.8703
LEXPOT1	2.901614	2	0.2344
LPE1	0.351618	2	0.8388
LM31	0.153339	2	0.9262
All	4.475592	8	0.8119

Table 5B
Dependent variable: INF1

Excluded	Chi-sq	df	Prob.
LGDP1	0.316151	2	0.8538
LEXPOT1	0.801999	2	0.6697
LPE1	0.602728	2	0.7398
LM31	2.318452	2	0.3137
All	4.208464	8	0.8378

Table 5C
Dependent variable: LEXPOT1

Excluded	Chi-sq	df	Prob.
LGDP1	10.52064	2	0.0052
INF1	4.678799	2	0.0964
LPE1	1.434979	2	0.4880
LM31	0.802862	2	0.6694
All	17.39353	8	0.0263

Table – 5 D
Dependent variable: LPE1

Excluded	Chi-sq	df	Prob.
LGDP1	9.224277	2	0.0099
INF1	9.734400	2	0.0077
LEXPOT1	5.441210	2	0.0658
LM31	0.573671	2	0.7506
All	27.75524	8	0.0005

Table – 5 E
Dependent variable: LM31

Excluded	Chi-sq	df	Prob.
LGDP1	3.416386	2	0.1812
INF1	0.626644	2	0.7310
LEXPOT1	1.733171	2	0.4204
LPE1	0.134123	2	0.9351
All	5.803062	8	0.6693

The Cointegration Test

It has been recognized in recent literature that if a linear combination of integrated variables is stationary then such variables are said to be cointegrated. Although Engle and Granger (1987) was the first to introduce the cointegration test, the tests propounded by Stock & Watson (1988), Johansen (1991) and Johansen & Juselius (1990) are more useful in testing the long run equilibrium relationships in multivariate setting.

Having established that the variables follow the same order of integration, we can test for cointegration following the methodology of Johanson & Juslius (1996). For the estimation part of Johansen & Juselius method, see relevant references. The two test statistics – trace and maximum eigen value - for alternative null hypotheses are presented in Table 6. The trace statistics indicate that there are two cointegrating relations both at 1 percent and 5 percent level of significance. The maximum eigen value test statistics also show the possibility of two cointegrating equations at 5 percent level of significance. These results confirm the fact that there is long run equilibrium relationship among these five variables. (Table 6)

Table - 6A

Sample (adjusted): 3 26
Included observations: 24 after adjustments
Trend assumption: Linear deterministic trend
Series: LGDP INF LM3 LPE LEXPORT
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.861298	103.1156	69.81889	0.0000
At most 1 *	0.707593	55.70528	47.85613	0.0077
At most 2	0.540446	26.19464	29.79707	0.1230
At most 3	0.235595	7.534693	15.49471	0.5164
At most 4	0.044278	1.086921	3.841466	0.2972

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.861298	47.41029	33.87687	0.0007
At most 1 *	0.707593	29.51064	27.58434	0.0279
At most 2	0.540446	18.65995	21.13162	0.1071
At most 3	0.235595	6.447771	14.26460	0.5564
At most 4	0.044278	1.086921	3.841466	0.2972

Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

LGDP	INF	LM3	LPE	LEXPORT
12.94714	0.266959	-41.37806	29.85264	8.815645
10.54263	-0.325266	11.07661	-24.75658	-0.439498
-9.329719	0.357090	21.46246	-18.28313	2.833758
-3.669901	0.142401	7.370366	-1.067801	-7.008197
16.94433	0.208800	12.68671	-25.13035	-9.878558

Unrestricted Adjustment Coefficients (alpha):

D(LGDP)	0.004720	0.003107	0.000893	0.009081	0.000412
D(INF)	-0.331492	0.260692	-1.337309	0.460230	-0.210431
D(LM3)	0.004042	0.003554	-0.005937	0.001540	0.001224
D(LPE)	-0.015524	0.020135	-0.002987	0.004262	0.000350
D(LEXPORT)	-0.060688	-0.043404	-0.007795	0.009012	0.003106

However, final conclusions should be based on the pair wise Granger Causality test, that is, none of the variables influence the GDP.

As the speed of adjustment coefficients provide additional base for inferring short run dynamic among these variables. If we select r =1 and normalize the cointegrating

vector with respect GDP, then the long run equilibrium relationship can be shown as: (Table 6B)

Table 6B

1 Cointegrating Equation(s): Log likelihood 184.1288

Normalized cointegrating coefficients (standard error in parentheses)

LGDP	INF	LM3	LPE	LEXPORT
1.000000	0.020619	-3.195922	2.305732	0.680895
	(0.00456)	(0.35512)	(0.37188)	(0.11338)

The cointegrating parameters in the above equation show that the explanatory variables are significant impact on GDP variable (the standard errors in the parentheses indicate that the coefficients are statistically significance at 5 percent)

Corresponding to the cointegration relation defined in the above equation, the speed of adjustment parameters are worked out and given in Table 7A and 7B.

Table 7A

Adjustment coefficients (standard error in parentheses)

D(LGDP)	0.061116
	(0.06061)
D(INF)	-4.291874
	(7.24412)
D(LM3)	0.052336
	(0.03575)
D(LPE)	-0.200985
	(0.08356)
D(LEXPORT)	-0.785733
	(0.19687)

The standard errors given in parentheses indicate that the short run disequilibrium error significantly affects all variables except Inflation at 5 percent level. The inflation doest not adjust to ensure equilibrium among these five variables.

Taking r = 2, the results of the adjustment parameters are given in Table 7B.

Table 7B

2 Cointegrating Equation(s): Log likelihood 198.8841

Normalized cointegrating coefficients (standard error in parentheses)

LGDP	INF	LM3	LPE	LEXPORT
1.000000	0.000000	-1.494777	0.441387	0.391434
		(0.34903)	(0.36486)	(0.11214)
0.000000	1.000000	-82.50330	90.41829	14.03849
		(15.1137)	(15.7995)	(4.85606)

Adjustment coefficients (standard error in parentheses)

D(LGDP)	0.093870	0.000250
	(0.07715)	(0.00194)
D(INF)	-1.543493	-0.173289
	(9.28215)	(0.23393)
D(LM3)	0.089800	-7.67E-05
	(0.04380)	(0.00110)
D(LPE)	0.011286	-0.010693
	(0.07046)	(0.00178)
D(LEXPORT)	-1.243329	-0.002083
	(0.18320)	(0.00462)

Conclusion:

The analysis on macro and monetary management with reference to the pre and post reform periods clearly indicates a paradigm shift in the approach to monetary policy. The post-reform period monetary policy of the RBI a adopted to market oriented approach from controlled and regulated approach, keeping at its centre the need for high trajectory growth with price stability, exchange rate stability and fiscal stability. This paper also throws light on the interface between the dynamics of monetary and fiscal management. The second part of the paper empirically analyses the causality between GDP and other variable such as inflation, money supply, net bank credit to Government, public expenditure and exports. The Granger causality relationship test between GDP on the one hand and the other variables are not significant barring exports. However, By the

Co-integration and other tests this study shows the long run relationship between GDP and other variables. Therefore, the study enables three possible inferences:
(a) Inflation management at single digit is very much within the competence of the RBI, of course barring supply constraints, (b) Exports tending to grow at a higher rate crossing around 10 percent, particularly during the post reform period augur well for sustained higher economic growth and (c) Since the study shows a fairly strong long run equilibrium relationship between GDP and other variables studies, control over these macro variables should enable the economy to march towards high trajectory of growth.

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