EMPIRICAL EVIDENCE OF FINANCIAL VARIABLES AS POLICY INDICATORS FROM INDIA

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Abstract: The Central Bank changed its focus from direct instruments of monetary policy to indirect policy of monetary policy and thus expanded the policy tools available with the bank. Thus, an orientation towards medium term instruments developed. The study tries to find if, empirically, such a stance of Apex bank has significant effect on very policy indicators in India.

Keywords: Monetary Policy, Fiscal Policy, IIP, Policy Indicators.

Introduction: The preamble to the RBI Act of 1934, in India objectifies the apex bank's target as "the Reserve Bank of India to regulate banknotes issuance and maintenance of reserves in order to ensure monetary stability in India and generally to operate the currency and credit system in the country to your advantage." It was these goals and targets, which are generally an indication of the stability of the general price level and growth of the economy, and since then, the goals remain the same, however, and focus on, with the passage of time, it has changed because of different prevailing economic conditions. On the contrary, we saw the storyline of monetary policy in the India to experience substantial and significant changes.

In relation to operational tools of monetary policies in the 1990s, RBI began to change its constant focus from direct instruments of monetary policy i.e., the CRR to a broader instruments based on markets, and this expansion widened the set of tools available at its disposal. Consider the example, in April of 1997, RBI reinitiated bank rate as policy variable by combining with interest rates in the market, and now, is used mostly, by RBI to indicate a medium-term orientation of monetary policy in India. In addition, as the Reserve Bank of India also carried out open market operations for sterilization as an instrument of monetary policy to manage the increase in capital flows impact during the latter half of the 1990s, and then in 2000, RBI initiated regulation of liquidity by LAF to moderate daily liquidity conditions.

Moreover, since the augmentation of financial sector reforms and thus resulting financial liberalization, monetary policy outlook of the Central Bank underwent a transformation. From 1985 to mid of 1997, Central Bank adopted flexible monetary policy targeting, focusing on intermediate target of M3 growth. Under the monetary targeting as a policy, M3 was used as operational target to control capital reserve of the commercial banks through CRR. However, with increased financial decentralization, it was realized that the financial innovations and technological developments, structurally, have eroded the predictive ability to estimate the demand for money in relation to the past, on the other hand, the money supply maintained its informative character as policy variable.

Finally, in the April of 1998, Reserve Bank of India announced, officially, shift in the conduct of the monetary policy from monetary targeting policy approach to Multi Policy Indicator Approach (MPIA). Since then, adhering to MPIA, the interest rates of overnight tenure are steadily emerging as a policy goal, the central bank sees a range of various financial and economic variables as proxy indicators of policy and tries to focus on their movements to draw the temporal prospects of the objectives of the policy. The set of policy Indicators includes the various rates in the financial markets, currency markets, credit advances by banks, current financial layout, trade balances, capital flows, rate of inflation, various exchange rate and refinancing and swap transactions in foreign currencies.

Thus, the paper attempts to establish and test the relationship of each policy indicative variable against level of output, proxy by IIP and price using statistical test such as Granger causality test and establish whether other indicative variables that RBI consider as indicator variable in reality a relationship with the objective variables.

Literature Review: As referred earlier, since the middle of 1990s, RBI has significantly modified monetary management. The RBI as an apex body, majorly targets stability of general price level and economic growth as policy targets by inter transmogrifying primarily the short tenured interest rates, adhering to framework of MPIA. Many recent studies attempt to establish the relation between the RBI's dictation of monetary policy and new conduct mechanism of transmission.

Studies conducted by Kalirajan et al. (2007) interpreted the rate of interest transmission mode as an effective manner of monetary policy transmission after the structural break of reforms using VAR analysis technique. Another study by Kubo (2009) illustrated the "impulse reaction function calculated using a VAR model" and tested whether mechanism of monetary transmission concentrating movements in interest rates. Besides this, Aleem (2010), to determine the importance of various modes of monetary transmission ran a set of VAR models, i.e., mode of bank lending, the exchange rate mode, and the bank credit mode, and result of his studies show that bank lending does has a significant role to play in transmission mode in case of India.

Also in paper by Samantaraya (2009), he formulated a "monetary policy index" by analysing qualitative data on various policy parameters extracted from the statements of Central Bank's governor and available data on growth of monetary aggregate M3 and lastly short term interest rate. With the index he tried, in quantitative terms, to estimate the framework of monetary policy and illustrated that changes in monetary policy variables instantly affect the interest rates of various tenure, while it has less impact on quantum of credit advanced by banks, inflation growth rates, and IIP index, with some lag.

Diverging from earlier researches, this paper tries to investigate whether the variables that Central Bank considers as policy indicator variables, have a statistical relationship with Price and economic growth and analyse the paradigm of the new monetary outlook as proposed by RBI marking the structural break.

Empirical Technique Used: For empirical analysis, the paper applies Dickey Fuller unit root test and Granger causality statistical techniques lag augmented (LA-VAR) model. In statistically using the Vector Auto Regressive model, it is generally mandatory to check if variables are integrated (also using lag values of variables), stationarity of data series by using the Dickey Fuller unit root test. It is believed that conventional asymptotic theory for testing hypothesis in VAR Model does not render accurate results if the variables considered in the study are integrated.

However, under certain lag values of data DF-urt may not be sufficiently accurate for testing hypothesis. In order to sway such biases in statistical testing, this paper applies the Lag Augmented-Vector Auto Regressive model, which allows study to determine the restrictions on coefficients in a   LA-VAR disregarding ideal statistical attributes of economic time-series. This method is as follows:

Suppose the following equation generates {yt}, the 'n-dimensional vector' for different level of the variables in this study:

$$y_t = \lambda_0 + \lambda_1 \, time + \Upsilon_1 \, y_{t-1} + \Upsilon_2 \, y_{t-2} + \ldots + \Upsilon_k \, y_{t-k} + e_t$$
$$for \ all \ t = 1, 2, 3, \ldots, T.$$

where time is the proxy measure for trend observed during sample period, k is the length of the $lag, = \lambda_0, \lambda_1, \Upsilon_1, \Upsilon_2, \ldots \Upsilon_k$ represent respective matrices of coefficients that study considers, and e is the matrix of iid distributed sequence of matrix with expectation = 0 and $\sum e$ as matrix of covariance.

Further, to test restrictions on coefficients in the model the study test null hypothesis $H_0: f(\Omega) = 0$, the study estimates the VAR model shown using OLS technique:

$$y_t = \widehat{\lambda_0} + \widehat{\lambda_1}\, time + \widehat{\Upsilon_1}\, y_{t-1} + \widehat{\Upsilon_2}\, y_{t-2} + \dots + \widehat{\Upsilon_k}\, y_{t-k} + \widehat{e_t}$$
$$for\ all\ t = 1, 2, 3, \dots, T.$$

Finally, the paper tests the null hypothesis of Granger causality and tries to establish a causal relationship among monetary policy variables and objective policy variables. Asymptotically, the test statistic follows a chi-square distribution with degrees of freedom equal to number of lag variables i.e. (k).

Data: The RBI came out with different monetary policy variables under MPIA. The new setup majorly consisted of set of variables, viz., financial market related indicators, fiscal sheets and trade balance, and capital flows. The study took into consideration M1, M2 and M3 as different monetary aggregates estimated by RBI, exchange rate (ER) (PPP adjusted), stock prices (SP) and bank credit (BC), among available relevant variables. For dependent variable as policy variables, the paper considers Index of Industrial Production (IIP) (adjusted seasonally by X12) and Wholesale Price Index (WPI) as both economic growth and price stability are regarded as objectives of monetary policy.

The data on Exchange Rate, stock prices, IIP and WPI have been obtained from IMF (2010). The data on bank credit, and call market rate have been sourced from RBI and data on M1, M2 and M3 i.e. monetary aggregates have been obtained from RBI Monthly Bulletin. The RBI had adopted monetary policy targeting, which primarily focused on growth of M3 from 1985 to 1998. Post 1998 also, the apex bank kept its diluted emphasis on M3 but other monetary policy indicators were also included in array of framework under the MPIA. The study uses monthly data from 1998 to 2016 for the empirical analysis. This is precisely the period corresponding to current monetary policy outlook. In addition to above statistical exercise, to test if changes occurred in relative to previous policy period regime i.e., monetary policy targeting by RBI from April 1985 to June 1998.

Empirical Results: The study uses tri-variate VAR models to establish causality of monetary variable on each policy indicator i.e. output and price levels. Table B indicates the test statistic (wald statistic) for the sample period from April of 1998 to 2016. This period marks the first thirteen years of new monetary policy outlook by RBI, as MPIA was introduced in April of 1998. To estimate the test statistic, the true lag length (k) from the 12 maximum periods premising on Akaike Information Criterion (AIC) is used. The study also fixes the maximum integration of order (dmax) to 1, because in Table-A Dickey Fuller-urt exhibits that the variables integrated of order 1 at most.

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              Table-A     Dickey Fuller Unit Root Test
Dickey-Fuller test for unit root            Number of obs   =      372
              ---------- Augmented Dickey-Fuller ---------
            Test         1% Critical      5% Critical    10% Critical
          Statistic         Value            Value           Value
      ----------------------------------------------------------------
Z(t)        -2.897         -3.850          -2.390          -2.500
      ----------------------------------------------------------------
         MacKinnon approximate p-value for Z(t) = 0.0474
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Table-B	Casualty During the MPIA Sample Period i.e. from 1998 to 2016					
Dependent Variables	Explanatory Variables (k)					
	M1(8)	M2(8)	M3(12)	BC(2)	SP(2)	ER(2)
IIP	12.805	12.860	16.078	1.435	0.675	4.069
WPI	150678**	15.762**	7.545	0.226	22.245***	6.257**

 "Note: ***, ** and * indicate that the null hypothesis of Granger non-casualty is rejected at 1%,5% and 10% LOS respectively.

Following empirical results can be inferred from Table B. Both M1 and M2 don't Granger-cause price level at any level of significance (1% or 5% or 10 %), while that in case of output Monetary Aggregates granger cause output at 5% statistical level. M3 on other hand has no impact on either output or level of prices. Similar to M3, bank credit fails to establish any relation with either of objective policy variable (in the Granger sense). Stock prices granger causes output at the 1% level of significance and 5% level in case of prices. Finally, exchange rate granger causes only output at 5% level of significance.

Table-C	Casualty During the Monetary Policy Targeting i.e.(1998 to 2016)					
Dependent Variables	Explanatory Variables (k)					
	M1(3)	M2(3)	M3(2)	BC(2)	SP(3)	ER(3)
WPI	51.365***	12.860***	26.896***	2.880	2.604	2.379
IIP	7.060*	6.710*	1.573	0.512	17.771***	5.311*

 "Note: ***, ** and * indicate that the null hypothesis of Granger non-casualty is rejected at 1%,5% and 10% LOS respectively."

Consider now, Table-C shows test statistic (wald statistic) for the sample period from 1985 to April of 1998. This sample period corresponds to the period wherein monetary targeting was adopted by RBI. In this table too, the study fixes the maximum integration of order (dmax) to 1.

Following results may be observed from Table-C. M1 and M2 Granger-cause level of prices at 1% level of significance while output at 10% level of significance, M3, on other hand differ in sense that it doesn't granger cause output at any level of significance. Bank credit doesn't cause either output or level of prices in the Granger cause sense. Exchange rate granger causes output only at 10 level of significance, while stock prices granger cause level of prices at 5% level of significance. It can thus be established that monetary policy aggregates do have significant causal relationships with the objective variables. The difference in results obtained in Table B and C results have a strict implication that significant change in the relationship among the monetary policy indicator variables and the objective variables because of implementation of RBI's new policy framework.

Table-D	Casualty During the MPIA Sample Period i.e. from 1998 to 2016					
Dependent Variables	**Explanatory Variables (k)**					
	M1(2)	M2(2)	M3(2)	BC(2)	SP(2)	ER(2)
WPI	0.379	0.364	3.328	1.436	0.585	4.178
IIP	6.078**	6.237**	0.357	0.228	23.124***	6.017**

"Note: ***, ** and * indicate that the null hypothesis of Granger non-casualty is rejected at 1%,5% and 10% LOS respectively."

Table-E	Casualty During the Monetary Policy Targeting i.e.(1998 to 2016)					
Dependent Variables	**Explanatory Variables (k)**					
	M1(2)	M2(2)	M3(1)	BC(1)	SP(2)	ER(1)
WPI	36.875***	36.405***	20.384***	2.540	1.415	1.898
IIP	6.078**	5.942*	1.683	0.321	14.881***	4.291**

"Note: ***, ** and * indicate that the null hypothesis of Granger non-casualty is rejected at 1%,5% and 10% LOS respectively."

For the robustness check of results obtained, the study also tests true lag length k on the basis of the Schwarz Bayesian Information Criterion (SBIC) instead of the AIC. The results thus obtained shows even after switching to a different k for monetary policy variables, there is least deviation from previous results on objective policy variables, implying the robustness of the initial findings.

Concluding Remarks: To sum up the studies' empirical results demonstrate that apart from bank credit, all other monetary policy variables included in study do have a causal relationship with either level of prices or output. This indicates the fact that many of the financial and economic variables that are announced by RBI have a certain deterministic degree to estimate policy indicators, under the new monetary policy framework by apex bank. Among the variables, stock prices in particular seemed to have played a significant role, as it can be inferred out that stock prices portray important casual relation for determining expected values of level of prices and output. However, M3 as a monetary aggregate seem to have a weaker predictive role, in objective variables.

RBI continues to announce forecast for rate of growth of M3, even after changing the monetary policy targeting framework as RBI considers it to be a measure to determine future price movements. Taking into account the empirical results of the studies, it may be concluded that RBI should take information content on monetary aggregates M1 and M2 along with other variables for monetary policy formulation.

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