



### PRE-CONDITIONS FOR INFLATION TARGETING IN AN EMERGING ECONOMY: THE CASE OF INDIA

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#### Abstract

This article looks at the preconditions that an emerging economy needs to fulfill, before it can adopt inflation targeting as a monetary policy regime. The study is conducted using the Indian economy as a case study. We conduct an in-depth sector-wise analysis of the Indian economy to evaluate the independence of India's monetary policy from fiscal, external, structural and financial perspectives. Dominance from any of these sectors may divert monetary policy from the objective of maintaining price stability in the economy. Our analysis suggests that among the four dominance issues, the issue of 'structural dominance' is the most acute for India. Supply shocks, hitting the economy due to structural bottlenecks, pose a major threat to the independent conduct of monetary policy. This study concludes that inflation band targeting with a wide target range would be a feasible monetary policy option for India.

**Keywords:** India, Inflation Targeting, Monetary policy, Fiscal Dominance, VAR, GFVD

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## **1. Introduction**

It is generally agreed among economists and central bankers that low inflation helps to promote economic efficiency and growth in the long run and that price stability should be the long run objective of monetary policy. However, for monetary policy to successfully achieve its target of price stability there is a need for a 'nominal anchor'. A nominal anchor is a constraint on the value of domestic money to tie down the price level to a specific value at a given time. It helps to promote price stability by fixing expectations directly through its constraint on the value of domestic money. Conducting monetary policy without an explicit nominal anchor is possible but risky. The most important risk is lack of transparency of approach that creates volatility in financial markets and causes uncertainty among producers and the general public about the future course of inflation and output. Monetary policy can be conducted better if there is a well-defined nominal anchor. Many central banks use an 'inflation-target' as an effective and successful nominal anchor for monetary policy. The inflation targeting strategy has the following key elements:

- Public announcement of a medium-term numerical target for inflation
- An institutional commitment to price stability as the primary long-run goal of monetary policy
- An information inclusive strategy
- Increased transparency of the monetary policy strategy through communication with the public and the markets about the plans and objectives of monetary policy
- Increased accountability of the central bank for attaining its inflation objective

Inflation targeting, as a monetary policy operating strategy, has some distinct advantages for the economy. It allows monetary policy to focus on domestic concerns. Velocity shocks become irrelevant in inflation targeting as monetary policy no longer relies on a stable money-inflation relationship. An inflation target allows the monetary authorities to use all the available information to decide the best course for monetary policy. Inflation targeting also has the advantage that it is easily understood by the public. An explicit numerical inflation target increases the accountability of the central bank. It helps the central bank to reduce political pressure to pursue inflationary monetary policy thereby avoiding falling into a time inconsistency trap. Another important advantage of inflation targeting regime is that it also

takes into account the fluctuations in other goal variables like output and employment and it is possible to accommodate short-run stabilization goals in an inflation targeting framework.

Inflation targeting was adopted by a number of industrialized economies in the 1990s, starting with New Zealand in 1990, Canada in February 1991, Israel in December 1991, the United Kingdom in 1992, Sweden and Finland in 1993 and Australia and Spain in 1994. The performance of inflation targeting based monetary policy has been quite good so far. Many of the empirical studies show that an inflation targeting regime was successful in reducing inflation significantly. Bernanke et al. (1999), for example, found that inflation remained lower after inflation targeting than would have been forecast using Vector Auto-Regressions (VARs) estimated with the data from the period before inflation targeting started. It also helped to maintain price stability once it is achieved. It has prevented one off shocks to inflation permanently affecting the inflation rate. As Mishkin (2001) observed;

“after Canada adopted inflation targets in February 1991, the regime was challenged by a new goods and service tax (GST), an adverse supply shock that in earlier periods might have led to a ratcheting up in inflation. Instead the tax increase led to only a one time increase in the price level; it did not generate second and third round rises in wages and prices that would lead to a persistent rise in the inflation rate. Another successful example of inflation targeting policy is the experience of the United Kingdom and Sweden following their departures from the European Exchange Rate Mechanism (ERM) rate pegs in 1992. In both cases, devaluation would normally have stimulated inflation because of the direct effects on higher export and import prices and the subsequent effects on wage demands and price setting behavior. It seems reasonable to attribute the lack of inflationary response in these episodes to adoption of inflation targeting, which short-circuited the second and later round effects and helped to focus public attention on the temporary nature of the devaluation shocks. Indeed, one reason why inflation targets were adopted in both the countries was to achieve exactly this result.”  
Mishkin (2001 p. 20)

The adoption of an inflation target resulted in below normal output during disinflationary phases, but once the low level of inflation was achieved, output and employment returned to their previous high levels and output fluctuations lessened.

However, inflation targeting did not establish immediate credibility for monetary policy. It came slowly with the changes in the corresponding institutional arrangements for wage and

price setting. As Bernanke et al. (1999, p. 275) said, “It appears that, for monetary policy makers, announcements alone are not enough; the only way to gain credibility is to earn it.” Further stressed by Mishkin (2001, p. 23), “It appears, unfortunately, that there is no free (credibility) lunch from inflation targeting. The only way to achieve disinflation is the hard way: by inducing short-run losses in output and employment in order to achieve the longer economic benefits of price stability.”

Many Emerging Market Economies (EMEs) also adopted an inflation-targeting approach to monetary policy, including Chile in 1991, Brazil in 1999, Czech Republic in 1997, Poland in 1998 and Hungary in 2001. Inflation targeting provided a strong nominal anchor that can keep inflation in check in emerging market economies, despite the fact that they often face a more challenging political and economic environment than developed countries. However, in these economies the frequency of target misses is likely to be higher than their developed counterparts. Thus inflation targeting central bankers in EMEs focus on the medium term horizon to ensure that disinflation remains on track and that inflation converges to a level deemed consistent with price stability. It also requires good transparency and good communication by the central bank to the public, explaining, why inflation targets were missed.

This study contributes to the growing literature of inflation-targeting in EMEs, with particular focus on the Indian economy. The increased integration of Indian economy with world economy has lead to transmission of uncertainties related to world financial and -oil markets, into the domestic (Indian) economy, hence making inflation more unpredictable. This changed scenario calls for a change to a monetary policy framework which is transparent and forward-looking. Inflation targeting by its very nature, encompasses all these properties. There are a few descriptive studies available on the suitability of inflation targeting regime for India and the practical issues related to it, however, the applicability and feasibility aspects of inflation targeting for India has rather been ignored in the exiting literature. This gap in the literature on Indian monetary policy motivated the current study.

The problems related to fiscal, financial and, monetary institutions are more severe in EMEs and this makes the application of inflation targeting more difficult in these economies. Thus the issue of economic and institutional preconditions necessary for the successful adoption of an inflation target becomes extremely relevant. This paper presents an in-depth analysis of the necessary preconditions for inflation targeting in India.

The organization of rest of this article is as follows: the next section presents the meaning and definition of preconditions for inflation targeting; the third section gives a brief overview of the changes occurring in Indian economy along the lines of inflation targeting regime; section four describes the data and outlines the methodology of this study. A discussion of results is presented in the fifth section and final section presents the conclusions and directions for future research.

## **2. Preconditions for Inflation Targeting**

There are five fundamental institutional weaknesses in emerging market countries that must be taken into account to derive sound theory and policy advice as pointed by Mishkin (2004). These are:

- Weak fiscal institutions
- Weak financial institutions including government prudential regulation and supervision
- Low credibility of monetary institutions
- Currency substitution and liability dollarization
- Vulnerability to sudden stops (of capital inflows)

These institutional weaknesses make the application of inflation targeting more difficult in EMEs. This requires the careful analysis of the existing state of affairs in these economies before putting inflation target into practice so that depending upon the institutional characteristics present in the economy, the policy can be suitably amended. Thus the issue of ‘institutional and economic preconditions’ necessary for the successful adoption of inflation target becomes extremely relevant.

The preconditions relate to potential features of emerging economies as weak fiscal regimes, the risks associated with poorly regulated financial system and large external shocks, each of which can hinder the use of inflation targeting. Each of these problems may lead to a form of dominance namely fiscal, financial and external.

Further, due to peculiar nature of the Indian economy in the form of many structural bottlenecks (namely constraints occurring due to underdeveloped infrastructure such as poor

irrigation facilities, poor transport facilities among others, there may be one other form of dominance namely structural dominance. A sector wise analysis of Indian economy can shed more light on these issues. This would in turn help in determining which form of dominance is more acute for India and how the inflation targeting framework may be amended to cope with it.

## **2.1 Fiscal Dominance**

Fiscal stability and a strong fiscal regime is the primary necessary condition for inflation targeting. Fiscal dominance is defined as a situation when irresponsible fiscal policy (or a large fiscal deficit of the government) puts pressure on the monetary authorities to monetize debt, thereby producing rapid money growth and high inflation. However, monetary policy is the part of the overall economic policy and so it cannot be separated from other policies like fiscal policy and policy objectives. Inflation targeting does not require the central bank to be fully independent but it should be able to use instruments of monetary policy freely to attain its inflation objectives.

## **2.2 External Dominance**

The macroeconomic environment is more volatile in emerging market economies and they are more susceptible to external shocks than developed economies. Therefore, external shocks play an important role and may result in huge volatility of exchange rate, inflation rate and interest rate in developing economies. External dominance is defined as the presence of large external shocks that generates instability in the economy and may jeopardize the fulfilment of the inflation target. This study econometrically analyses the importance of external shocks for the Indian economy to see whether the Indian economy exhibits the symptom of external dominance.

## **2.3 Structural Dominance**

The Indian economy is still a developing economy with structural weaknesses and physical bottlenecks and this made the economy vulnerable to various shocks in the form of adverse supply shocks. We try to quantify the importance of these shocks by studying the impact of these shocks on the money supply and hence inflation in the economy. Our basic purpose is to see how far the Reserve Bank of India<sup>3</sup> (RBI) is independent of these shocks or whether it is required to

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<sup>3</sup> India's Central Bank

accommodate these shocks and make changes in money supply leading to a form of ‘structural dominance’.

## **2.4 Financial Dominance**

A sound and stable financial system is a necessary prerequisite for an independent and efficient implementation of monetary policy and thus for an inflation targeting regime. The financial sector poses problems in the independent conduct of monetary policy when it is fragile and prone to financial crisis or segmented thus hindering the interest rate as monetary policy instrument.

Given the higher severity of these problems for the EMEs, they need to be addressed prior to, adoption of inflation targeting as a monetary policy regime. A noteworthy point in this discussion, as argued by Mishkin (2004),

“However, although fiscal and financial stability are necessary conditions for inflation control, I think the view that these reforms are prerequisites for attempting an inflation targeting regime in emerging market countries is too strong... . . . . If an inflation targeting regime is to be sustainable, a commitment to and work on these reforms is required when inflation targeting is implemented.”

## **3. The Indian Scenario**

The Indian policy makers initiated major economic reforms in the early 1990s which were accompanied by major changes in the fiscal policy, monetary policy and the fiscal-monetary relationship. On the fiscal front, the fiscal-monetary relationship has undergone a momentous change with the ‘September 1994 agreement’ between the central government and the RBI to phase out the use of ad hoc Treasury Bills over a period of three years. The practice of issuing ad hoc Treasury bills meant that there was no check on the expansion of RBI credit to the Central Government. For over three decades, the system of ad hoc treasury bills has been the cause of automatic monetization of the Government’s budget deficit. This system of issuance of ad hoc Treasury Bills was replaced with the system of ‘Ways and Mean Advances (WMA)’ with effect from April 1997. The quantum available to the government as WMA to meet the temporary mismatch between receipts and expenditure is now eventually agreed upon between the RBI and the government with semiannual ceilings. Delinking of the budget deficit from its monetization by the RBI admittedly provided the central bank greater

functional independence. An increasing portion of the fiscal deficit of the government is being financed by the borrowing at market related rates of interest.

There has been a reduction in pre-emption of commercial bank's resources from well over a half to about third of their resources. Thus the mandatory component of market financing of government borrowing has decreased. A policy decision has been taken by the RBI to eliminate its long term lending operations to the commercial sector and to moderate other forms of monetization by reducing direct funding of development activity. Most public enterprises have been moved out of what is described as the 'approved borrowing programme' and are encouraged to borrow from the market through voluntary subscriptions. Several initiatives and measures have been taken in recent years on the fiscal front to contain the fiscal deficit and also revenue deficit.

The major step in this direction was taken in December 2000 when the 'Fiscal Responsibility and Budget Management Bill' was passed by the Indian parliament. This bill provided for a legal and institutional framework to eliminate the revenue deficit, bring down the fiscal deficit, contain the growth of public debt and stabilize deficit as a proportion of GDP within a timeframe. The proposed law puts the onus on the government itself to strengthen the institutional framework for the conduct of prudent and accountable fiscal policies and paves the way for macroeconomic stability. Table 1 lists several fiscal dominance measures; namely, seignorage revenue, fiscal deficit, RBI credit to government (as % of GDP) and the inflation tax rate. All the fiscal dominance measures decline for the period 1994-95 to 2003-04 except for fiscal deficit (as a ratio of GDP) which was lowest for the period 1970-71 to 1985-86. However, it shows a fall from the period 1985-2004 to 1994-2004. These preliminary fiscal dominance measures provide evidence in favor of the declining effect of fiscal policy over monetary policy for the recent period.

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The Indian government launched a comprehensive program of structural reforms for the external sector in the early 1990s. These reforms included the following major changes in the external sector:

- Introduction of a market-determined exchange rate;
- Liberalization of current account transactions leading to current account convertibility;
- Compositional shift in capital flows away from debt to non-debt creating flows;
- Strict regulation of external commercial borrowings especially for short-term debts
- Discouraging volatile elements of flows from Non Resident Indians(NRIs)
- A new benchmark for reserve –adequacy
- Full freedom for outflows associated with inflows (i.e., principal, interest, dividend, profit and sale proceeds)

The policy framework for the external sector was implemented along with policy changes in trade, industrial and financial sectors. As a part of the external sector reforms capital flows were managed keeping in view the needs of efficiency and stability. There was also a smooth movement from an administered exchange rate system to a market-determined exchange rate. India adopted current account convertibility in 1994. It was also recognized that there could be capital outflows from residents in the guise of current account transactions. Hence certain safeguards were built into the regulation relating to current account transactions. On dollarization, it is recognized that large-scale dollar denominated assets within a country can disrupt the economy by creating potential for destabilizing flows. No dollar denominated transactions are allowed between residents. Exchange earners' foreign currency accounts can be used only for external payments and if such balances have to be used for local payments, they have to be converted into rupee. The counterpart of dollarization is the internationalization of domestic currency i.e. there are instances when a currency of a developing country could be officially traded outside the country without any underlying trade or investment transactions. India does not permit the rupee to be transacted offshore. In brief, a highly conservative approach is adopted with reference to dollarization and internationalization of the domestic currency. Foreign currency reserves have been steadily

built up by encouraging non-debt creating flows and de-emphasizing debt creating flows. Foreign exchange reserves are kept at the level, which is adequate to withstand both cyclical and unanticipated shocks.

Table 2 presents the changes in the Indian economy since the 1990s on the external front. Both imports as well as exports exhibit a rising trend. The main point of concern is continuously increasing dependence on oil imports which may increase the vulnerability of the economy to external crisis but at same time some favorable developments are also taking place in the form of a continuously declining trend in short term debt (as a percentage of GDP) and an increasing trend in non-debt creating capital inflows in the form of foreign investment. Further, foreign reserves also show a continuously rising trend. These developments limit the susceptibility of the economy to shocks originating outside the country.

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Financial Sector reforms also started with the adoption of the structural adjustment cum stabilization programme by the Indian government in 1991. In November 1991, the Narsimham Committee was set up to study the working of the financial system. The main recommendations of the committee were to reinstate the Cash Reserve Ratio (CRR) as an instrument of monetary policy and not as a means of controlling the secondary expansion of credit brought about by monetization of the fiscal deficit, bring down the Statutory Liquidity Ratio (SLR) to 25% in a phased manner over 5 years and phase out the directed credit program to the priority sector by the Scheduled Commercial Banks (SCBs). The committee also recommended the deregulation of interest rates and dismantling the policy of concessional interest rates on Government borrowing which were to be in line with the market determined rate of interest. The committee proposed to liberalize policies towards foreign banks with regard to opening of offices and branches or subsidiaries.

The reforms in the financial sector were carried out along the above described lines. These changes in the financial sector helped in reducing the reducing fiscal dominance over the financial sector, thus, making way for more independent monetary policy. Progress in the use of market-based instruments was achieved with the introduction of the Liquidity Adjustment

Facility (LAF) in June 2000. The LAF operations combined with strategic open market operations, consistent with market liquidity conditions, have evolved as the principal operating procedure of monetary policy of the RBI.

A feature unique to the Indian financial system and having bearing upon the independence of the central bank, relates to government ownership of most of the commercial banks in India. With the onset of reforms, there has been a change in the ownership pattern of banks. The legislative framework governing Public Sector Banks (PSBs) was amended in 1994 to enable them to raise capital funds from the market by way of public issue of shares. The government has initiated legislative process to reduce the minimum Government ownership in nationalized banks from 51% to 33%, without altering their public sector character. Steps have also been initiated to infuse competition into the financial system. RBI issued guidelines in 1993 with respect of establishment of new banks in the private sector. Likewise, foreign banks have been given more liberal entry and the norms for entry of new private banks were established. Another major element of financial sector reforms in India has been a set of prudential measures aimed at strengthening the banking system as well as ensuring safety and soundness through greater transparency, accountability and public credibility. Capital adequacy norms for banks are in line with the Basel committee standards and from the end of March 2000, the prescribed ratio has been raised to 9%. The Board for Financial Supervision (BFS) was constituted as a part of the reforms. The supervisory strategy of BFS consists of a four-pronged approach, including restructuring system of inspection, setting up of off-site surveillance, enhancing the role of external auditors and strengthening corporate governance, internal controls and audit procedures. The BFS, in effect, integrates within the Reserve Bank the supervision of banks, NBFCs and financial institutions.

These reforms had a significant impact on India's financial sector in terms of soundness, stability and ability to absorb risks. Tables 3 and 4 present some leading financial soundness indicators for the Indian economy<sup>4</sup> and the trends in them in the recent period (mainly the period since and 2000 onwards when financial sector reforms started showing their impact). Table 3 presents the capital adequacy indicators for SCBs. Two basic indicators; namely, the Capital Adequacy Ratio (CAR) and Capital to Risk Weighted Asset Ratio (CRAR) suggest significant improvement in the health of the banking sector in India. The capital adequacy ratio for nationalized banks and state bank group banks has increased from 10.29% in 1996-

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<sup>4</sup> Our choice of sample range is governed by the availability of data.

97 to 13.15% in 2003-04 and more importantly the ratio shows a significant improvement for the period after 2000. Also table 3 suggests that there have been a significant increase in the number of banks having CRAR above 10%, in the period after 2002. Table 4 lists other financial soundness indicators of interest. These are mainly asset quality indicators (columns I, II, III, and IV), earning and profitability indicators (columns V, VI, VII) and liquidity indicators (columns VIII and IX).

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Insert Tables 3 and 4 here  
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Overall as we see that all the financial soundness indicators show increasing robustness of the banking sector for the period 2000 to 2004. The only worrying fact is the liquid assets as a percentage of total assets of SCBs (IX column of Table 4) which showed some deterioration for the period 2000 to 2004.

The above discussion reflects that desired changes are taking place in Indian economy from inflation targeting point of view. Since our preliminary dominance measures are only suggestive, we did more elaborative econometric testing to examine all the above- mentioned dominance issues for India.

#### **4. Data and Methodology**

We formulated sector specific VAR models to examine all the four dominance issues for India. To analyze the fiscal dominance issue, we formulated a three variable VAR model consisting Wholesale Price Index (WPI) inflation, gross fiscal deficit as a percentage of Gross Domestic Product (GDP) at current market prices and reserve money growth; for external dominance issue, we formulated a four variable VAR model consisting call money rate (as a measure of short term interest rate), nominal effective exchange rate, WPI inflation and Index of industrial production (IIP). Considering the typical nature of the Indian economy where

exchange rate may not accurately measure the effect of external shocks<sup>5</sup> and the economy is more prone to oil price shocks (more in recent years as dependence on oil and world oil prices are rising.), the external shocks are measured by exchange rate shocks as well as oil price shocks also. Therefore, to examine external dominance, we also considered alternative VAR framework consisting Oil price inflation instead of nominal effective exchange rate. For oil price inflation, we have taken crude oil price index series published by International Monetary Fund, which is a simple average of ‘Dated Brent’, ‘West Texas Intermediate’, and ‘Dubai Fateh’ oil prices. For structural dominance, we formulated a VAR model consisting of reserve money growth, WPI inflation and supply shocks,<sup>6</sup> for financial sector dominance, we formulated VAR model consisting of call money rate, reserve money growth and BSE-sensex (stock market is taken as a representative of financial sector in India).

All the variables are sourced from RBI database other than the series for international crude prices. All the series other than interest rate and supply shocks are transformed as annual changes in log values. Thus all the variables denote year-on year changes in the original series and this takes care of seasonality issues in the monthly sample. All the variables are on 1993-94 base period. All the variables entering into the estimation are stationary.

The period of analysis for different dominance issues differ depending on availability of the data and also on the concerns of time-frame of impact of reforms on the sector as suggested by the literature.

#### **4.1 Methodology**

The main methodology employed to examine all the four issues is that we computed Generalized Forecast Error Variance Decompositions (GFVD) from the sector specific VAR models. Besides quantifying the importance of different shocks for the economy, this also helps to bring out variables which are important for explaining inflation volatility in India.

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<sup>5</sup> Since, exchange rate in India is not yet market determined and can be best described as ‘managed float’.

<sup>6</sup> Supply shocks have been taken from the paper ‘Identifying Long Run supply Curve in India’ by Goyal and Pujari, (2005). In this paper, authors estimated two-equation structural vector-auto regression model consisting of WPI inflation and Index of Industrial Production.<sup>6</sup> The authors employed two alternative identification schemes one for Vertical supply Curve (VSC) model in which aggregate demand shocks have no effect on growth rate of output giving a vertical long run supply curve and the other is Horizontal Supply Curve (HSC) model in which aggregate demand shocks have no effect on inflation giving horizontal supply curve. The sample for this analysis is also from 1994 April to 2004 March.

Generalized VAR analysis, proposed by Koop et al. (1996), is based on reconsidering what impulse responses and variance decompositions are meant to recover. This technique changed the focus from the “pure” structural shocks that are identified by orthogonalizing VAR innovations, to an understanding of what a typical *historical* innovation tells regarding the dynamics of the model. These historical innovations are not necessarily orthogonal, but contrary to VAR innovations, embody the information regarding the contemporaneous correlation of these innovations.

Consider the following VAR model in the moving average form

$$y_t = C(L)^{-1} \mu_t \quad (1)$$

And assume that  $\mu_t$  is distributed multivariate normal, i.e.,  $N(0, \Omega)$ . This implies that  $y_t$  is also multivariate normal with zero mean and covariance matrix  $C(L)^{-1} \Omega C(L)^{-1}$ .

Generalized impulse response analysis considers the conditional expectation of  $y_t$  given a specific shock to  $\mu_t$  instead of orthogonalizing the VAR innovations.

The ‘average’ effect on  $y_t$  of a historical shock of say  $\mu_{it}$ , the  $i$ th component of  $\mu_t$ , can be obtained by taking the expectation of equation(1) conditional on shock  $\mu_{it} = v$ ,

$$GIR(y_t, \mu_{it} = v) = E[y_t | \mu_{it} = v, \Omega] = C(L)^{-1} E[\mu | \mu_{it} = v, \Omega] \quad (2)$$

and given the properties of the multivariate normal distribution:

$$GIR(y_t, \mu_{it} = v) = C(L)^{-1} \Omega_i \sigma_{ii}^{-1} v \quad (3)$$

Where  $\Omega_i$  is the  $i$ th column of  $\Omega$ . Although  $v$  could be any value, it seems appropriate to set it equal to its historical value: the standard error of the  $i$ th shock,  $\sigma_{ii}^{-1/2}$ . This choice for the value of  $v$  corresponds to a unit shock of the historical shock.

The generalized impulse response for the  $i$ th shock will be numerically equivalent to the impulse response function obtained using Choleski Decomposition when the  $i$ th variable is put first in the ordering. And also they will be numerically equivalent when  $\Omega$  is diagonal, i.e. when system is subject to shocks that are independent.

The Generalized Variance Decomposition (GVD) can be derived following a procedure similar as discussed. Namely, using the expression for  $y_{t+s}$  and  $y_{t+s|t}$  from equation (1), the forecasting error can be expressed as:

$$y_{t+s} - y_{t+s|t} = \sum_{j=1}^k \{\mu_j (C_{j0}^{-1} + C_{j1}^{-1} + C_{j2}^{-1} + \dots + C_{js}^{-1})\} \quad (4)$$

The VAR innovations  $\mu_j$  does not embody the historical correlations of the shocks as summarized by  $\Omega$ , so that using directly the above equation to calculate variance decomposition would be misleading. GVD instead look at the average portion of mean square forecast error (MSFE) associated with each historical shock contained in  $\mu$ , conditional on the value of the shock equal to its standard error. Assuming as before that  $\mu$  is multivariate normal,

$$E[y_{t+s} - y_{t+s|t}] = \sum_{j=1}^k \{\Omega_j \sigma_{jj}^{-1/2} (C_{j0}^{-1} + C_{j1}^{-1} + C_{j2}^{-1} + \dots + C_{js}^{-1})\} \quad (5)$$

This expression when squared can be used to calculate the portion of the variance associated with each of the historical shocks suitably scaled by the MSFE ( $y_{t+s}$ ). GVDs (Generalized Variance Decompositions) are intended to provide the ‘share’ of the movements of a series to historical shocks.

The main advantage of GFVD over standard forecast error variance decomposition is that the forecasts are unique and not subject to the compositional effects of traditional Choleski decompositions. Since, we were not certain the order in which different variables included in different sector specific VAR models could affect each other, we computed GFVDs which is ordering invariant.

GFVDs were alone not sufficient to examine fiscal dominance hypothesis (fiscal dominance issue) and risk bearing capacity of Indian financial market to withstand unanticipated monetary policy shocks (unexpected changes in interest rate or reserve money growth rate), we computed some additional statistics to analyze these two issues.

For fiscal dominance issue, we estimated the following two equation model following Fratianni and Spinelli (2001):

$$def_t = c_1 + A_{11}(L)def_t + A_{12}(L)\Delta mb_t + \varepsilon_{1,t} \quad (6)$$

$$\Delta mb_t = c_2 + A_{21}(L)def_t + A_{22}(L)\Delta mb_t + \varepsilon_{2,t} \quad (7)$$

Where ‘def’ is the fiscal deficit as a percentage of GDP at market prices and ‘ $\Delta mb$ ’ denotes the change in the monetary base and ‘L’ is the lag operator.

This simple two-equation model allows us to examine the causal relationship between deficit and change in monetary base. Fiscal dominance implies that changes in monetary base react to changes in fiscal deficit by a strict Granger causality relationship. Existence of two-way causality is not an indication of fiscal dominance, because change in fiscal deficit and growth of monetary base may be correlated without the fiscal policy dominance also. As suggested by Barro (1987) when government targets real budget deficits and adjust nominal deficits to the evolution of the price level then price level changes become correlated with changes in monetary base leading to positive correlation between government deficits and growth of monetary base even in the absence of fiscal dominance.

Strict granger causality (fiscal dominance hypothesis) from def to  $\Delta mb$  imposes two restrictions:

$$A_{12}(L)=0 \text{ in equation (1) and } A_{21} \neq 0 \text{ in equation (7)}$$

The analysis in the bivariable framework is restrictive as these two variables may be affected by a host of other variables in the economy. Hence, we extended the analysis in the multivariable framework as well. In the multivariable framework few other variables (namely real GDP growth and inflation<sup>7</sup>), which may affect these two variables were included.

For multivariate analysis, following Haan and Zelhorst (1990) the following system of equations were estimated:

$$\dot{m}_t = \alpha + \sum_{i=1}^l \beta_i \dot{m}_{t-i} + \sum_{j=1}^m \lambda_j d_{t-j} + \sum_{k=1}^n \phi_k X_{t-k} + \varepsilon_t \quad (8)$$

Here  $m_t$  and  $d_t$  denote the reserve money growth and fiscal deficit as a percentage of GDP respectively as before and vector X contains all the other relevant variables<sup>8</sup>. Here, the basic hypothesis is that if the (change in) the fiscal deficit has a positive long run effect on money

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<sup>7</sup> Real GDP growth captures the cyclical behaviour of money growth. Inflation, on the other hand, is the most important variable which can affect or be affected by deficit and money growth. The other variables of relevance are abstracted from the analysis to keep sufficient degrees of freedom

<sup>8</sup> For multivariable analysis it is necessary to decide what variables should be included in vector X. For this analysis, three and four variable systems are estimated. In the three -variable system real GDP growth ( $\Delta rgdp$ ) has been included to capture the cyclical behavior of money growth and in the four-variable system WPI inflation (log change in wholesale price index ( $wpiinf$ )) has been included as this is the most important variable which can affect or be affected by deficit and money growth. The other variables of relevance are abstracted from the analysis to keep sufficient degrees of freedom.



growth, the sum of  $\lambda_j$  coefficients should be positive and significantly different from zero and for (change in) deficit to have only a temporary effect on money growth the coefficients of  $\lambda_j$  should be jointly significant.

To find out how far the stock markets in particular and financial sector in general is affected by the unexpected changes or the arrival of some new unanticipated information about reserve money and interest rate changes, it is necessary to remove the effect of past information on the reserve money and interest rate series. This was done by fitting an appropriate time series model to the respective series and interpreting the error term from the model as the change in the respective series that is caused by the arrival of new or unexpected information. We fitted ARIMA models to call money rate, growth of reserve money and BSE sensex. The BSE sensex and reserve money growth are log-differenced series. The residuals from these models are interpreted as innovations in respective time series.<sup>9</sup> The models were identified by Akaike information criterion. The residuals from the fitted time series models are the changes in call money rate, reserve money growth and BSE sensex due to arrival of some unexpected news or shocks. Since, by definition innovations are white noise processes the dependent variables in the estimated equation will not have any lags and the number of lags included for the independent variables is selected on the basis of exclusion criterion depending upon the F statistics.

## **5. Discussion of Results**

### **5.1 Issue of Fiscal Dominance**

Table 5 presents the results of analysis in the bi-variable and multivariate framework. The results of bivariate analysis suggests that for the entire period strict Granger causality holds between the deficit ratio and growth of reserve money as changes in fiscal deficit ratio causes reserve money growth but not vice-versa thus confirming the hypothesis of fiscal dominance for the Indian economy. The same holds for the initial sub-period from 1970-71 to 1984-85. However for the later period one of the identifying restrictions fails to hold as for this period the deficit is not granger causing reserve money growth. The analysis in the multi variable framework shows that deficit has temporary as well as positive long run effect on reserve money growth in both the systems. The similar analysis has been carried out for the later period from 1985-86 to 2003-04 to see whether in later years the situation is changing. Since

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<sup>9</sup> The results of the fitted time series models are presented in appendix A.2.

the numbers of observations are less so we included only 1 lag of all the variables in the estimation of three and four variable VAR. This analysis for the later period however does not support the fiscal policy dominance over the monetary policy as the deficit has neither temporary nor long run effect on reserve money growth in any of the system considered.

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Insert Tables 5 and 6 here  
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The GFVDs results (Table 6) show that historical shocks to reserve money growth are not particularly important in explaining volatility of inflation and they explain roughly 6% of variance of inflation in quarterly sample at the forecasting horizon of the year. The historical shocks to deficit are important in explaining volatility of inflation. They explained approximately 39% of variance of inflation in a quarterly sample at the forecasting horizon of the year. This result suggests that deficit (as a ratio of GDP) contains useful information about the future course of inflation development and thus are important for making inflation forecasts.

These findings present evidence in support of fading fiscal dominance in the recent period. We also found that careful monitoring of fluctuations in deficit would be important for inflation forecasting at a targeting horizon of the year.

## **5.2 Issue of External Dominance**

For measuring external dominance, the importance of external shocks for the Indian economy is quantified. This exercise is helpful in analyzing the two major questions; first, the vulnerability of the economy to the external factors and secondly, how far these external factors play a role in determining domestic inflation. The external shocks are measured by exchange rate shocks as well as oil price shocks also. Four variables VAR containing exchange rate (or oil prices), WPI inflation, call money rate and index of industrial production for the period 1994 April to 2004 March is run and variance decompositions are computed.

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Insert Table 7 here  
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These results show that shocks to exchange rate explain roughly 12% of forecast error of inflation and 5% of forecast error of interest rate at the forecasting horizon of the year. Since, fluctuations in exchange rate do not measure accurately the pressure of external shocks as central bank actively intervenes in the foreign exchange market to curb excessive volatility in exchange rate. Therefore, we also measured external shocks as shocks to international crude oil inflation. Shocks to international crude oil inflation also explained roughly the same forecast error of inflation and interest rate as explained by exchange rate shocks. The oil prices in Indian economy are not yet fully market determined but after dismantling of Administered Price Mechanism (APM) the susceptibility of domestic prices to international crude oil prices has increased. As mentioned in RBI Annual Report, 2004(Chapter 3 Money, Credit and Prices, page no.41), “Domestic Petroleum, oil and lubricants (POL) have, in general, become relatively more responsive to changes in international crude oil prices after dismantling of the administered price mechanism (APM) in April, 2002.” These results suggest that external shocks do not affect the volatility of inflation and interest rate in India as severely as in other emerging market economies<sup>10</sup>. Thus, it seems that external dominance is not much an issue for India in the sample considered here. But with the rising dependency of Indian economy on oil imports, dismantling of APM and increasing globalization, this situation may change in future. There is a need to continue efforts towards strengthening the fundamentals in the economy.

### **5.3 Issue of structural Dominance**

The above results (Table 8 suggest that supply shocks under horizontal supply curve explains almost 20 percent of variance of reserve money growth and 38% variance of inflation after a year while supply shocks under vertical supply curve explains about 13% movement of reserve money growth and 20% variance of domestic inflation after a year. Thus, the effect of supply shocks originating from horizontal supply curve identification scheme is much more

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<sup>10</sup> For the results on other emerging market economies, refer to table 6 in Fraga et al. (2003).

pronounced on growth rate of reserve money and inflation than the effect from vertical supply curve identification scheme. Goyal and Pujari (2005) also concluded:

“While reality probably lies somewhere in the middle of our two extreme identifying assumptions, the results suggest that on the whole the long-run supply curve is highly elastic for the Indian economy, so that the HSC needs to be kept in mind in designing macroeconomic policy for the economy.” Goyal and Pujari (2005).

Our analysis also suggests that shocks coming from horizontal supply curve carry greater relevance, implying presence of structural dominance in Indian economy.

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Insert Table 8 here  
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#### **5.4 Issue of Financial Sector Dominance**

To analyze the effect of unexpected changes on the volatility of the financial sector, we have taken two periods into consideration: one is from 1990 April to 1999 December and the other is from 2000 January to 2005 March<sup>11</sup>. Depending upon number of observations in both the samples, we have initially included six lags in first sub sample and four lags in the next sub sample and then come to the number of significant lags by following general to specific approach and on the basis of exclusion criterion on the basis of F-statistic.

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Insert Table 9  
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Our results (Table 9) suggest that though stock markets are no longer susceptible to unanticipated movements in reserve money growth but they are affected by the unexpected

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<sup>11</sup> The choice of subsample is guided by the findings of financial soundness indicators (as given in section 3), which suggest that financial sector reforms started showing its impact after 2000.

changes in interest rates. It also highlights the fact that in recent years, interest rate has become a primary instrument of monetary policy, as it was not the case before.

In order to understand the possible interactions among reserve money growth, call money rate and stock prices we computed the GVDs.

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Insert Table 10 here  
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The GVD results support the previous findings. In the first sample shocks to both reserve money as well as interest rate are negligible in explaining variance of stock prices. The situation is changing for the period after 2000 and interest rate shocks are becoming important in explaining variance of stock index and explain almost 18% of its variance at the forecasting horizon of 1 and half year. The increasing responsiveness of financial sector to interest rate impulses suggest strengthening of interest rate channel of monetary transmission. This is also indicative of increasing robustness of financial sector and decreasing financial dominance arising from fragile financial sector hindering the use of interest rate as an effective instrument of monetary policy.

## **6. Conclusion and Direction of Future Research**

In this exercise, we attempted to evaluate the independence of monetary policy in India from all the possible spheres which may divert it from the objective of maintaining price stability in the economy. This analysis also addressed the question that how far India is ready for the inflation targeting regime. This analysis also brought out some variables which contain useful information about the future course of development in inflation at a forecasting horizon of a year.

We found evidence in favor of fading fiscal dominance in Indian economy. We also found that external dominance is not much an issue for Indian economy as of now but with growing linkage of Indian economy with a global economy, there is a need to keep constant vigil on the external sector and continued efforts on improving the fundamentals of the economy. The analysis of financial sector highlighted the increasing robustness of banking sector and increasing responsiveness financial market (as characterized by stock market) to interest rate

signals, which is an essential pre-requisite for an inflation-targeting regime. However, we found that Indian economy suffers from structural dominance.

Inflation forecasts play a central role in inflation targeting framework because it is a forward-looking regime where central bank attempt to control inflation over a targeting horizon of one to two years. Since, central banks do not have perfect control over inflation and inflation reacts to monetary policy changes with long and variable lags and also affected by factors other than monetary policy, inflation forecasts provides for an ideal intermediate target. “The central bank’s inflation forecast is indeed an ideal intermediate target: it is by definition the current variable that is most correlated with the goal, it is more controllable than the goal, and it can be made more observable than the goal. It can also be made very transparent, and may therefore facilitate the central bank’s communication with the public and the public ‘s understanding of monetary policy.” Svensson (1997) This discussion suggests that the careful monitoring of the variables that contain useful information about the movements of inflation over the forecasting horizon of one to two years is very crucial for the success of inflation (or inflation forecast) targeting. Our sector wise analysis of Indian economy highlighted some variables, which contain useful information about future developments in inflation. These are mainly deficit (as a ratio of GDP at market prices), nominal exchange rate and international crude oil price inflation. Thus, careful monitoring of the developments in these variables may help in forming accurate inflation forecasts and ensures better implementation of inflation targeting frame-work.

The essential preconditions for the adoption of inflation targeting are taking place in Indian economy. The monetary policy is becoming independent from fiscal, external, and financial concerns. However, the analysis here, suggests that Indian monetary policy is still suffering from structural dominance. This suggests that inflation band targeting with a wide target range would be a better alternative for India. The existence of supply shocks also suggest that there should be more emphasis on transparency and communication under inflation targeting regime in India. As suggested by Mishkin (2006), “developing countries, which typically are characterized by greater supply shock volatility, should implement an inflation band targeting regime with a high degree of accountability and wide target range.”

This exercise highlights the preconditions for inflation targeting in Indian economy. From here, the next interesting research question would be effect of a change in monetary policy institution or rules. This question can be tackled within the confines of quantitative general

equilibrium models. But we have different competing models, each of which has their own frictions and policy implications. Therefore, we can build a VAR model of monetary policy for India to provide evidence on stylized facts to include in the theoretical model opted for policy analysis and to decide between competing general equilibrium economic models. In VAR models, monetary policy actions are identified using theory free restrictions and taking into account potential endogeneity of policy instruments. . The main inferences of that model can be used in to formulate the theoretical model, which in turn can be used to analyze the effectiveness of ‘inflation targeting’ as a monetary policy rule for India.

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## TABLES

**Table 1: Fiscal Dominance Measures<sup>12</sup>**

Period (Averages)	Seignior age revenue (as a ratio to GDP)		Inflation tax rate	Fiscal deficit as a ratio of GDP	Net credit as a ratio of GDP	RBI as a ratio of GDP
	Measure1	Measure2				
1970-71 to 2003-04	1.59	0.91	5.11	5.53	9.99	
1970-71 to 1985-86	1.39	0.87	7.85	4.73	10.06	
1985-86 to 2003-04	1.75	0.92	6.53	6.25	10.37	
1994-95 to 2003-04	1.51	0.77	5.46	5.59	7.20	

Source: Author's calculations, based on RBI's handbook of statistics on Indian economy.

**Table 2: India's position on External front**

Ratio (as % of GDP)	1990-91 to 1994-95	1995-96 to 1999-00	2000-01 to 2003-04
Imports	8.16	10.39	11.65
Exports	7.18	8.49	9.94
Oil imports	2.03	2.22	3.30
Short term debt	2.28	1.28	0.75
Short term debt/total debt	6.75	5.24	3.73
Foreign investment	0.68	1.20	1.74
Foreign portfolio investment	0.52	0.55	0.78
Foreign direct investment	0.17	0.66	0.96
Foreign reserves	4.93	7.46	13.33

Source: Author's calculations, based on RBI's handbook of statistics on Indian economy.

<sup>12</sup> Method to calculate the seigniorage revenue and inflation tax rate has been given in appendix section A.1.

**Table 3: Financial Soundness Indicators - 1**

<b>Year/Period (Averages)</b>	<b>Capital Adequacy Ratio<sup>13</sup> (CAR)</b>	<b>Number of Scheduled Commercial Banks<sup>14</sup> with Capital to Risk Weighted Asset Ratio (CRAR) Above 10%</b>
1996-97	10.29	64
1997-98	11.5	71
1998-99	11.24	76
1999-00	11.39	84
2000-01	11.43	84
2001-02	11.82	81
2002-03	12.42	88
2003-04	13.15	87
1996-97 to 2003-04	11.66	-
1996-97 to 1999-00	11.11	-
2000-01 to 2003-04	12.21	-

Source: Handbook of Statistics on Indian Economy and Report on Trend and Progress of Banking in India, 2005

<sup>13</sup> Above calculated capital adequacy ratio is simple arithmetic average of 26 public sector banks' ratio including 8 banks of State Bank Group (this list excludes Indian Bank).

<sup>14</sup> Scheduled commercial banks include state group banks, nationalized banks, old private sector banks, new private sector banks and foreign banks in India and SCBs had to comply with minimum CRAR of 8% by end March 1999 and of 9% by end March 2000

**Table 4: Financial Soundness Indicators - 2**

<b>Period (Averages)<sup>15</sup></b>	<b>I Gross NPAs to total assets (In %)</b>	<b>II Net NPAs to total assets (In %)</b>	<b>III Deposits to total liabilities (In %)</b>	<b>IV Borrowin gs to total liabilities (In %)</b>	<b>V Gross P/L to total assets (In %)</b>	<b>VI Net P/L to total liabilities (In %)</b>	<b>VII Net interest income to total assets (In %)</b>	<b>VIII Borrowings from RBI to total liabilities of SCBs (In %)</b>	<b>IX Liquid assets to total assets of SCBs (In %)</b>
1990-91 to 2003-04	-	-	78.93	10.65	-	-	-	0.42	14.4
1990-91 to 1999-00	-	-	78.55	11.19	-	-	-	-	-
1991-92 to 2003-04	-	-	-	-	1.57	0.30	8.94	-	-
1991-92 to 1999-00	-	-	-	-	1.41	0.07	9.20	0.54	15.42
1996-97 to 2003-04	5.24	2.65	-	-	-	-	-	-	-
1996-97 to 1999-00	6.28	3.23	80.78	9.31	1.50	0.58	9.18	0.60	16.39
2000-01 to 2003-04	4.20	2.08	79.87	9.29	1.93	0.81	8.34	0.14	11.86

Source: Author's calculation

<sup>15</sup> The figure shows the simple arithmetic average over the entire period.

**Table 5: Analysis in Bivariate Framework<sup>16</sup> and Multivariate Frame-Work<sup>17</sup>**

<b>Bivariate Framework</b>			
<b>Period</b>	<b>A<sub>12</sub> (L) Δmb<sub>t</sub>=0</b>	<b>A<sub>21</sub>(L)def<sub>t</sub>≠0</b>	<b>Outcome</b>
1970-71 to 2003-04	0.31(0.58)	7.34***(0.01)	Both the identifying restrictions are met
1970-71 to 1985-86	0.30(0.58)	3.05*(0.08)	Both the identifying restrictions are met
1985-86 to 2003-04	2.47(0.12)	1.87(0.17)	One of the identifying restriction fails to meet
<b>Multivariate Frame-Work</b>			
<b>1970-71 to 2003-04</b>	$\sum \lambda_j$ <sup>18</sup>	$\lambda_1 = \lambda_2 = 0$	<b>Lags</b>
Three-Variable System	2.75**(0.01)	7.59***(0.0059)	1
Four-Variable System	2.14**(0.04)	4.59**(0.0322)	1
<b>1985-86 to 2003-04</b>	$\sum \lambda_j$	$\lambda_1 = \lambda_2 = 0$	<b>Lags</b>
Three-Variable System	1.37(0.20)	1.88(0.17)	1
Four-Variable System	1.47(0.17)	2.18(0.13)	1

**Table 6: GFVDs for Quarterly Sample: 1996Q1 TO 2004 Q1**

<b>Horizon</b>	<b>Shock to M<sub>0</sub> growth Explaining Forecast Error of Inflation</b>	<b>Shock to deficit explaining Forecast Error Of Inflation</b>
Q1	3.5248	4.7507
Q2	6.5031	35.3639
Q4	5.5175	39.4728

<sup>16</sup> For all the three periods two-variable VAR has been estimated and lags are selected on the basis of AIC criterion turns out to be 1.

<sup>17</sup> The stationarity tests of the variables included in the system are given in appendix and lags has been selected on the basis of Akaike Information criterion. Maximum lag length has been set to two to maintain sufficient degrees of freedom.

<sup>18</sup> The relevant P-value is shown in the bracket.

**Table 7: GFVDs from a VAR with Exchange Rate and Crude Oil Price Inflation**

<b>Horizon</b>	<b>VAR with Exchange Rate</b>		<b>VAR with International Crude Oil Price Inflation</b>	
	<b>Shocks to exchange rate explaining Forecast Error for inflation</b>	<b>Shocks to exchange rate explaining Forecast Error for interest rate</b>	<b>Shocks to oil price inflation explaining Forecast Error for inflation</b>	<b>Shocks to oil price inflation explaining Forecast Error for interest rate</b>
1	1.332	0.745	6.375	0.884
3	4.619	4.117	6.021	1.413
6	10.980	3.696	9.696	4.399
12	12.187	4.887	12.515	4.176
18	15.016	4.731	20.439	5.298

**Table 8: GFVDs from a VAR with Supply Shocks**

<b>Horizon</b>	<b>Under HSC Identification</b>		<b>Under VSC Identification</b>	
	<b>Supply shocks explaining Forecast Error of <math>M_0</math> growth</b>	<b>Supply shocks explaining Forecast Error of inflation</b>	<b>Supply shocks explaining Forecast Error of <math>M_0</math> growth</b>	<b>Supply shocks explaining Forecast Error of inflation</b>
1	6.537	38.278	0.016	14.149
3	18.114	39.134	2.381	18.418
6	18.367	38.325	10.606	17.759
12	20.365	38.527	13.417	11.606

**Table 9: Model Selection for Financial Sector Dominance**

	<b>Specification 1</b>	<b>Specification 2</b>	<b>Specification 3</b>	<b>Specification 4</b>
Time Period	1990:M4 – 1999:M12	2000:M1 – 2005:M3	1990:M4 – 1999:M12	2000:M1 – 2005:M3
Dependent Variable	$BSE_{res}$	$BSE_{res}$	$BSE_{res}$	$BSE_{res}$
Independent Variable	$M_{0res}$	$M_{0res}$	$CMR_{res}$	$CMR_{res}$
<b>Lags↓</b>	<b>Coefficients→</b>			
1	0.106	-0.032	-0.022	-0.022
2	0.366	-0.350	-0.002	-0.305***
3	0.020	0.210	0.020	0.202**
4	0.619**	-0.150	0.014	0.043
5	0.131		0.002	
6	-0.511*		-0.007	
Wald test F-Statistics	2.05*	0.31	0.70	4.50***
Outcome of Granger Causality Test	Granger Causing	Not Granger Causing	Not Granger Causing	Granger Causing

Notes: \*, \*\*, \*\*\* denote significance at 10%, 5% and 1% level respectively.

**Table 10: GFVDs from a VAR of Financial Sector (1990:M4 to 1999:M12)**

<b>Horizon</b>	<b>Period: 1990:M4 to 1999:M12</b>		<b>Period: 2000:M1 to 2005:M3</b>	
	<b>Shock to <math>M_0</math> growth Explaining Forecast Error for BSE Sensex</b>	<b>Shock to CMR Explaining Forecast Error for BSE Sensex</b>	<b>Shock to <math>M_0</math> growth Explaining Forecast Error for BSE Sensex</b>	<b>Shock to CMR Explaining Forecast Error for BSE Sensex</b>
1	0.038	0.419	0.016	7.78
6	0.189	0.692	1.65	17.60
12	0.205	0.922	1.69	17.81
18	0.210	0.989	1.69	17.82

## APPENDIX

### A.1 Fiscal dominance measures:<sup>19</sup>

#### A.1.1 Seigniorage

Measure 1: defined as annual change in the reserve money divided by nominal GDP

Measure 2: defined as annual monetary base multiplied by inflation tax rate and divided by nominal GDP

#### A.1.2 Inflation tax rate

Inflation tax rate is defined by the following formula:

$$\frac{\text{WPI Inflation}}{100 + \text{WPI Inflation}} \times 100$$

### A.2 Summary of fitted ARIMA models for causality testing

Lag↓ / Variable→	BSE Sensex	M <sub>0</sub>	CMR
<b>1990:M4 to 1999:M12</b>			
Fitted ARIMA Model	(3,1,0)	(4,1,0)	(1,0,2)
AR(1)	0.326***	-0.244***	0.915***
AR(2)	0.029	-0.187*	
AR(3)	-0.237**	0.029	
AR(4)		-0.204**	
MA(1)			0.349***
MA(2)			0.247***
<b>2000:M1 to 2005:M3</b>			
Fitted ARIMA Model	(1,1,0)	(1,1,4)	(0,1,1)
AR(1)	0.256**	-0.625**	
MA(1)		-0.454*	0.657***
MA(2)		0.230	
MA(3)		-0.619***	
MA(4)		0.605***	

Notes: (1.) The figures in parenthesis below the variables denote (p, d, q) i.e. ar terms, order of differencing and ma terms respectively, (2.) \*, \*\*, \*\*\* denote significance at 10%, 5% and 1% level respectively, (3.) BSE Sensex and M<sub>0</sub> are converted to their natural logarithm.

<sup>19</sup> These formulae are taken from “The scope for inflation targeting in Developing Countries”, Masson et al. (1997)