
Fiscal Seigniorage “Laffer-curve effect” on Central Bank Autonomy in India

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FISCAL SEIGNIORAGE “LAFFER–CURVE EFFECT” ON CENTRAL BANK AUTONOMY IN INDIA

Lekha Chakraborty¹

Abstract

It is often emphasised that seigniorage financing of public sector deficits is technically a “free lunch” if the economy has not attained the full employment levels. However, conservative macroeconomic policies in many emerging and developing economies, especially in the last two decades, have moved away from seigniorage financing to debt financing of deficits to give greater autonomy to the central banks. Against this backdrop, the paper analyses the fiscal and monetary policy co-ordination in India by constructing a fiscal seigniorage Laffer curve. If such a curve exists, it is possible to derive a seigniorage-maximizing inflation rate to estimate the optimal level of seigniorage financing of deficits. The illustrative estimates from the Indian data using error correction mechanism models confirm the possibility of a fiscal seigniorage Laffer curve.

Key Words: Fiscal-Monetary Policy Co-ordination, Seigniorage, Fiscal Deficits, error correction mechanism, Seigniorage Laffer Curve

JEL Classification Codes: E52; E58; E62; E63; H62

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1. Introduction

There is a growing concern about the tendency of segregating the monetary and fiscal policy while assessing the macroeconomic impact of deficits on economic growth outcomes. This paper attempts to revisit this dichotomy that prevails in the contemporary macro policy space and analyses the plausible linkages between the fiscal and monetary policy co-ordination, through constructing fiscal seigniorage in the context of India.

The significance of institutional linkages between fiscal and monetary authorities can be traced back to 'Unpleasant Monetary Arithmetic' (UMA) of Sargent and Wallace (1981). The 'Unpleasant Monetary Arithmetic' revealed that fiscal policymaker (where fiscal authority has the 'first mover advantage, and the monetary policy follows) dominates in the financing decision of deficits. If the bond financing of deficits becomes sooner or later unsustainable, the Central Bank has to step in and generate the monetary seigniorage revenues to monetize the deficits eventually. Under this fiscal dominance hypothesis, the attempts by the central bank to keep inflation low through inflation targeting cannot last and must ultimately give into higher inflation in the longer run. Under UMA, inflation today or inflation tomorrow is the only plausible macro policy option and therefore it is referred to as the 'unpleasant monetarist arithmetic'.

Does the macroeconomic scenario of UMA better for growth outcomes rather than central bank independence? The situation of central bank independence and inflation targeting with no fiscal policy dominance is referred to as 'Unpleasant Fiscal Arithmetic' (UFA). The Unpleasant Fiscal Arithmetic thus visualizes to reverse the order of adjustment, assumed in UMA, and to transfer the first mover advantage from fiscal agencies to the Central Bank authorities. By introducing strict fiscal policy rules, it obliges fiscal agencies to adjust to the anti-inflationary policy of the independent Central Bank and thus *Unpleasant Monetary Arithmetic* turns into *Unpleasant Fiscal Arithmetic* (Winckler, et al., 1998).

A recent treatment of the Sargent-Wallace argument of fiscal-monetary policy linkages is the "fiscal theory of the price level", (FTPL), pioneered by Leeper (1991), Sims (1994), Woodford (1994) and Cochrane, J H (1998). This fiscalist literature argues that the price level is independent of monetary policy but dependent strictly on fiscal policy; price level indeterminacy problems can be solved by having the central bank peg the nominal interest rate at a level consistent with the central bank's desired inflation rate, rather than by controlling the growth rate of the (base) money supply (Sims, 1994 and Woodford, M , 1994).

These theoretical debates find relevance in contemporary macro policy transition in India from discretion to rules. The fiscal policy institutions have moved away from discretionary fiscal stance towards fiscal rules - the efficacy of fiscal authorities to keep the deficits within the numerical threshold level of deficits normalized to GDP (Andrea Schaechter et al., 2012). Recently, the monetary policy authorities have begun the policy rules to 'inflation targeting' and 'central bank independence' in India

(for details, Urjit Patel Committee recommendations, Reserve Bank of India, 2014 and the ‘new monetary framework’, signed between Government of India and Reserve Bank of India, February 2015). This new dimension of the rule-based monetary policy stance in India has spurred from Taylor’s rule (Taylor and Williams, 2010).

The contemporary macroeconomic policy transition from discretion to rules gives rise to one pertinent question: does monetary rule require a fiscal rule? Such monetary-fiscal linkages are treated in the literature (for instance, Sargent and Wallace, 1981) through analyzing the macroeconomic channels through which deficits affect monetary policy stance². Unfortunately, over the years, the coordination between fiscal and monetary policy has been weakening and the policy debates have confined to just numeric values of deficits –the ‘levels’ of deficit to 3 percent of GDP- in attempting such linkages. Apparently there has been a widening acceptance that numeric Fiscal Rules are associated with greater fiscal discipline (Alesina and Perotti, 1995).

Against this backdrop, the paper attempts to examine the theoretical and empirical linkages between fiscal and monetary policy. It presents an illustrative estimation of seigniorage and deficits linkages, through arriving at a plausible seigniorage Laffer curve. The construction of fiscal seigniorage (Neumann, 1992) is attempted in this paper.

The paper is organized into four sections. Section 1 explores the analytical framework while section 2 deals with the stylized facts relate to measuring deficits and financing pattern of deficits in India, with special reference to seigniorage financing. Section 3 deals with the estimation of both fiscal and monetary seigniorage. Using error correction mechanism models, an attempt to develop a threshold level of seigniorage maximizing inflation and plausibility of Seigniorage Laffer curve would be attempted in section 4, the estimation is preliminary and illustrative. Section 5 concludes and suggests policy options.

2. The Analytical Framework of Fiscal Seigniorage

The fiscal seigniorage is derived from the intertemporal budget constraint of financing the public sector deficit. In this framework, we try to derive fiscal seigniorage from the central government budget identity as well as from the components of Central Bank’s balance sheet. This derivation of fiscal seigniorage is drawn from Klein and Neumann (1990) and Neumann (1992).

The reserve money or the high powered money (M) can be created by the central bank by lending credit to the government (A), by lending credit to the private sector(B), by acquiring the net FOREX reserves (F) and through open market operations by purchasing public debt in open markets (D). Symbolically, the balance-sheet of the central bank for the flows can be as follows:

$$\dot{M} = \dot{A} + \dot{B} + \dot{D} + e^{\dot{F}} + N_M, \quad (1)$$

² For details on fiscal-monetary policy co-ordination, see Reserve Bank of India, 2012.

where dots over variables denote time derivatives, e is the nominal exchange rate and N_M denotes the change in the net balance of all other items.

Klein and Neumann (1990) derived the central bank's profit transfer to the government from the central bank's profit and loss account as follows:

$$R = aA + bB + dD + efF + N_R - V - C \quad (2)$$

The central bank's profit transfer to the government (R) can be derived as the difference between total revenues and total costs. The rates of interest on the assets are denoted by a , b , d and f . N_R is the surrogate of all other net revenues of central bank. V represents revaluation losses (or gains, if negative) on net FOREX reserves and C denotes the central bank's operating costs.

After incorporating these stylised facts into the intertemporal budget constraint of central government, the equation transforms into an identity of financing public deficits, as follows:

$$G - T + bB_T + aA = B_T + \dot{A} + R \quad (3)$$

The LHS of this equation denotes the fiscal deficit. The RHS denotes how fiscal deficit can be financed. Fiscal deficit is interpreted in the LHS as an aggregation of primary deficit ($G-T$) and interest payments expenditure. The interest expenditure comprises of two components, the interest payments on all government bonds (bB_T) and those held by the central bank (aA). The RHS reveals that the total public deficit can be financed by issuing bonds, by net credit from the central bank, and by using the profit disbursed by the central bank. B_T denotes the total stock of government bonds.

Consolidating the equations (1), (2) and (3) yield the intertemporal budget constraint identity of the public sector³.

$$G = T + (bB_P - \dot{B}_P) = \dot{M} + (dD - \dot{D}) + e(fF - \dot{F}) - V - \dot{V} - N \quad (4)$$

where B_P denotes the government bonds with the public and $N = N_R - N_M$ is a net residual of all other items. Equation (4) provides the analytical framework for deriving the fiscal seigniorage. The LHS of equation (4) reflects the accounts of the central government while the RHS reflects the accounts of the central bank.

Fiscal seigniorage can be derived from the above analytical framework. The method of estimating fiscal seigniorage is through central government's intertemporal budget constraint, as follows.

$$S_G = (G - T + aA_o - \Delta A_o)/P, \quad (5)$$

where $(G - T)$ is the primary budget deficit or surplus of the central bank and aA_o is the interest payments expenditure on the public debt held outside the monetary system (A_o) (Neumann, 1992).

³ The term "public sector" is used in this context as the consolidation of the central government and the central bank (Klein and Neumann, 1990).

Equation (5) denotes that fiscal seigniorage is the portion of the public deficit that is not financed by borrowing from the public (ΔA_o). This translates that fiscal seigniorage contributes to the financing of the primary deficit and of the interest payment expenditures on debt held by the public (outside the purview of central bank).

3. Stylised facts: Measuring deficits and seigniorage financing

As a prelude to estimating fiscal seigniorage, it is pertinent to discuss the appropriate concept of public deficit, and the optimal financing patterns of the public deficit with special emphasis on seigniorage. This section deals with the measurement issues related to the public deficit; and in turn interprets data on the trends and financing patterns of public deficits in India.

It is argued that unless a correct indicator of deficit is adopted, there is a possibility of miscalculation of pre-emption of resources by the government and thus the assessment of the fiscal policy and its impact on macro economy (Boskin, 1988). This evolution towards a series of *purpose-specific* deficit measures worldwide, as a prelude to Fiscal Rules, from the conventional approach of *single measure* of budget deficit resulted in construction of primary deficit, fiscal deficit, monetized deficit and revenue deficit (for details, four pioneering surveys on the measurement of *purpose-specific* budgetary deficits by Blinder and Solow (1974), Heller, et al (1986), Blejer and Chu (1988) and Blejer and Cheasty (1993); and Pattnaik et al, 1999 for details on India-specific measurement issues of deficit).

As for the coverage, the ideal concept of deficit to study the macroeconomic impact is the *Public Sector Borrowing Requirement (PSBR)*. In other words, ideally, any measurement of the deficit should consider the deficit of the public sector as a whole instead of a sectoral deficit of different public sector entities. But problem lies in covering the public sector as a whole for a comprehensive measurement of public sector deficit because there are more exhaustive lists of government entities and there are intra-public sector transactions for which data is not readily available. Unless, into a public sector transactions are netted out, estimation of public sector deficit may suffer from the problem of double counting leading to the overestimation of the deficit. Thus, any measurement of government deficit should be defined by a public sector of given coverage, the intersectoral linkage within the public sector has to be delineated and a time horizon should be specified to assess the impact of fiscal deficit (Blejer and Cheasty: 1993).

Apart from the above-discussed Public Sector Borrowing Requirement (PSBR), various concepts of the deficit and their use as indicators to evaluate the budgetary performance of the government are recent phenomena in India. This evolution is also a result of the contemporaneous paradigm shift to a series of purpose-specific deficit measures worldwide, from the conventional approach of a single measure of the budget deficit.

The generation of purpose-specific deficits has the huge relevance of facilitating the analysis of the impacts of fiscal policy stance on macroeconomic activity. However, the formulation of numerical bound and fiscal rules has shrunk the possibility of maturing such debates of macroeconomic impacts of fiscal stance, and the debates have confined to the numerical fiscal rules.

Traditionally (up to the late '80s), the concept of the *budget deficit* was in prominence in India and containing of the *budget deficit* was the prime objective of fiscal management. *Budget deficit* or the overall deficit of the central government is that part of the deficit that was covered by 91 days Treasury bills and withdrawal of cash balances with RBI. As the *budget deficit* is the borrowing from the central bank, it increases reserve money into the system and could fuel inflation and destabilize the monetary system. Thus, the emphasis was given to reduce the volume of the *budget deficit*. As RBI holds dated government securities, which also increases the volume of reserve money into the system, the *budget deficit* could only give a partial picture of the total increase in the reserve money. To capture the exact impact of deficits in the creation of reserve money, Chakraborty Committee (RBI: 1985) recommended the concept of monetised deficit. The monetized deficit is the increase of net RBI credit to the central government.⁴

The traditional measure of the *budget deficit* and its expanded form, the *monetised deficit*, excludes part of the resource gap of the government, which is financed through borrowing outside RBI. Thus, in recent years, the emphasis has been given to contain the *fiscal deficit*, which is the net borrowing requirement of the Government. Conventional measurement of fiscal deficit is defined as the difference between total government receipts (non-debt creating) and the total government expenditure net of repayment of previously incurred debt. In India, the gross fiscal deficit is defined as the excess of the total of revenue expenditure, capital outlay and net lending over revenue receipts and non-debt-creating capital receipts including the proceeds from disinvestment. Thus,

Gross Fiscal Deficit = Revenue Expenditure + Capital Outlay + Net Lending - (Revenue Receipts + Non-debt creating Capital Receipts).

Methodological limitations apart, it should be noted that in India, a reliable measure of total public sector deficit, the ideal measurement of deficit to capture the macroeconomic impacts, is not constructed due to paucity of data on intra-public sector transactions and the data at subnational (local) government. Therefore, the second best alternative measure of the deficit which can capture the macroeconomic impacts in India is the gross fiscal deficit.

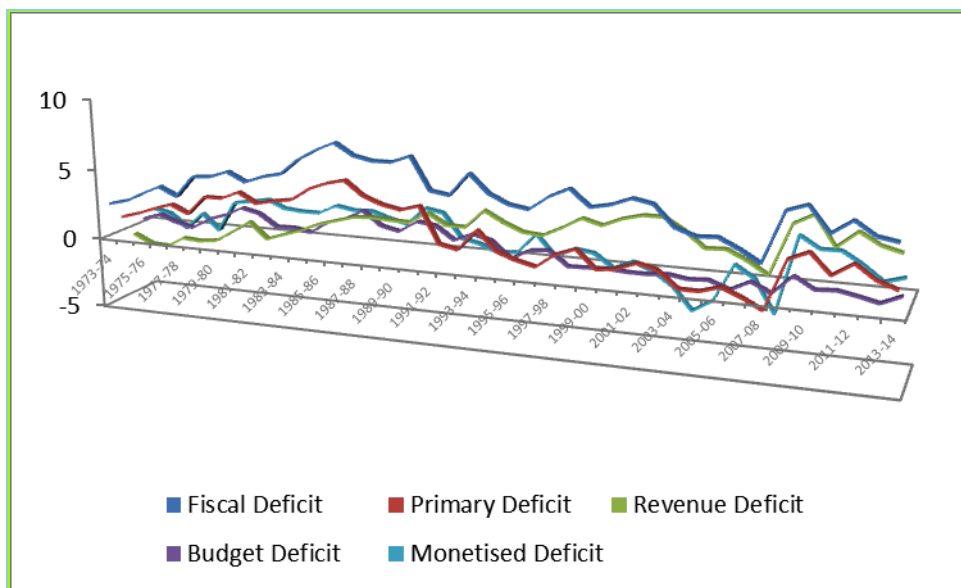
Along with fiscal deficit, other important deficit indicators introduced to assess the budgetary performance of the government are *primary deficit* and *revenue deficit*. In India, the primary deficit is an indicator to assess the impact of current year's discretionary fiscal action on the indebtedness of the government. *Primary Deficit = Fiscal Deficit - Interest payments.*

⁴ RBI's holding of ad hocs, dated government securities, 91 days Treasury bills and government's currency liabilities constitute the net RBI credit central government, the measure of monetised deficit in India.

Revenue deficit as a concept has received immense attention in recent years. Boskin (1988) argued that conventional deficit does not measure government dissavings, the latter being reflected in the revenue deficit. *Revenue deficit* is defined as the difference between the revenue earning of the government and revenue / current expenditure government. In the context of the structural adjustment programme, as a policy of demand management, reduction of both fiscal and primary deficit assumed paramount importance. Among the economists, there have been arguments for and against the adoption of these indicators to evaluate the budgetary performance of the government.

The trends in different concepts of deficits in India as a percent of GDP are given in Figure 1. The trends in deficits revealed that budget deficit and monetized deficit was controlled intertemporally though the latter has shown a rise in the recent years. The revenue deficit is not yet completely phased out in India. The primary deficit and fiscal deficit have moved in tandem and have shown a comparatively slight decline in the recent years, as percent of GDP.

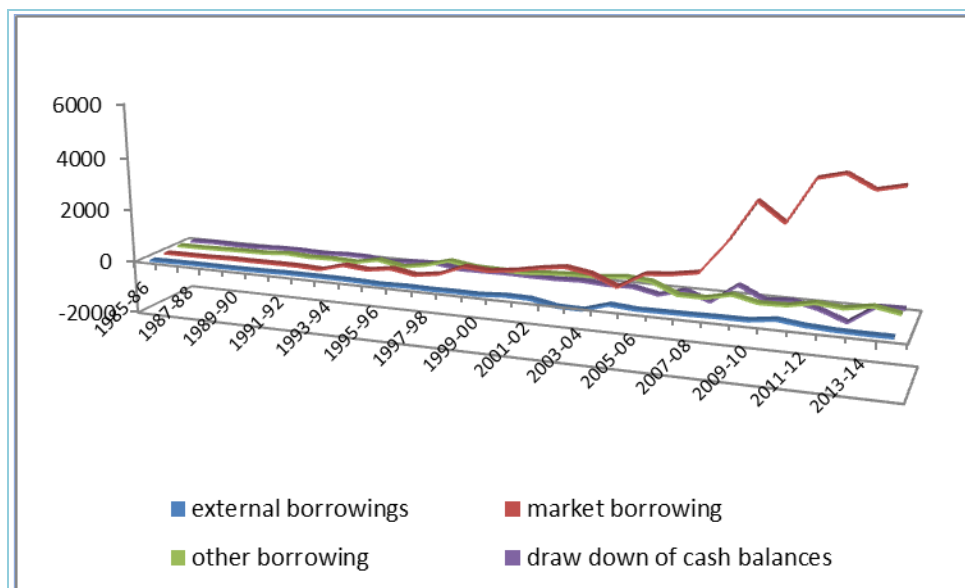
Figure 1: Trends in Deficits (as percent of GDP)



Source: (basic data), RBI (various years)

The fiscal deficit is financed through the issuance of bonds, seigniorage financing, financing through ad-hoc Treasury Bills and external financing. It is evident from figure 2 that over the years, Government of India resorted more to internal financing than to external financing, and market borrowing (bond financing of deficits) has emerged as the most important source of financing of fiscal deficit in India. The rationale behind the market borrowing by the Central Government was to create and widen the investor's base for government securities outside the captive market by attractive rates of interest and thereby to reduce government's dependence on monetisation of deficit.

Figure 2: Financing Pattern of Deficits (in Rs crores)

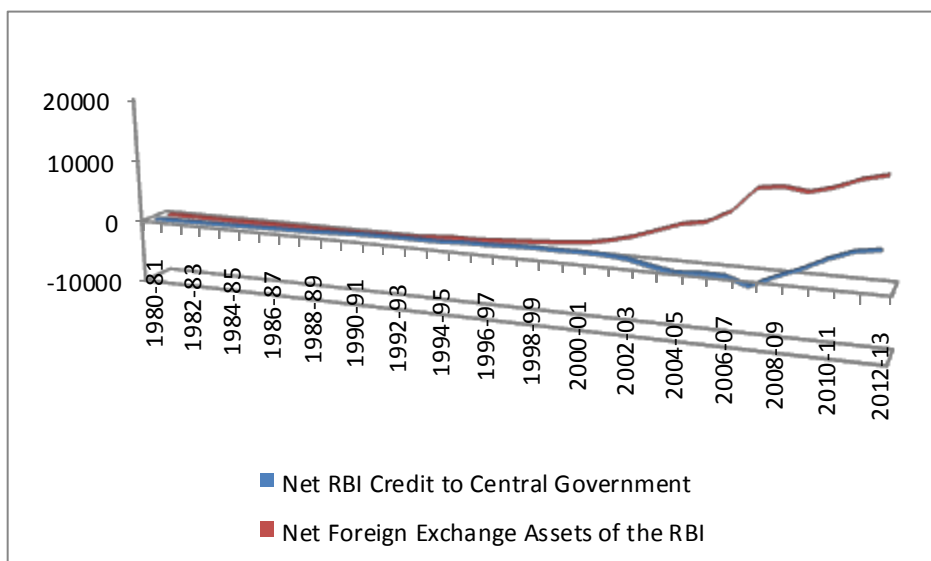


Source: (basic data), RBI (various years).

The deregulation of interest rate in India made market borrowing more expensive because of the sharp rise in the interest rates on government securities. When government's ability to monetize the fiscal deficit became limited, especially after doing away with automatic monetisation of deficit through ad-hoc Treasury bill in April 1st, 1997, government has been compelled to resort to high cost market borrowing to finance the fiscal deficit. Increasing recourse to bond financing is reflected in the increase in the share of market borrowing during the 1990s (Figure 2).

It is important in this context to understand the role of fiscal policy in creating seigniorage revenue in India. Historically the change in reserve money in India is attributed to the conventional *budget deficit* of the government or *deficit financing* (monetisation of fiscal deficit). Ex-post to Chakravarty Committee Report (Reserve Bank of India, 1985), the government has made a clear distinction between the overall budget deficit and deficit financing since their implications on money supply could be entirely different. The overall budget deficit denoted the gap between the expenditure and the receipts under revenue and capital accounts taken together and this budgetary gap was met by the sale of Treasury Bills (of 91-day maturity period). This conventional budget deficit had been phased out since 1997-98. On the other hand, deficit financing refers to the increment during the year on the net RBI credit to the Government (for details, Rakshit, 1993). Through an institutional reform, of signing an agreement between central bank and central government, thus the monetized deficit has been reduced in India.

Figure 3: Two Significant Components of Reserve Money (in Rs crores)



Source: (basic data), RBI (various years)

It is evident from Figure 3 that despite controlling for the monetized deficit (net RBI credit to the Government), the reserve money has not been able to decline. The factor which contributed to this trend of no significant decline of reserve money, despite the decline in net RBI credit to the Government, is due to the increasing share of net foreign exchange assets of RBI in reserve money creation (Figure 3). The net RBI credit to the Government is on the increase recently, and it is important to test whether it has implications for seigniorage-deficit linkages.

The second institutional reform was imposing fiscal rules on public deficits in India. A fiscal rule imposes a long-lasting constraint on fiscal policy through numerical limits on budgetary aggregates (Kopits and Symansky, 1998). This implies that a domain is set for fiscal policy which cannot be frequently changed and a roadmap is provided by specifying a numerical target that limits a particular budgetary aggregate. The Fiscal Rules aim at correcting distorted incentives and containing pressures to overspend, in particular in good times, so as to ensure fiscal responsibility and debt sustainability (Andrea Schaechter, et al., 2012).

In India, the “golden rule” is invoked for the reduction of revenue deficit to zero or negative levels. A limit on fiscal deficits to 3-5 per cent of GDP was imposed with an emphatic rationale to avoid “crowding out” of private investment. However, many empirical evidences do not suggest ‘direct’ or ‘financial’ crowding out in the context of India (Chakraborty, 2002, 2006, 2007, 2012; Chakraborty and Chakraborty, 2008; Goyal, 2004; Vinod, Chakraborty and Karun, 2014) that deficits crowd out private corporate investment, and does not induce rise in interest rates or output gap either.

What is missing in the design of numeric fiscal rules is the macroeconomic channel through which the deficits affect the output gap. It is not only the levels of deficit, but also the financing pattern of deficits that creates macroeconomic consequences. This aspect was surpassed in the debates

related to Fiscal Rules and budget management policies. The Fiscal Rules have taken the deficit financing rules as granted and deal with only numerical targets of deficits. However, excessive use of any financing mode of deficits has macroeconomic repercussions and cannot be tackled by focusing on the fiscal rules alone. Against this backdrop, the construction of seigniorage is attempted in next section.

4. Estimating Fiscal Seigniorage

As a prelude to estimating fiscal seigniorage, the monetary estimates of seigniorage are attempted for a comparative perspective. There was an increasing recognition that the seigniorage causes inflation (Easterly W and Schmidt-Hebbel, K. 1993; Dornbusch and Fischer 1981; Van Wijnbergen 1989; Buiters 2007; and Easterly and Schmidt-Hebbel 1994). The monetary seigniorage is defined as the change in the nominal stock of reserve money (Buiters, 2007). It is measure of seigniorage which is a change in reserve money divided by GDP at current prices.

Monetary seigniorage can be expressed by the following equation:

$$S_1 = \frac{\Delta M_t}{Y_t} \quad (6)$$

Where S_1 = seigniorage revenue;

ΔM_t = change in reserve money; and

Y_t = GDP at current prices.

Equation (6) can be rewritten in the following form

$$S_{rev} = \frac{\Delta M_t}{M_t} * \frac{M_t}{Y_t}$$

$$S_{rev} = \mu_t * m_t \quad (7)$$

Where, $\mu_t = \Delta M_t / M_t$ and $m_t = M_t / Y_t$

As per equation (7), seigniorage is defined as the product of the rate of growth of nominal reserve money (μ_t) and the reserve money per unit of GDP (m_t).

A distinct but related concept of revenue from Central Bank and seigniorage is inflation tax. Inflation tax and seigniorage are not synonymous always. Inflation tax is the erosion of the value of reserve money held by the public.

Seigniorage (S_2) can be decomposed further into two components: inflation tax and real change in the reserve money. The change in reserve money in real term can be written as

$$S_2 = \frac{M_t - M_{t-1}}{P_t}$$

$$S_2 = \frac{M_t}{P_t} - \frac{M_{t-1}}{P_t} + \frac{M_{t-1}}{P_{t-1}} - \frac{M_{t-1}}{P_{t-1}}$$

$$S_2 = \frac{M_t}{P_t} + (M_{t-1} * \frac{\pi_t}{P_t}) - \frac{M_{t-1}}{P_{t-1}}$$

$$S_2 = \dot{m}_t + \pi_t * m_{t-1} \tag{8}$$

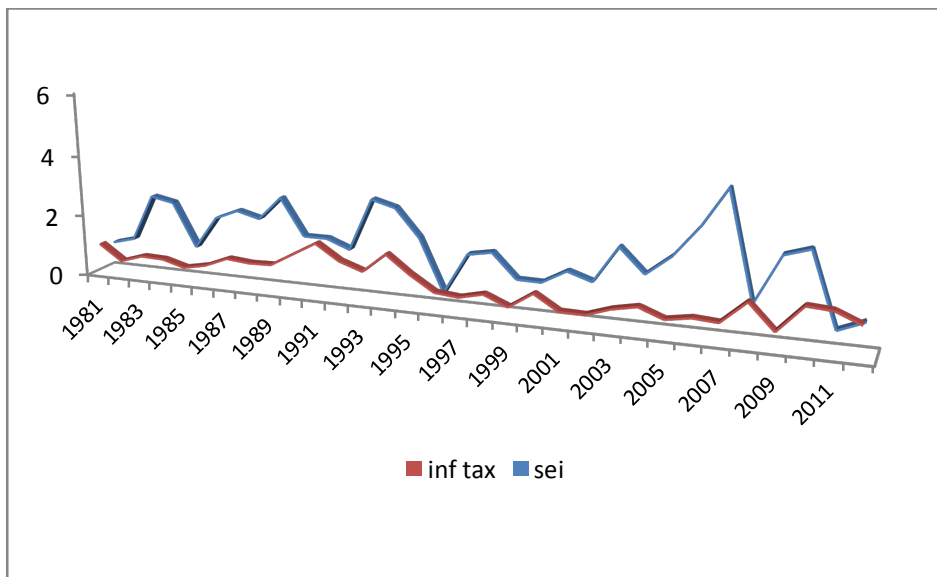
where $\pi_t = \frac{(P_t - P_{t-1})}{P_{t-1}}$, $\dot{m}_t = \frac{M_t}{P_t} - \frac{M_{t-1}}{P_{t-1}}$ $m_{t-1} = \frac{M_{t-1}}{P_t}$

The equation (8) expresses seigniorage as the sum of increase in the real stock of money \dot{m} and the change in real stock of money that would have occurred with a constant nominal stock because of inflation ($\pi_t * m_{t-1}$) (Agenor and Montiel,1996). The expression ($\pi_t * m_{t-1}$) of equation (8) is the inflation tax.

As mentioned above, the inflation tax is not always equal to seigniorage. They are equal only in a stationary state, that is, when m_t becomes zero. From equation (8), it becomes clear that inflation tax revenue is a component of seigniorage revenue. The inflation tax, as noted above, is the product of inflation rate (tax rate) and the real monetary base (tax base).

$$I_{tax} = \pi_t * m_{t-1} \tag{9}$$

Figure 4: Monetary Seigniorage and Inflation Tax (as percent of GDP)



Source: (basic data), RBI (various years)

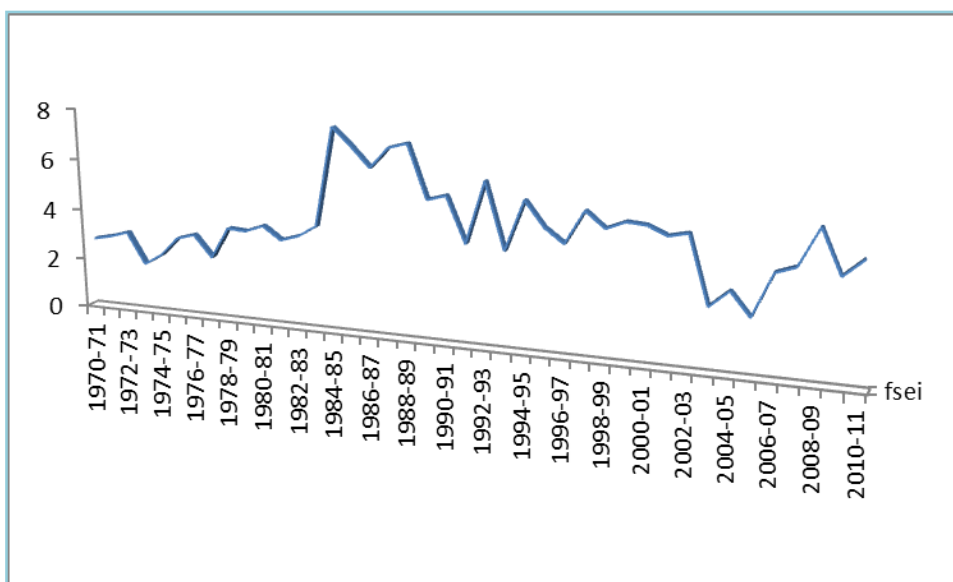
Seigniorage and Inflation tax are equal only in a stationary state. In other words, seigniorage is defined as the change in high-powered money to GDP while inflation tax is defined as the product of the rate of inflation and high-powered money in period (t-1). Figure 4 presents the trends in illustrative estimates of seigniorage and inflation tax for India; the trend revealed that the former (seigniorage

generation) has not crossed over 4 percent of GDP. It can be seen from the figure 4 that there have been wide year-to-year fluctuations in the creation of seigniorage in India during the last three decades.

Fiscal seigniorage (S_G), as mentioned in the section 3, is the government's net monetary finance requirement in output units. It measures that part of seigniorage which the central bank passes on to the government (Klein and Neumann, 1990). Fiscal seigniorage denotes the proper measure of the government's revenue from the creation of money, while monetary seigniorage confines to the fiat money or cost of printing money technically captured by the changes in reserve money.

Fiscal Seigniorage is symbolically, $S_G = (1^0 + aA_0 - \Delta A_0)/P$ where 1^0 is the primary balance, A_0 is the interest expenditure incurred outside the purview of central bank. The financing of public deficit through the open market operations (OMO) are deducted to arrive at the estimate of fiscal seigniorage.

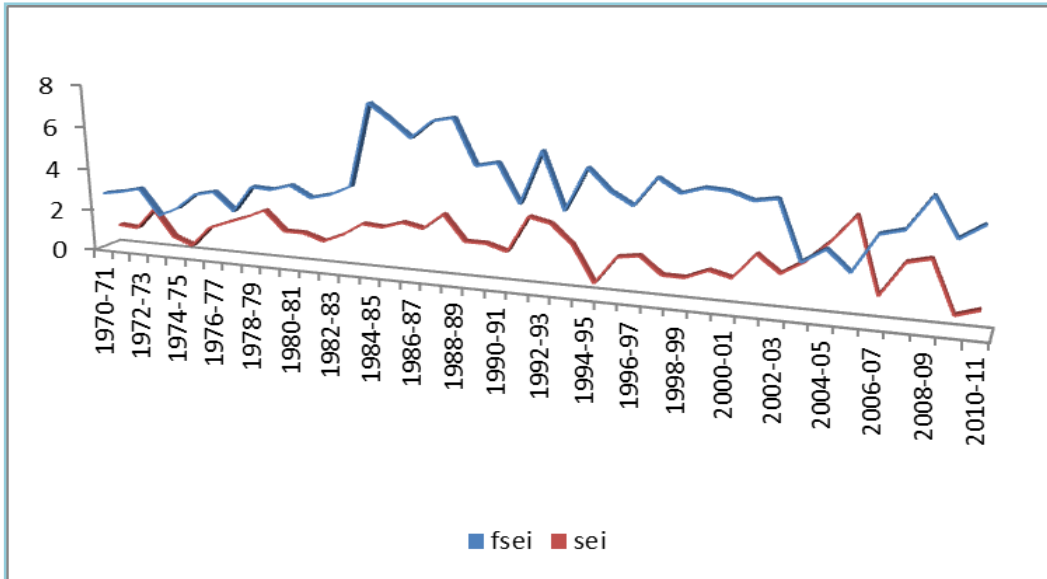
Figure 5: Fiscal Seigniorage in India (in per cent)



Source: (basic data), RBI (various years)

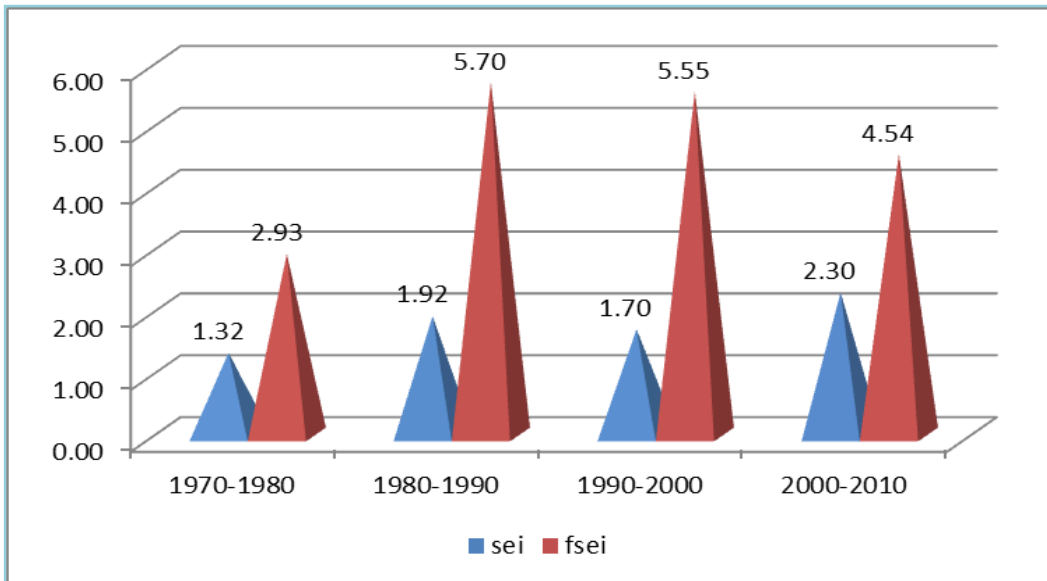
The fiscal seigniorage has increased from around 3 per cent of GDP in the seventies to a peak of 8 per cent of GDP in late eighties (figure 5). However since nineties, fiscal seigniorage fluctuates within the range of 2-5 per cent of GDP.

Figure 6: Co-movement of Fiscal and Monetary Seigniorage (in per cent)



Fiscal seigniorage has always been greater than monetary seigniorage except for a crossover in mid-2000 (figure 6). This crossover is not due to the rise in the net RBI credit to the government, but due to rise in net FOREX reserves which has increased the high powered money in the system.

Figure 7: Fiscal and Monetary Seigniorage in India (%): Decadal Averages



The decadal averages of fiscal and monetary seigniorage suggest that irrespective of the agreement between Central Government and Central Bank to control the monetization of deficits in India signed in 1996-97, the reserve money has not been on the decline due to net foreign exchange assets, which is reflected in the increasing trend of monetary seigniorage in the recent decade (figure 7).

5. Estimating Fiscal Seigniorage Laffer Curve

Sargent and Wallace (1981) and Bruno and Fischer (1990) noted that there might be both high and low inflation equilibrium when government finances the deficit through seigniorage. The dual equilibria – a reflection of Laffer curve – imply that an economy may be stuck in high inflation equilibrium when, with same fiscal deficit as percent of GDP, it could be at a lower inflation rate. The Seigniorage Laffer curve phenomenon depicts the non-linear relationship between revenue from money creation (μ_t) and the inflation rate (π_t). Easterly et al. (1994) noted that econometric estimation of the following quadratic equation statistically confirms the seigniorage Laffer curve.

$$S_{rev} = \alpha + \beta_1 \pi_t + \beta_2 \pi_t^2 + v_t \quad (10)$$

where S_{rev} is seigniorage (fiscal and monetary in separate model specifications) and π_t is the rate of inflation. The fiscal seigniorage and monetary seigniorage Laffer curve is estimated through separate equations.

The monetary seigniorage is estimated using two data sets; high frequency data (monthly) for the period ex-post to global financial crisis and also using the annual data for the period 1970-71 to 2012-13. However the high frequency data estimation of fiscal seigniorage is not possible as the data on public expenditure on interest payments is not available on monthly basis. One way to tackle this problem partially is to deduct the bond market operations data from the fiscal deficit. The analysis is thwarted here too as the high frequency data on bond financing of deficit is not available, though fiscal deficit could be available for the recent decade on monthly basis.

Using error correction mechanism, the plausibility of monetary seigniorage Laffer curve estimated using the high frequency data, 2009:03 to 2013:07, for India is reported in Table 1. The estimation revealed that monetary seigniorage Laffer curve exists in the context of India, ex-post to global financial crisis period. The squared coefficient is negative and significant, which depicted that the seigniorage revenue creation initially rises and eventually falls with the rise in the rate of inflation, the estimates (π and π^2) are significant (Table 1).

Table 1: High Frequency Data Estimation of Monetary Seigniorage Laffer Curve: ECM Estimates for 2009:03 to 2013:07

	coefficient	t
α	-0.094	-0.653 [0.516]
π	1.078	1.638 [0.108]
π^2	-0.095*	-1.739 [0.088]
ecm	-0.645***	-11.545 [0.000]
R-squared	0.435	

Notes: figures in the parentheses denote probability
Source: (Basic data), RBI (various years)

Theoretically, the coefficient of Π^2 provides a seigniorage-maximising inflation rate, which provides the plausible inflation rate where the seigniorage Laffer curve peaks. This model can be extended by incorporating the relevant control variables and the policy dummy to capture the phasing out of monetized deficits in 1997. However, these results are partial and illustrative.

Table 2: Annual Frequency Data Estimation of Monetary Seigniorage Laffer Curve: Error Correction Mechanism Estimates for 1970-71 to 2012-13

Variable	Coefficient	t-Statistic	Prob.
α	-0.020	-0.217	0.829
π	1.932***	4.614	0.0001
Π^2	-0.500*	-3.118	0.004
ECM	-0.833***	-7.087	0.000
R-squared	0.423		

Source: (Basic data), RBI (various years)

The re-specification of the nonlinear monetary seigniorage Laffer curve models with annual frequency data is reported in Table 2. The model provided a preliminary evidence for the seigniorage Laffer curve.

Table 3: Fiscal Seigniorage Laffer Curve: Annual Frequency Data: 1970-71 to 2012-13: Error Correction Mechanism Estimates

Variable	Coefficient	t-Statistic	Prob.
α	0.007	0.176	0.861
π	0.872***	3.776	0.0007
Π^2	-0.216**	-3.3823	0.002
ECM	-0.530***	-4.236	0.0002
R-squared	0.330		

Source: (Basic data), RBI (various years)

The fiscal seigniorage estimates also showed a plausibility of Laffer curve as the squared term is significant and negative. The seigniorage maximizing inflation rate from these preliminary estimations are seemingly not explosive rates and there could be a possibility for seigniorage financing at moderate inflation rates. However, these estimates are illustrative and needs to be read with caution, and these non-linear models need to be further strengthened by incorporating appropriate control variables. These preliminary estimates have policy implications on the current mode of financing public deficits in India, with bond financing as the predominant method. It is interesting to recall heterodox economists' emphasis to seigniorage finance of deficits for public deficits, as they believe it is in technical terms "free lunch", if the economy has not attained the full employment levels (for details, Rakshit, 2005, 2010).

If we take recourse to the original arguments for monetary-fiscal linkages, bond financing of deficits can be flawed even under a fiscal dominance regime. Does bond financing - the dominant source of financing the deficit in India - has an empirical upper bound? If so, does it imply when the rate of interest on government bonds exceed the growth rate of the economy, we need to monetize eventually the deficits through generating seigniorage? The fiscal stance, however, would not be unsustainable soon in India, as the present structure of deficit financing has a negligible share of external financing of debt, and the composition of debt is more of long term maturities. Still, the assumption that the monetary regime has no influence on the conduct of fiscal policy need a revisit, especially when the economic growth rate (g) is plummeting and the rates of interest (r) have shown no signs for a significant downward trend in recent years in India. This concern is not because of any straightjacket unsustainability condition of $r > g$ impending for India, but the monetary policy stance contains relevance for the term structure of interest rates (the relationship between short and long-term rates of interest) and has a catalytic role in promoting economic growth.

6. Conclusion

Fiscal seigniorage is a wider concept than traditional monetary seigniorage to take into consideration the institutional and policy changes which has direct bearing on government's net monetary finance requirement. Despite the concerted policy changes undertaken by the Government of India and the Central Bank to contain the monetized deficit in India, the monetary seigniorage is not yet on the decline. Though the net RBI credit to the government (monetized deficit) has been controlled through policy co-ordination, the net FOREX reserve is on the rise. Further, the shift in the financing pattern of deficits from seigniorage to bond financing which has occurred prior to the deregulation of interest rate regime in India has implications for the fiscal seigniorage. The estimates of error correction mechanism models suggested a possibility of a Fiscal Seigniorage Laffer curve phenomenon in India. These estimations are partial and illustrative. The plausibility of existence of fiscal seigniorage Laffer curve opens the possibilities of monetary and fiscal policy co-ordination, especially when India is moving towards central bank independence and new monetary policy framework.

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