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Debt-Inflation Dynamics in India

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Abstract: The paper analyses debt-inflation dynamics in India, covering the time period 1980-81 to 2018-19. The empirical analysis covers both indirect and direct effects of growth in debt on inflation. The results indicate the presence of weak financial crowding-out effect in the post-reform phase. The monetisation channel remains important even as it operates through the liquidity module in the G-Sec market post-2006. The Granger causality test shows that the WPI inflation is granger caused, among other factors, by the past values of central government debt. The VAR estimation establishes that debt growth has a positive effect on inflation rate in India.

Keywords: Debt, Liabilities, Interest Rate, Inflation

JEL Classification: H6, E4, E31

Introduction

In the theoretical literature, there is an intense debate on whether inflation is a monetary or fiscal phenomenon. The monetarists consider inflation to be always and everywhere a monetary phenomenon and talk of strong correlation between money stock and inflation[1]. Sargent and Wallace (1981) coined the term 'unpleasant monetarist arithmetic' to explain that monetisation of a deficit may not result in a higher rate of inflation *vis-a-vis* financing of the same deficit through issuance of bonds. They argue that "given the time path of fiscal policy and given that government's interest-bearing debt can be sold only at a real interest rate exceeding the growth rate, the tighter is the current monetary policy, the higher must the inflation rate be eventually". In other words, large fiscal deficits ultimately require monetisation of debt, and tend to influence the price level through the monetisation channel and in that sense inflation remains a monetary phenomenon.

Under the fiscal theory of price level (FTPL), the price level is primarily determined by fiscal policies and government debt. Given that the government's inter-temporal budget constraint is stipulated as an equilibrium condition, it requires an adjustment in the price level endogenously to ensure that the real value of nominal stock of bonds is equated to the real present value of the given sequence of future primary balances of the government (Leeper (1991), Sims (1994), Woodford (1994, 1995, 2001)).

The fiscal regimes are categorised as Ricardian and non-Ricardian (Aiyagari and Gertler 1985, Woodford 1995). The FTPL view is supported in the non-Ricardian regime, which implies that in case the debt- GDP ratio is

high, it would push up aggregate demand through the wealth effect. As a result, the price level increases, leading to reduction in the real value of government liabilities and in that process to the fulfilment of the transversality condition[2]. In the Ricardian regime, the issuance of government interest-bearing debt does not influence economic behaviour, as it is perceived to be an indicator of future taxes rather than wealth accretion. Further, the government is expected to adjust its fiscal policy so that the present value of future primary budget balances improves and fulfils the government's inter-temporal budget constraint (Canzoneri *et al.* 1997, 2000, 2001, Cochrane 1999, Bohn 1998, Woodford M, 1999 & 2000, Debrun and Wyplosz 1999, Melitz 2000, Erdogdu, 2001, Creel, 2002, Mikek, 2001).

There are two versions of the FTPL depending on the operating framework for monetary policy *i.e.*, the nominal money stock *vs*. nominal interest rate rules. The FTPL, under nominal money stock rules, produces results in line with the monetarist doctrine when there is co-movement of the general price level and the nominal money stock in equilibrium. However, under nominal interest rate rules, the impact is explained in terms of the monetary accommodation (though indirect) of deficits by the Central bank when it is following an interest rate rule.

In contrast to the extreme views on the issue of inflation being a purely monetary or fiscal phenomenon, the recent literature indicates that it is the interaction of monetary and fiscal policies that plays an important role in determination of inflation in an economy.

Against this backdrop, we have analysed the relationship between debt and inflation in India. In the Indian context, there are several studies which have drawn attention to the inflationary effect of expansionary fiscal policies and high fiscal deficits but the impact of rising debt on inflation has not been explicitly examined. We have attempted a holistic assessment of the relationship between debt and inflation based on its several inter-related dimensions in general and specific characteristics in the Indian context. We have divided the paper into six sections. Section II provides an overview of empirical studies that establish the inflationary potential of large public debt levels. The empirical studies, which do not show any relationship between public debt and inflation, are also covered in this section. Further, it also includes a brief discussion on the channels through which high public debt levels are said to impact inflation in various countries. Section III covers stylised facts relating to the debt-inflation dynamics in India, covering the time period from 1980-81 to 2018-19. Section IV delineates the interest rate channel and the monetisation channel through which the rising debt level could have impacted inflation in India. The impact of debt on inflation through aggregate demand channel is examined separately through VAR analysis in Section V. Finally, the results of these empirical exercises are summed up in Section VI.

Section II: Review of Empirical Literature

The impact of government debt on inflation has been extensively examined for individual countries or for a group of countries under different theoretical frameworks including SW's unpleasant monetarist arithmetic, FTPL, and so on. There are also several empirical studies which have examined the impact of various explanatory variables including debt/fiscal deficit on inflation, without following any specific theoretical framework.

The empirical studies which observe a positive relationship between public debt and inflation include Obstfeld (1990), Kwon, McFarlane and Robinson (2009), Loyo (2000), Reinhart and Rogoff (2011), Kia (2010), Davig and Leeper (2011), Davig, Leeper and Walker (2011), Shim (1984) and Sims (2013). The empirical evidence points out that the relationship is positive in indebted developing countries (Kwon, McFarlane and Robinson, 2009), in emerging market countries with higher public debt levels (Reinhart and Rogoff, 2011), in high inflation episodes and mostly in developing countries (Fischer, Sahay and Vegh, 2002 and Catao and Terrones, 2005). However, the positive relationship is not observed in developed/advanced countries (Kwon, McFarlane and Robinson, 2009; Fischer, Sahay and Vegh, 2002; Catao and Terrones, 2005; Bassetto and Butters, 2010). This is attributed, among others, to institutional constraints to fiscal dominance, deeper financial markets and credibility of monetary policy in these countries.

The empirical evidence of Bhattacharya and Haslag (1999) supports the SW's 'unpleasant monetarist arithmetic' hypothesis while an empirical analysis of hyperinflation in Brazil during 1975-85 by Loyo (2000) recognises the existence of a regime consistent with the FTPL. Glenn and Samad (2014) explain that in case the monetary authority cannot influence the government's deficit path (when fiscal authority is dominant) but is expected to manage the debt created by the given deficit path, it hampers its effectiveness to influence the inflation rate permanently as also in the short run.

The effect of higher government debt-GDP ratio on inflation is explained through its contribution to riskier environment (Kia, 2000), shift in household expectations of future monetary policy from targeting inflation to stabilising debt (Davig and Leeper, 2011), passive stance of the central bank (Davig, Leeper and Walker, 2011) and monetisation (Barsky and Mankiw, 1983). Shim (1984) argues that under the assumption of rational expectations, any unexpected change in nominal debt would lead to changes in the price level in an economy in case people do not expect a reversion through future budget surpluses.

There are several empirical studies which either do not find any relationship or observe at the most a weak relationship between the two. Protopapadakis and Siegel (1984), in an empirical study relating to the impact of increases in nominal government debt (independent of the behaviour of money stock) on inflation in seven industrialised countries, find a weak relationship between debt growth and M1 growth in countries with high debt

to GNP ratios. Hafer & Hein (1986, 1988) observe that increases in government debt (either par value or market value) do not Granger cause inflation. Afonso (2002) notes that primary budget surpluses were used to reduce the debt-GDP ratios in the EU-15 countries during 1970-2001 and fiscal policy, as a result, did not influence the price level in these countries. Martin (2013) argues that the shift to an inflation targeting regime reduces the indirect impact of the level of public debt on central bank operations.

From the review of both theoretical and empirical literature as presented above, it is evident that the debt-inflation dynamics works through direct and indirect effects of government debt on inflation. While the direct impact is said to operate through the aggregate demand channel, the indirect impact runs through three other channels (Box 1). Of these channels, the monetisation channel[3] is the most dominant one even as the crowding-out[4] and wealth effects have also been considered in the context of government debt levels impacting inflation in different countries. The likelihood of monetisation of government debt generates inflation expectations and drives the current inflation up, even as the institutional arrangements like the independence of the central bank may influence the extent to which the increases in public debt impact inflation (Nautet and Meensel, 2011). However, the co-existence of sharp increases in the debt ratios of several advanced countries and low inflation rates during the post-financial crisis of 2008 has remained an exception. This is notwithstanding the recognition of the fact that the credible consolidation of

Box 1: Deficits/Debt Financing and Inflation: Various Channels

Crowding-out effect

Higher interest rates
Lower domestic investment and capital formation
Lower aggregate supply
Higher prices

Monetisation of deficit/debt

An increase in current/future monetisation (seigniorage)
Higher inflation expectations
Higher current nominal interest rates
Increase in the velocity of money
Higher prices

Wealth effect (FTPL)

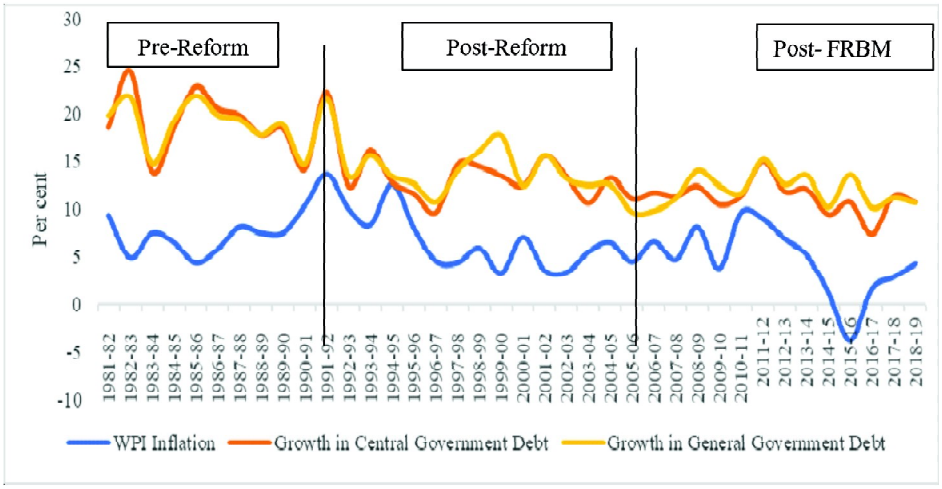
Issuance of bonds
Increase in wealth
Increase in demand for goods and services
Increase in prices

public finances in the advanced countries is eventually key to ensure macroeconomic stability in these countries in the medium-term.

Section III: Stylised Facts relating to Debt-Inflation Dynamics in India

We have analysed the relationship between debt (liabilities) and inflation in India during 1980-81 to 2018-19. In the Indian context, the relationship between debt and inflation has evolved over time, which we have divided into pre-reform and post-reform phases. In the pre-reform phase, *i.e.*, the period between 1980-81 and 1990-91, the growth in debt and inflation in India did not move in the same direction. The relationship, however, reversed in the post-reform period, *i.e.*, since 1991-92, and debt-inflation exhibited even stronger co-movement in the post-FRBM phase[5] (Chart 1).

Chart 1: Debt and Inflation in India



Source: RBI and authors' calculations

The changing pattern of the relationship between debt and inflation in different phases in India has been studied in terms of correlation coefficients and the results are furnished in Table 1. During the pre-reform phase, the correlation coefficient between inflation and growth in central government debt turned out to be –0.76, indicating strong inverse relationship between the two series. During this phase, inflation rate remained high even though there was a moderation in the growth rate of central government debt. This reflects the impact of high level of monetisation of government debt on inflation while the presence of financial repression (*i.e.*, the real interest rates being low or negative) contributed to subdued debt growth. Kaur and Mukherjee (2014) found that the real interest rates in India were negative during 1982-83 to 1995-96 but turned positive thereafter.

Table 1
Correlation Coefficients between Government Debt and WPI Inflation in India

Period	*Years*	*Correlation Coefficients between WPI Inflation and Growth in Government Debt*	
		Central Government Debt	*General Government Debt*
Pre-Reform	1981-82 to 1990-91	-0.76***	-0.70**
Post-Reform	1991-92 to 2018-19	0.55***	0.39**
Post-FRBM	2004-05 to 2018-19	0.62***	0.21
Full Period	1981-82 to 2018-19	0.35**	0.30*

Note: *, ** and *** indicate significance at 10%, 5% and 1% level, respectively.

The liquidation (monetisation) effect moderated since 1996-97 when the practice of automatic monetisation of fiscal deficit was done away with. Accordingly, the correlation coefficient between central government debt and inflation in the post-reform phase turned positive and significant, indicating that the growth in central government debt is associated with a rise in inflation. The co-movement has become particularly strong in the last decade, after the implementation of FRBM Act 2003 and FRBM Rules in 2004. An almost similar relationship was seen in the case of general government debt and inflation even as the correlation coefficients were smaller in each period as compared to the central government debt.

Section IV: Financial Crowding–out and Monetisation Channels

After having analysed the relationship between growth in central government debt and inflation, it is pertinent to study the operational mechanism through which the central government debt tends to influence inflation in India. We are confining ourselves only to crowding-out and monetisation channels as the wealth channel is not considered important in the Indian context, given the negligible share of retail participation in issuance of dated securities by the central government and the relatively lower share of small savings (around 6 per cent) in total debt of the central government.

Section IV.1: Financial Crowding-out in India

Theoretically, the direct crowding-out effect is explained in terms of increases in government debt contributing to reduction in productive physical capital. The indirect crowding-out (or financial crowding-out) effect of government debt is said to operate when an additional supply of bonds at higher levels of debt puts pressure on prices of government bonds, leading to an increase in bond yields and in turn to the rates at which the private sector would be able to raise funds for investment purposes. In case bond financing route is resorted to and magnitudes are large, it may also crowd-out the private sector. The financial crowding-out effect of government debt would be smaller, in case it is held partly by the Central Bank. These effects taken together imply that

both private sector borrowings and investments are crowded out by a fraction when the government deficit/debt increases.

The crowding-out effect is mostly analysed in terms of financial[6] crowding-out even as this effect is ruled out under the Ricardian Equivalence (Barro, 1974 & 1989). In the empirical studies (Laubach, 2003; Engen and Hubbard, 2004, Kinoshita, 2006 and Chung and Leeper, 2007), an increase in the government debt- GDP ratio is observed to lead to higher real long-term interest rates. An increase of one percentage point in the government debt-GDP ratio impacts real long-term interest rates to the extent of 2-5 basis points, depending on the model specification and other underlying assumptions in the empirical studies. Kinoshita (2006) points out that the impact is considerably large when it is driven by higher government consumption expenditure. Gale and Orszag (2003) and Claeys *et al.* (2012), however, find it to be smaller in magnitude in advanced/industrial countries, while Ardagna, Caselli and Lane (2004) recognise its impact only in countries with above average debt levels. In an integrated global financial system with capital mobility, the financial crowding-out effect of debt weakens. Net capital inflows from abroad increase the total supply of loanable funds in domestic market and moderate the likely impact of increases in government deficits/debt on domestic interest rates even as the exchange rate adjustment to fiscal deficits assumes significance (Tanzi, 1985 and Cebula and Koch, 1989). Overall, the empirical evidence relating to financial crowding-out effect of government debt remains inconclusive (Barth, Iden, Russek, and Wohar 1991, Engen and Hubbard, 2005 and Hauner and Kumar, 2011).

In the Indian context, the empirical studies have drawn attention to the adverse impact of high levels of fiscal deficits/debt on macroeconomic variables including interest rates and inflation in the medium to long run (Rangarajan and Srivastava, Kannan and Singh 2009; Rao, 2000; Patnaik[7], 2001; Lal *et al.* 2001). Chakraborty (2002, 2012) does not find fiscal deficit exerting any upward pressure on the interest rates. Vinod *et al.* (2014) observe that fiscal deficit is not significant for interest rate determination in India. Goyal (2004) points out that interest rates in India in recent years were not impacted despite high fiscal deficits and attribute it to large liquidity available to the system. In a recent study, Mohanty and Panda (2019) have found that public debt has a positive impact on long term interest rates in India.

Before undertaking an empirical exercise, it is pertinent to describe the evolution of interest rate regime in India which may have been a crucial determinant of financial crowding-out impact of central government debt in India during the period under review. The pre-reform phase was characterised by an administered interest rate regime and automatic monetisation of budgetary deficit of the central government through issuance of 91-day *ad hoc* T-Bills (Chart 2c). The use of interest rate (then Bank Rate) as a monetary policy tool was limited. However, the net Reserve Bank Credit to central government

accounted for, on an average, of around 94 per cent of Reserve Money during 1981-82 to 1991-92. In fact, the real effective cost of debt remained negative during this phase (Kaur and Mukherjee 2014). The high and increasing Statutory Liquidity Ratio (from 34.0 per cent effective September 25, 1981 to a high of 38.5 per cent in September 1990), provided captive market for central government securities during this period (Chart 2a).

With the introduction of auction system for primary issuances of dated securities from 1992-93, the market participants began to play a more active role in determination of interest rates on these securities in the post-reform period. However, the Reserve Bank continued to extend initial support to government borrowing programme which was seen in the form of accepting private placement of government securities. The devolvement of central government dated securities and 364-day Treasury Bills[8] in the primary auctions, and liquidity support through open market operations (OMOs) by the Reserve Bank ensured fairly stable interest rates even as market borrowings of the central government were on a rising path. While market borrowings as a percentage of the total borrowings of the central government, which were 20.7 per cent in 1991-92, increased to 62.6 per cent in 1998-99, the interest cost of market borrowings was minimised by raising a large part of total borrowings through short-term loans[9] during this period. From 1999-2000 onwards, the maturity pattern of the debt issuances showed a shift towards medium to longer tenor buckets. Notwithstanding this shift, the effective cost of debt remained significantly lower than the weighted average yield on issuance of government securities (Chart 2b), which reflected the impact of low cost at which debt was raised in the past. The share of marketable debt (and dated securities) in total internal liabilities of the central government was also relatively lower at about 40 per cent in the beginning of 2000s and even lower before that period.

The period since 2000-01 has witnessed a series of reforms even as the Reserve Bank continues to undertake debt management operations of the central government. While the Reserve Bank has discontinued subscription to primary issuances of dated securities since 2006, the SLR stipulation (despite a phased reduction to 18.25 per cent till date[10]) and the recognition of investment in Government securities towards the Liquidity Coverage Ratio (LCR) provision[11] continue to ensure a steady flow of demand for government securities and moderates the impact of market forces on interest rates. In fact, banks have generally exhibited a tendency to hold government securities over and above the stipulated SLR. With the introduction of capital account liberalisation measures during the reform phase, there was a significant rise in capital inflows from abroad. The capital inflows influenced the interest rates on central government dated securities through the liquidity channel even as external financing of the central government debt has remained limited (Chart 2d). The large net capital flows during 2002-03 to 2007-08, despite sterilisation measures (foreign exchange intervention and issuance of bonds

under the Market Stabilisation Scheme), eased liquidity conditions in the domestic market, and contributed to benign interest rate situation in the Indian economy. It may also be added that this period also coincided with the fiscal consolidation phase at the central government level.

The effectiveness of Reserve Bank's role as a banker to the central government also weighs down on yields, even as this effect is often contested. As a debt manager, the Reserve Bank ensures adequate liquidity to support subscription to primary issuances of dated securities through open market operations (purchases). While it is a fact that the OMOs (sales) during the period of large capital inflows were primarily driven by the objective to sterilise the impact of these flows on domestic liquidity, the OMOs (purchases) are often undertaken to improve market liquidity conditions, which, in turn, generate replacement demand for new issuances of dated securities[12].

A cursory look at the data relating to the yield on 10-year benchmark G-Sec during 1998-99 to 2018-19 reveals that the impact of reform measures began to be noticed in both primary and secondary market transactions in central government dated securities and was reflected in a positive relationship of growth in central government debt with the yield on 10-year benchmark G-Sec (Chart 3). The correlation coefficient between the two series (for the period 1998-99 to 2018-19) at 0.45 is significant at 5 per cent level.

Chart 2: Indicators of Central Government Liabilities

Chart 2a: Statutory Liquidity Ratio

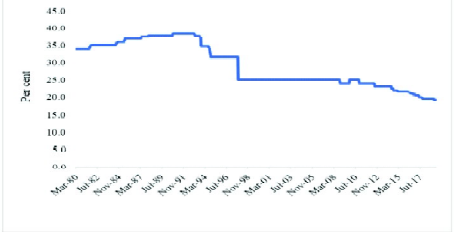


Chart 2b: Weighted average yield on Central Government securities and effective interest rate

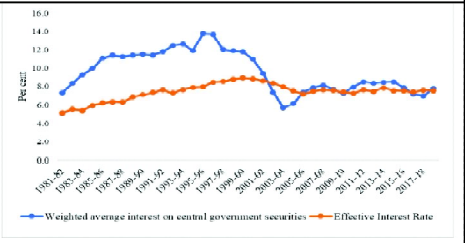


Chart 2c: 91-Day T-Bills as a percentage of Central Government Liabilities

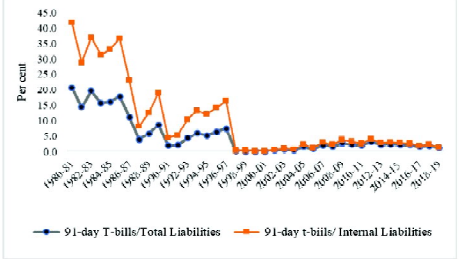
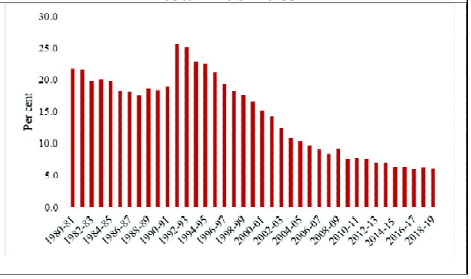
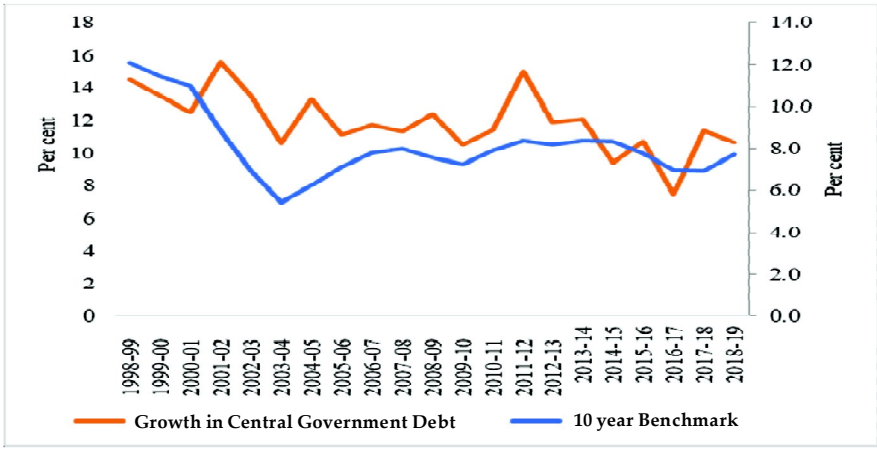


Chart 2d: External liabilities as a percentage of total Liabilities



Source: RBI

Chart 3: Financial Crowding out in India



Source: RBI and FIMMDA

VAR Analysis

After having provided an overview of evolution of interest rate regime since the early 1980s, the relationship between the central government market borrowings (outstanding) and long-term interest rates in India has been examined through a Vector Autoregression (VAR) framework. The empirical literature suggests the use of VAR models (Miller and Russek 1996; Engen and Hubbard 2004; Goyal 2004; Wang and Rettenmaier, 2008; Chakraborty, 2012; Arshad *et al.*, 2014; Essien *et al.*, 2016; and Kapur *et al.*, 2018) for the purpose of measurement of financial crowding-out effect of deficits/debt in an economy. The variables used by us for the VAR analysis are market borrowings (outstanding) of the central government (GMB), 10-year benchmark yield (BMY)-an indicator of long-term interest rate, net capital flows from abroad (NCF) and output gap (OG). In a VAR model, each variable is explained in terms of its owned lagged values and the past values of the other variables. Thus, the VAR model considered for this study is as follows:

$$Zt = \sum_{i=1}^{K} Ai\, Zt - i + \mu t \tag{1}$$

where,

$$Z = \begin{pmatrix} \Delta GMB \\ BMY \\ \Delta NCF \\ OG \end{pmatrix} \text{ and } \mu t = \begin{pmatrix} \mu 1t \\ \mu 2t \\ \mu 3t \\ \mu 4t \end{pmatrix}$$

Ai (*i* = 1, ….., *k*) is a 4Xk matrix and k is the maximum lag length to be determined.

Quarterly data for the period 2003-04 to 2018-19 (post-FRBM phase) has been used for the analysis. The data source for market borrowings (outstanding) and nominal GDP is the Government of India, 10-year benchmark yield is Fixed Income Money Market and Derivatives Association of India (FIMMDA) and Financial Benchmarks India Private Ltd (FBIL) and net capital flows is Reserve Bank of India. The output gap is derived using HP filter and is expressed as a percentage of GDP (current market prices). The changes in market borrowings (outstanding) and net capital flows are captured through their respective growth rates.

The results of the Augmented Dicky Fuller (ADF) unit root test indicate that all the variables are stationary (Table 2). Thus, a VAR model is estimated with ΔGMB, BMY, ΔNCF, and OG, all of which are I (0).

Table 2
Unit Root Test

Variable (X)	*ADF*	*Order of Integration*	*Exogenous*
Δ GMB	-5.07***	I (0)	Intercept
BMY	-3.23**	I (0)	Intercept
Δ NCF	-7.23***	I (0)	Intercept
OG	-3.61***	I (0)	Intercept

Equation 1 is first estimated using unrestricted VAR. The optimal lag length for the VAR model turned out to be 2 based on different test criteria (SC and HQ). Using lag length of *k* = 2, the VAR model is re- estimated and tested for stability. The result indicates that the VAR model is stable. The LM test results revealed that there is no autocorrelation in the residuals.

Granger Causality

The results of the Granger Causality/Block Exogeneity Wald Test for the estimated VAR model are furnished in Table 3. The results show that the 10-year benchmark yield is granger caused by the past values of central government's market borrowings and output gap (at 10 per cent level of significance).

The impulse response analysis indicates that the 10-year benchmark yield responds positively to innovations in market borrowings of the central government and the output gap and negatively to net capital flows from abroad (Chart 4). This supports the a priori expectations that a rise in central government market borrowings leads to an increase in 10-year benchmark yield which puts pressure on interest rates in the domestic market. Higher capital flows from abroad add to liquidity and ease the interest rate. An increase in output gap, which is indicative of higher aggregate demand tends to put

Table 3
VAR Granger Causality Results

Dependent variable: ΔGMB	*Chi-sq*	*df*	*Prob.*
BMY	14.18842	2	0.0008
ΔNCF	0.859003	2	0.6508
OG	9.570104	2	0.0084
All	22.92112	6	0.0008
Dependent variable: BMY	*Chi-sq*	*df*	*Prob.*
ΔGMB	5.491967	2	0.0642
ΔNCF	0.606219	2	0.7385
OG	5.399788	2	0.0672
All	7.335919	6	0.2909
Dependent variable: ΔNCF	*Chi-sq*	*df*	*Prob.*
ΔGMB	4.269222	2	0.1183
BMY	6.493399	2	0.0389
OG	0.757505	2	0.6847
All	11.72378	6	0.0684
Dependent variable: OG	*Chi-sq*	*df*	*Prob.*
ΔGMB	7.543039	2	0.0230
ΔBMY	10.73193	2	0.0047
NCF	5.456303	2	0.0653
All	25.03453	6	0.0003

pressure on the available resources and thus increases the cost of credit. The impulse response results, however, are not statistically significant and are robust to the changes in the ordering of the variables in the VAR. Estimation of the model in a structural VAR (SVAR) framework also yields similar results (Annex 1). From the granger causality and impulse response results, we can infer that at best there is a weak evidence of financial crowding-out in India.

The results of variance decomposition reveal that the changes in 10-year benchmark yield are accounted for by central government market borrowings by around 10 per cent after 10 quarters (Table 4).

Section IV.2: Monetisation in India

As in the case of financial crowding-out, there is no conclusive evidence supporting the impact of deficits/debt on inflation through the monetisation channel, even though it is held that the relationship at best is found in the case of developing and emerging market economies. In the Indian context, Nachane and Nadkarni, 1985, Ray and Namboodiri, 1988, Singh, 1989, Biswas and Saunders, 1990 do implicitly refer to the link between fiscal deficits and money supply. Khundrakpam and Goyal (2008) also point out that the government deficit, defined as the difference between investment and savings of the

Chart 4: Impulse Response of Benchmark Yield

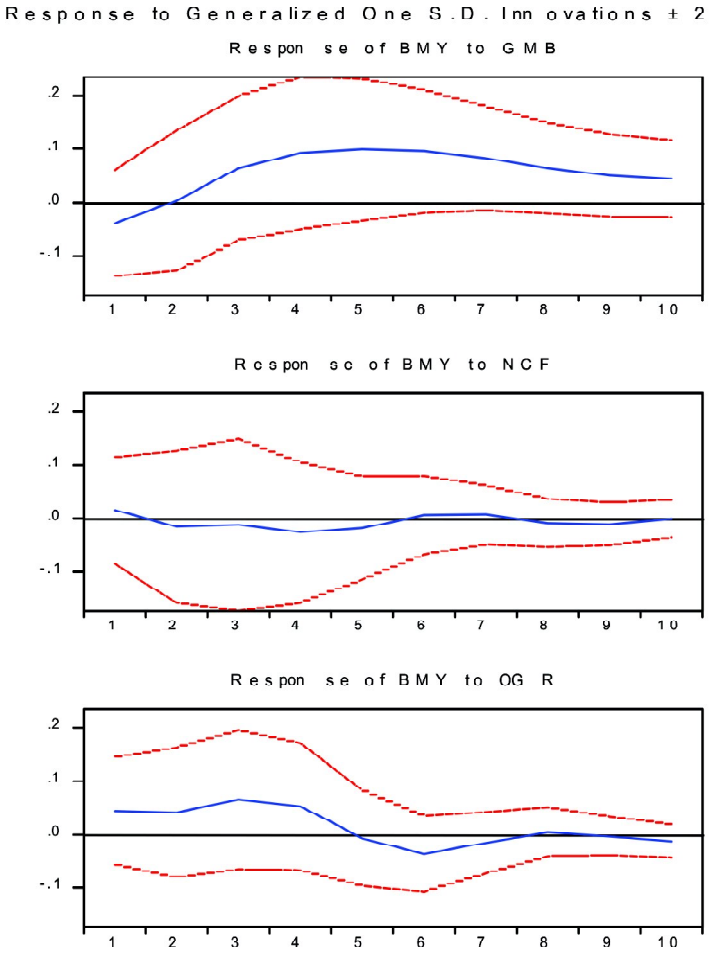


Table 4
Variance Decomposition of Benchmark Yield

Period	*S.E.*	*GMB*	*BMY*	*NCF*	*OGR*
1	1.632895	1.005194	98.99481	0.000000	0.000000
2	1.920903	0.531876	98.83659	0.579806	0.051729
3	2.016294	1.533965	95.72868	1.012742	1.724609
4	2.034415	3.381235	91.68576	1.795384	3.137622
5	2.061485	5.378790	89.26353	2.267623	3.090060
6	2.081142	7.194580	87.51118	2.303144	2.991099
7	2.099544	8.495037	86.19621	2.314189	2.994561
8	2.115523	9.203584	85.24079	2.436044	3.119587
9	2.124954	9.607034	84.72799	2.552018	3.112955
10	2.130762	9.919200	84.42329	2.574205	3.083300

Cholesky Ordering: GMB BMY NCF OGR

government sector, continues to influence the incremental reserve money creation in India.

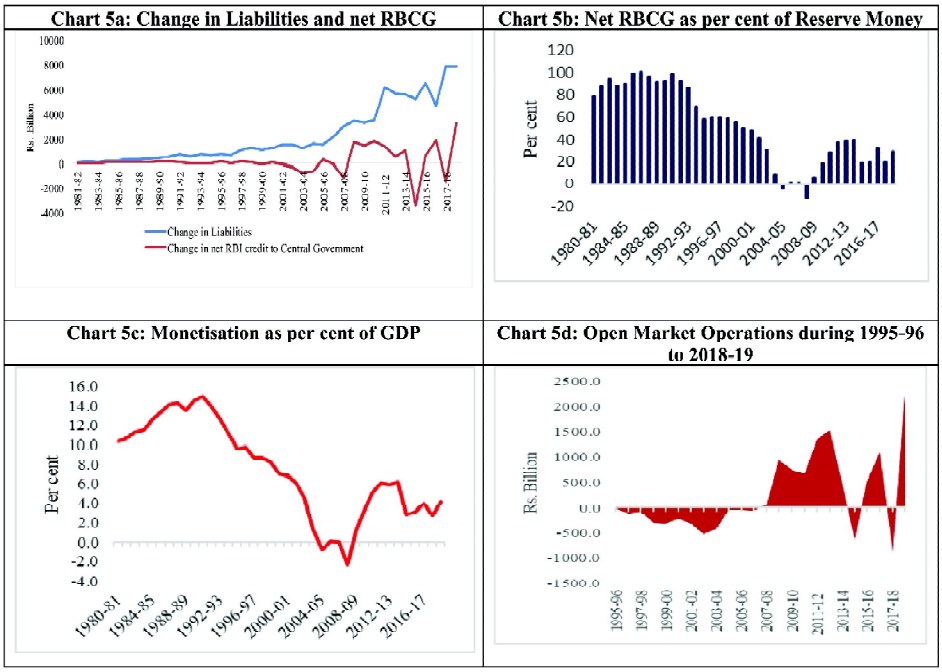
Following the accepted practice, we have used the net Reserve Bank credit to the central government (RBCG) as an indicator of the net monetary impact of fiscal operations. Available data reveals a close relationship between the change in liabilities of the central government and the net RBCG during the period from 1980-81 to 1989-90, indicating very high proportions of monetisation of liabilities (change in) (Chart 5a). This is also evident from the fact that the net RBCG accounted for a large percentage of reserve money during that period (Chart 5b). However, there was a deviation from this pattern, following the policy consensus to fix deficit financing within safe limits in the Seventh plan and the introduction of the analytical framework of monetary targeting in 1985. The dependence on monetisation moderated during 1990-91 to 1996-97 (Chart 5c), which was also aided by the phasing out of *ad hoc* Treasury bills during 1994-95 to 1996-97 and their replacement by the introduction of WMA limits for the central government from 1997-98 onwards. However, the practice of subscription to primary issuances of government securities by the Reserve Bank continued in situations of less than full subscription by the market players during 1992-93 to 2005-06. The implementation of the FRBM Act, 2003 and the FRBM Rules, 2004 paved the way for fiscal consolidation, and the sharp rise in capital flows in the post refarm period and consequent comfortable liquidity position reduced the dependence of the government on the Reserve Bank for meeting its financing requirements.

Under the extant arrangement effective from April 1, 2006, the Reserve Bank is prohibited from buying securities directly from the Government. However, it continues to be debt manager of the government and it can, in that capacity, re-purchase/sell securities directly from investors under its OMOs which are generally intended to address liquidity concerns (Chart 5d). This so-called indirect monetisation of debt through buy-back of securities and OMOs gets reflected in net RBCG.

The evolution of these institutional arrangements was reflected in monetisation of fiscal/debt operations of the central government. In the initial phase of reforms, there was a sharp dip in the share of net RBCG in reserve money from 56.1 per cent at end-March 1999 to 8.5 per cent at end-March 2004; it turned negligible or even negative during 2004-05 to 2008-09 before increasing steadily thereafter to reach 40.3 per cent by end-March 2014. During 2014-15 to 2018-19, it remained in the range of 18.7-32.6 per cent.

It is evident from Chart 5a that in the pre-reform phase, the two series *viz*., change in liabilities of the central government and change in net RBCG moved closely. However, the monetisation effect weakened significantly in the post-reform phase, before picking up again from 2008-09, although it remained much lower in comparison to the high levels of monetisation in the pre-reform phase.

Chart 5: Monetary Operations of RBI



Source: RBI

Section V: Debt and Inflation

The empirical studies which support the relationship between government deficits and inflation in India include Sarma (1982), Jadhav (1994), Rangarajan and Mohanty (1998), Rao (2000) and Khundrakpam and Pattnaik (2010). In the previous section, it was found that there is a weak evidence of financial crowding-out while the monetisation (indirect) of debt in India has assumed significance from 2009-10 onwards, each of which can raise the general price level. In this section, we have analysed the impact of debt (through the aggregate demand channel) on inflation in India, using a VAR model.

Empirical studies have used different set of control variables to estimate the impact of debt on inflation. Following Kwon *et al* (2006) and Essien *et al.*, (2016), the VAR model considered for this analysis includes the following variables:

CGD = liabilities of the central government
RM = reserve money
WPI = wholesale price index for all commodities
ER = exchange rate
RGDP = real GDP at market prices

As mentioned earlier, in a VAR model, each variable is explained in terms of its owned lagged values and the past values of the other variables (Equation 1). Accordingly, in this model,

$$Z = \begin{pmatrix} \Delta CGD \\ \Delta RM \\ \Delta WPI \\ \Delta ER \\ \Delta RGDP \end{pmatrix} \quad and \quad \mu t = \begin{pmatrix} \mu 1t \\ \mu 2t \\ \mu 3t \\ \mu 4t \\ \mu 5t \end{pmatrix}$$

Ai (i = 1, ….., k) is a 5Xk matrix and k is the maximum lag length to be determined.

Data

The VAR analysis is carried out with annual data for the period 1991-92 to 2018-19, during which there was a positive correlation between the growth in debt and inflation in India (Table 1). Outstanding liabilities of the central government has been used to represent the level of debt. The inflation rate is measured based on the WPI series for all commodities. The Rupee-Dollar exchange rate has been considered for the analysis. The real GDP (at market price) series has been spliced appropriately to control for the impact of base year revisions. The data source for all the variables is the Handbook of Statistics on the Indian Economy published by the Reserve Bank of India. The growth rates of the variables have been used for the VAR analysis.

The results of the ADF unit root test indicate all the variables are stationary (Table 5). Thus, a VAR model is estimated with Δ Central Government debt, Δ reserve money, ΔWPI, Δ exchange rate and Δ real GDP, all of which are I (0).

VAR Estimation

Table 5
Unit Root Test

Variable (X)	*ADF*	*Order of Integration*	*Exogenous*
Δ CGD	-6.10***	I (0)	Intercept
Δ RM	-5.41***	I (0)	Intercept
Δ WPI	-3.28**	I (0)	Intercept
Δ ER	-4.87***	I (0)	Intercept
Δ RGDP	-5.30***	I (0)	Intercept

Equation 1 is estimated using unrestricted VAR. Different test criteria (LR, AIC) indicate that the optimal lag length for the model is three. Thus, using lag length of k = 3, the VAR model is re -estimated and tested for stability and autocorrelation (LM test). The test results indicate that the estimated VAR

model is stable (all the roots lie inside the unit circle) and there is no autocorrelation among the residuals.

Granger Causality

The results of the Granger Causality/Block Exogeneity Wald Test for the estimated VAR (5,3) model are furnished in Table 6. The results show that the WPI inflation is granger caused by the past values of central government debt, reserve money, exchange rate and real GDP.

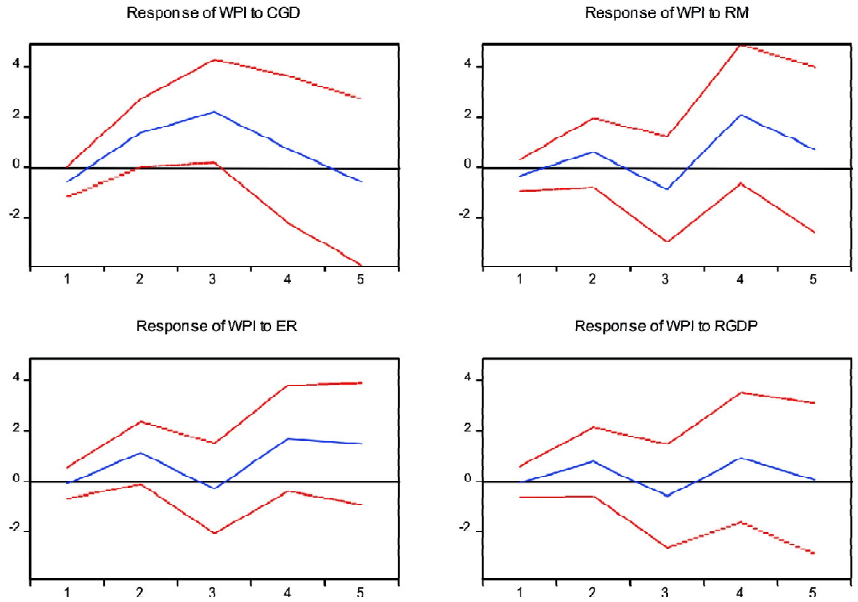
Table 6
VAR Granger Causality Results

Dependent variable: ΔWPI	*Chi-sq*	*df*	*Prob.*
ΔCGD	24.34141	3	0.0000
ΔRM	30.45432	3	0.0000
ΔER	11.75473	3	0.0083
ΔRGDP	8.403236	3	0.0384
All	64.73067	12	0.0000

Impulse Response and Variance Decomposition

In the next step, an impulse response analysis of WPI Inflation to innovations in real GDP, central government debt, reserve money and exchange rate has been carried out for 5 years period. The impulse response graph reveals that WPI inflation responds positively to shocks in innovations from central government debt (Chart 6). The impact of shocks to other variables on WPI

Chart 6: Impact on WPI



inflation are not significant. The result is robust to changes in ordering of the variables in the VAR model. Estimation of the model in a SVAR framework also yields similar results (Annex 2).

The variance decomposition was also carried out to check the impact of the four variables on WPI. The variance decomposition results corroborate the results obtained from impulse response analysis. The changes in WPI are accounted for by central government debt by around 50 per cent in the third period (Table 7). Thus, the results confirm our initial finding in Section III that the central government debt has impacted inflation rate in India, particularly in the post-reform period.

Table 7
Variance Decomposition of WPI

Period	*S.E.*	*CGD*	*RM*	*WPI*	*ER*	*RGDP*
1	1.978649	13.65573	15.85927	70.48499	0.000000	0.000000
2	2.381759	25.39562	23.45206	26.67772	14.41573	10.05887
3	2.923051	49.50138	14.19626	16.50925	10.99297	8.800132
4	2.998262	33.25840	39.23703	12.46210	8.738885	6.303592
5	3.134477	30.24237	35.21255	12.25425	13.77660	8.514233

Cholesky Ordering: CGD RM WPI ER RGDP

VI. Conclusion

An attempt was made in the paper to empirically examine the relationship between central government debt and inflation in India. The direct impact of central government debt/deficit on inflation operates through the aggregate demand channel, whereas the indirect impact runs through three other channels, *viz.,* the crowding - out effect; monetisation of debt/deficit; and the wealth channel. Our study finds weak evidence of financial crowding-out in India, given the institutional practices which continue to provide captive market for central government securities, and liquidity support available from the central bank. At the aggregate level, debt growth seems to granger cause inflation in India in the post-reform period and it operates mainly through the aggregate demand and the monetisation channel.

Notes

1. This relationship holds based on the premise that money demand function is fairly stable.
2. The transversality condition, which relates to the terminal debt, states that the present discounted value of terminal period debt converges to zero as time goes to infinity. This is satisfied when debt grows at a rate lower than the nominal interest rate.
3. The monetisation channel implies financing of present or future level of debt by printing more money rather than through generating primary surpluses.
4. High levels of public debt crowd out private sector borrowing either by raising interest rates or by reducing availability of resources for the private sector.

5. In India, the Fiscal Responsibility and Budget Management (FRBM) Act was enacted in August 2003 and it came into force in July 2004.
6. While financial crowding-out is attributed to constraints in the financial markets imposed by fixed money supply, real crowding-out reflects constraints in aggregate supply in a situation of full employment (Ussher, 1998).
7. Patnaik argues that fiscal deficit raises interest rates when it is assumed that the real economy is supply- constrained and bank credit is supply-constrained.
8. It was seen for the first time in 1998-99.
9. The share of short-term loans in total outstanding marketable debt increased sharply from 24.2 per cent at end-March 1992 to 81.8 per cent at end-March 1998.
10. It is to be reduced further by 25 basis points every calendar quarter until the SLR reaches 18 per cent of NDTL.
11. Banks are allowed to reckon investment in Government securities (i) in excess of the minimum SLR requirement, and (ii) within the mandatory SLR requirement (a) under Marginal Standing Facility (presently 2 per cent of the bank's NDTL) and (b) Facility to Avail Liquidity for Liquidity Coverage Ratio (presently 13 per cent of the bank's NDTL) as Level 1 High Quality Liquid Assets (HQLAs) for the purpose of computing the Liquidity Coverage Ratio. In addition, banks hold Government securities to meet their other operational needs.
12. This may not give rise to any conflict as long as it does not lead to liquidity expansion beyond what is required under the inflation targeting mandate of the Central Bank.
13. The views expressed in the paper are the personal views of the authors and not of the institution they represent.

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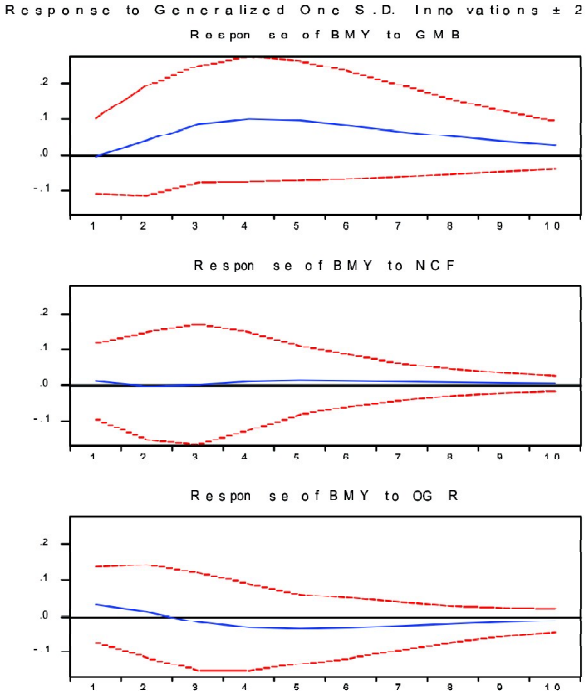
Annex 1

Financial Crowding-out in India -SVAR Approach

The evidence of financial crowding out effect in India is examined in a SVAR framework using the four variables, gross market borrowings of the central government, 10-year benchmark yield, net capital flows from abroad and output gap as defined in Section IV.1 of this paper. The assumptions made regarding structural shocks in the model are as follows: (1) gross market borrowing is the most exogenous variable in the system and shocks to other variables do not affect it. Market borrowing is driven by fiscal policies of the central government; (2) benchmark yield is assumed to be affected by shocks to market borrowings of the central government, net capital flows and itself. Higher market borrowings by the government put pressure on the available resources in the market and is expected to lead to a rise in interest rates as measured by movement in 10-year benchmark yield. An increase in the supply of capital flows from abroad, on the other hand, improves liquidity and eases the pressure on interest rates; (3) net capital flows are influenced by shocks to market borrowings, benchmark yield and itself. Rise in government borrowing raises the benchmark yield which in turns attract higher capital flows from abroad; and (4) the output gap is affected by shocks to all other variables in the system as well as itself. Higher borrowings by the government and the resultant upward movement of benchmark yield raise cost of investible resources for the private sector leading to lower investment and thus higher output gap (assuming the output gap is negative). Higher capital flows from abroad, on the other hand, improves liquidity, increases investment and lowers the output gap. The impulse response functions obtained from the SVAR model largely corroborates the results obtained from unrestricted VAR model in Section IV.1.



Annex 2

Debt and Inflation in India -SVAR Approach

The relationships between central government debt, reserve money, inflation, exchange rate and GDP are analysed in a SVAR framework. The same variables which were used in Section V for estimating the unrestricted VAR have been used here. The assumptions made regarding structural shocks in the model are as follows: (1) central government debt is not affected by shocks to other variables in the model and is determined by the fiscal policy of the government; (2) reserve money is affected by shocks to central government debt and itself. The impact of an increase in government debt on monetisation and reserve money in the system operates through the liquidity channel; (3) Inflation is affected by shocks to all other variables in the model. An increase in reserve money tends to put an upward pressure on prices. Currency appreciation reduces inflation through lower cost of imports while an increase in GDP increases aggregate demand which may increase the prices; (4) exchange rate is impacted by shocks to all other variables in the model. While higher inflation tends to weaken the currency, higher GDP growth leads to an increase in capital flows from abroad which tends to appreciate the currency; and (5) Real GDP is assumed to be affected by shocks to all other variables in the model. The impulse response functions obtained from the SVAR model largely corroborates the results obtained from unrestricted VAR model in Section V.