The Impact of Public Debt on Economic Growth and Capital Formation in India: An SVAR Approach

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Abstract

The paper analyses how India's public debt policy has affected the GDP Growth Rate and Investments over the period 1980-81 to 2018-19. It finds a statistically significant negative effect of debt on growth and no effect of debt on investments. Various measures of debt are taken into account such as the Central Government and Total Government Debt to GDP Ratio, as well its flow counterpart (the Fiscal Deficit) to arrive at these results. While no relation is found between growth and the fiscal deficit, there is a negative effect of the stock of debt on growth. Investments are found to not have any relation with either the fiscal deficit or with the stock of debt. Hence, it shows that there is no crowding out of investment in India. The study employs an econometric technique known as Structured Vector Autoregression (SVAR). Results are shown in the form of Structural Parameters, Impulse Response Functions and Variance Decompositions of Forecasted Error Terms. The study suggests that public debt is negatively affecting GDP Growth through channels other than Investments.[1]

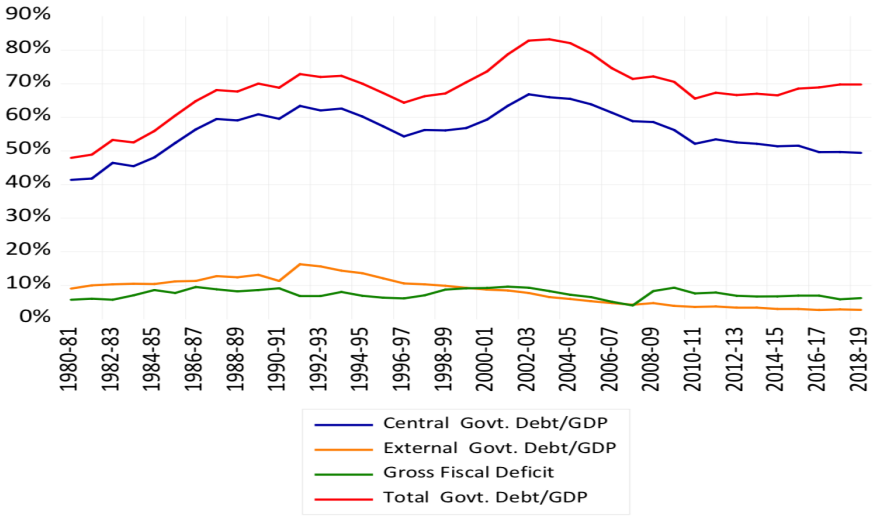
JEL Classification Codes: C40, E62, H63
Keywords: Public Debt, GDP Growth Rate, Investments, SVAR, Shocks

[1]I would like to thank Professor Rakesh Mohan, Professor Michael Boozer, Anisha Grover and Siu Yuat Wong for their inputs and support

1 Introduction

Global Sovereign Debt is currently (at the time of writing this paper) at a staggering $50 Trillion. Public Debt is regarded as one of the few variables, largely in control of the State that can influence a wide variety of other macroeconomic variables. It not only provides the asset base for the money supply but also has an important bearing on inflation, the exchange rate, investments, financial market stability and ultimately, long term economic growth (Sen, 2019). Currently the 5th largest and the fastest growing emerging economy in the world, India's public debt is around 70% of its Gross Domestic Product (GDP), one of the highest amongst its peers. Due to the ongoing COVID-19 pandemic, it is forecasted to touch 77% [2].

Figure 1: Various Debt Indicators of the Government of India

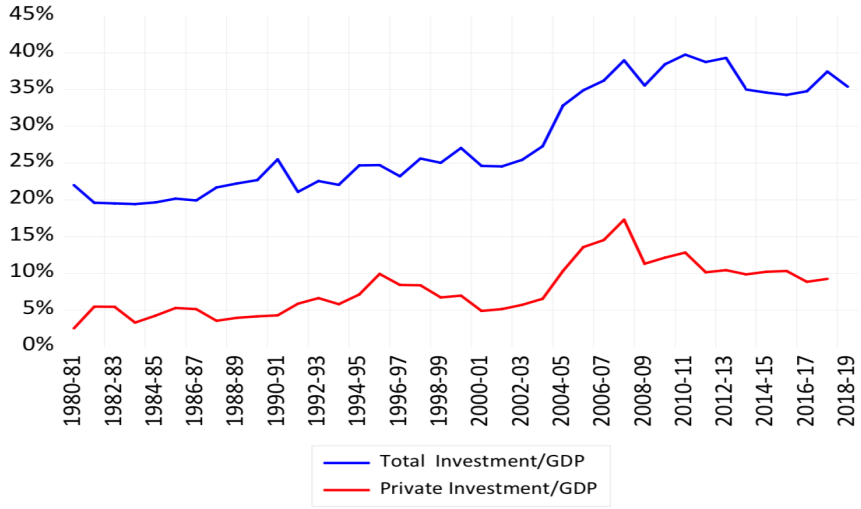


Even though there is extensive literature on the sustainability of public debt and its impact (Alesina & Passalacqua, 2016), there exists little literature on public debt in the Indian context and how it impacts other macroeconomic variables particularly GDP Growth and Investments (Mohanty et al., 2019). Public Debt has long been an important tool to mobilise financial resources by the Government of India. Longstanding financial repression before the economic reforms of 1991 ensured that banks and financial institutions were captive holders of Government securities. Much has changed since then. The enactment of the Fiscal Responsibility and Budgetary Management Act in 2003 (FRBMA) in the backdrop of poor state finances marked a watershed in India's fiscal policy. Its objective was to lay down a roadmap for the trajectory of budgetary deficits and debt in order to instil macroeconomic discipline and to prevent ad-hoc borrowings from the Reserve Bank of India. After all, the 1991 Balance of Payments (BoP) crisis was in large part due to excessively high fiscal deficits (Rangarajan & Srivastava, 2005).

India's public debt has been roughly constant at around 65%-70% of GDP save large expansions just before the 1991 BoP Crisis, around the time of the East Asian Financial Crisis and before the enactment of the FRBMA. Contractions were seen during the boom years during UPA-I. The trends have been largely constant from 2012-13 onwards. Interestingly, it seems that State Governments have started to borrow relatively more as can be seen from the divergence of the red and blue line from FY 2010-11 onwards. India's external debt is a meagre 3.9% of GDP.

[2]Fitch Ratings in April 2020 had forecasted India's Debt to GDP ratio to touch 77%

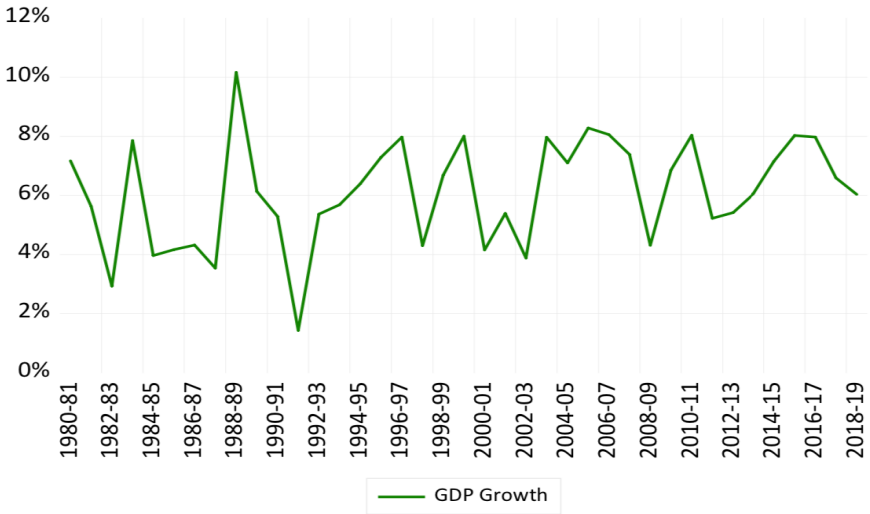
Figure 2: Capital Formation in India



Capital Formation seems to have had an upward structural break in FY 2002-03 and since then has been 32% on average. Private Corporate Investment is roughly one-third of Total Investment and appears to be tapering down ever since the coming of NDA-II in power.

The paper contributes to the economic literature by comprehensively studying how growth and investment have been impacted by public debt, by analysing the most recent estimates of the data. The literature on these are scarce and ambiguous (Mohanty et al., 2019). The paper tries to first answer the age old yet lively debate on whether public debt has led to crowding out of investment especially private investment in the Indian context as is widely believed. This argument is given as a first order justification for reducing the fiscal deficit. The existing neoliberal and international finance narrative sees public debt as a necessary evil that crowds out private sector investment by competing for the same set of financial resources. The Government of India especially appears to be buying into this, propagated by its chief hand maidens: the rating agencies, who demand a reduction in fiscal deficit and debt as a necessary condition for better sovereign ratings (Sen, 2019).

Figure 3: Real GDP Growth Rate of India



2 Literature Review

According to the Ricardian Equivalence approach, public debt has no real effect on the economy (Barro, 1974) (Barro, 1979). Rational and forward looking agents know that repayment of debt will take place through future taxation, this leads them to increase their savings (to pay taxes in the future) and consumption in the present goes down. This decrease in consumption negates the increase in demand brought about by higher public debt. Classical Monetarist theories on the other hand assert that debt crowds out private investment through an increase in the interest rate (Modigliani, 1961) (Friedman, 1983). Keynesian Theories argue that an increase in government debt induced by deficit-financed fiscal policy will increase the level of income and transaction demand for money in an economy that is liquidity constrained and has underemployed resources. Public Debt redistributes wealth from the younger populations to the old; this depresses savings and capital formation in the short run and lowers the steady-state capital labour ratio (Diamond, 1965). In certain situations, a large public debt might create a situation in which investment is reduced because the private sector anticipates that the returns from their investment will be used to pay back the public debt (Krugman, 1988). Cohen (1993) suggested that at a certain threshold point, public debt has a positive impact on investment, but after that point, public debt has a negative impact on investment and economic growth. Similarly, Aschauer (2000) pointed out that government debt is useful in the financing of public investments which have positive effects until a certain limit and negative effects beyond that.

Sheikh et al. (2010) shows how domestic debt affects economic growth in Pakistan for the period 1972-2009. The study indicates that there is a net negative impact of debt servicing on economic growth. Kumar (2010) do the same for a panel of developed and developing economies. Reinhart & Rogoff (2010) provide evidence of a negative link between public debt and growth in forty-four countries spanning over one hundred years. They find evidence of growth slowing down by 1 percent when the debt to GDP ratio exceeds the 90 per cent threshold. However, Herndon (2014) finds an even higher (2.2 percent) decline in growth when countries crossed the 90 per cent mark. Song et al. (2012) use an Overlapping Generations Model and find that an older population would favour taking on debt because they do not have to bear its burden while a younger population would be more conscious of inter-generational equity and push for lower debt.

Singh (1999) explored the relationship between domestic debt and economic growth in India by applying Co-Integration techniques and Granger Causality for the period of 1959-95. They show evidence supporting the Ricardian Equivalence Hypothesis (REH) between domestic debt and growth in India. Rangarajan et al. (2005) imply that primary deficits and interest payments adversely affecting growth. Similarly, Kannan et al. (2007) find that public debt and fiscal deficit negatively affect interest rates, output and inflation in the long run. Das (2010) explored the relationship between domestic borrowing and net wealth of the private sector in India. However, Goyal (2011) finds a positive relationship between public debt and economic growth. Kaur et al. (2012) examined public debt sustainability and found that India's public debt is sustainable. Bal (2014), using an SVAR technique, finds that public debt has a positive impact on gross fixed capital formation as well as output.

The question of public debt in the Indian context has been highly contested ever since the N.K. Singh Fiscal Responsibility and Budgetary Management (FRBM hereon) Review Committee proposed new ceilings on the debt-GDP ratio and a new glide path for fiscal deficits in order to tame fiscal profligacy and ensure a credible counter-cyclical fiscal policy. The Reserve Bank of India's recent Inflation Targeting Framework also marks a fundamental shift in the interest rate-growth differential which is key for public debt management.

3 Data and Methodology

Data for this study have been taken from the Reserve Bank of India's (RBI) Handbook of Statistics on the Indian economy. Data for each variable spans financial years 1980-2019. The debt variable in this study (y_t^{Debt}) is represented either by: (i) Central Government Debt to GDP Ratio or (ii) Total Government Debt to GDP Ratio (which includes debt levels of the State Governments) or (iii) Gross Fiscal Deficit (which is the flow variable for debt). The investment variable (y_t^{Inv}) measures crowding out and uses either the Total Investment to GDP ratio or the Private Sector Investment to GDP Ratio (measured as investment undertaken by the private corporate sector: financial and non-financial, in any given year). The Real GDP Growth Rate variable (y_t^{GDP}) is taken directly from RBI's database. Data for GDP and Investments are in constant year prices expressed in 2004-05 base year. Data is backward spliced for periods beyond FY 2012 to maintain uniformity in base year.

The paper uses a Structured Vector Autoregression Model. The SVAR methodology can accommodate contemporaneous and dynamic relationships among the variables (Sims, 1980), and these relationships can be customised to be consistent with economic theory and intuition. The SVAR technique recovers the structural parameters from its reduced form equations.

The SVAR technique treats each variable as endogenous and allows for dynamic interactions between them. It also achieves non-recursive orthogonalisation of the structural innovations in order to obtain Impulse Response Functions. By imposing suitable restrictions based on economic intuition, it allows us to define the contemporaneous relationship variables. Restrictions also allow us to exactly estimate the structural model from the reduced form equations. We can then use the estimated structural innovations to get Impulse Response Functions for our variables of interest and to obtain Variance Decompositions for each variable.

4 Model

The model is an SVAR in three endogenous variables: (i) Debt to GDP Ratio (y_t^{Debt}) (ii) Real GDP Growth Rate (y_t^{GDP}) and (iii) Investment to GDP Ratio (y_t^{Inv})[3]

$$AY_t = B_0 + B_1 Y_{t-1} + u_t \tag{1}$$

$$A = \begin{pmatrix} 1 & a_{12} & a_{13} \\ a_{21} & 1 & a_{23} \\ a_{31} & a_{32} & 1 \end{pmatrix} Y_t = \begin{pmatrix} y_t^{Debt} \\ y_t^{GDP} \\ y_t^{Inv} \end{pmatrix} B_0 = \begin{pmatrix} b_{10} \\ b_{20} \\ b_{30} \end{pmatrix} B_1 = \begin{pmatrix} b_{11} & b_{12} & b_{13} \\ b_{21} & b_{22} & b_{23} \\ b_{31} & b_{32} & b_{33} \end{pmatrix} Y_{t-1} = \begin{pmatrix} y_{t-1}^{Debt} \\ y_{t-1}^{GDP} \\ y_{t-1}^{Inv} \end{pmatrix} u_t = \begin{pmatrix} u_t^{Debt} \\ u_t^{GDP} \\ u_t^{Inv} \end{pmatrix}$$

where,

A is a 3x3 matrix describing contemporaneous coefficients between Debt to GDP ratio, GDP Growth and Investment to GDP Ratio.

Y_t is a 3x1 column vector containing the three endogenous variables of the Debt to GDP Ratio, GDP Growth and Investment to GDP Ratio

B_0 is a 3x1 column vector of constants

B_1 is a 3x3 matrix containing coefficients for the three system of equations

Y_{t-1} is a 3x1 column vector containing the one period lagged values of the three endogenous variables

u_t are the structural innovations

[3]The words Investment to GDP Ratio and Total Investment to GDP Ratio are used interchangeably in this paper.

This gives us the system of equations:

$$y_t^{Debt} = -a_{12}y_t^{GDP} - a_{13}y_t^{Inv} + b_{10} + b_{11}y_{t-1}^{Debt} + b_{12}y_{t-1}^{GDP} + b_{13}y_{t-1}^{Inv} + u_t^{Debt}$$

$$y_t^{GDP} = -a_{21}y_t^{Debt} - a_{23}y_t^{Inv} + b_{20} + b_{21}y_{t-1}^{Debt} + b_{22}y_{t-1}^{GDP} + b_{23}y_{t-1}^{Inv} + u_t^{GDP}$$

$$y_t^{Inv} = -a_{31}y_t^{Debt} - a_{32}y_t^{GDP} + b_{30} + b_{31}y_{t-1}^{Debt} + b_{32}y_{t-1}^{GDP} + b_{33}y_{t-1}^{Inv} + u_t^{Inv}$$

Pre-multiplying equation (1) with the inverse of A, we get

$$Y_t = A^{-1}B_0 + A^{-1}B_1Y_{t-1} + A^{-1}u_t \tag{2}$$

Equation (2) is known as the reduced form equation and can also be expressed as

$$Y_t = G_0 + G_1Y_{t-1} + \varepsilon_t \tag{3}$$

The vector of errors ε_t and the structural innovations u_t are related in the following manner

$$u_t = A\varepsilon_t \tag{4}$$

In order to exactly identify and recover the structural system of equations (equation (1)) using our reduced form (equation (3)), we need to specify at least $n(n+1)/2$ restrictions (where n is the number of endogenous variables in the system). In this case, we need to specify three restrictions in order to exactly identify the structural model from the reduced form.

I first assume that Public Debt in the current period are not impacted by shocks to the GDP Growth rate or the Investment to GDP ratio but only by shocks to itself, because: (i) The borrowings undertaken by the Government are a policy variable (ii) Data on GDP Growth and Investments are received at the end of the year when the Government's debt requirements are already undertaken (iii) The magnitude of debt to be issued is usually a function of past growth and future growth expectations

Similarly, I assume that GDP Growth in the current period is contemporaneously affected by shocks to the Debt-GDP ratio and itself. Shocks to the Investment to GDP ratio in the current period do not affect current GDP Growth. This is primarily because Investments in the current period show their effect on growth only after a few years due to a certain gestation period in their design and implementation. Debt on the other hand has an impact on several variables like inflation, financial market stability and interest rates which affect growth in the current period.

Lastly, the Investment to GDP ratio is affected by the current growth rate as well as the debt to GDP ratio. The former is because of how current growth shapes expectations of growth and that growth has a direct impact on the denominator in the Investment to GDP Ratio. The latter has an effect on Investments through the interest rate (which has an important bearing on the cost of capital for undertaking investments).

Therefore we get:

$$u_t^{Debt} = \varepsilon_t^{Debt}$$

$$u_t^{GDP} = a_{21}\varepsilon_t^{Debt} + \varepsilon_t^{GDP}$$

$$u_t Inv = a_{31}\varepsilon_t^{Debt} + a_{32}\varepsilon_t^{GDP} + \varepsilon_t^{Inv}$$

We now identify Matrix A as (due to the restrictions we have put) as,

$$A = \begin{pmatrix} 1 & 0 & 0 \\ a_{21} & 1 & 0 \\ a_{31} & a_{32} & 1 \end{pmatrix}$$

We can now run Ordinary Least Squares on the Reduced Form (equation (3)) to consistently estimate the Structural Model (Equation (1)) using our time-series data. Before conducting the estimation[4], we need to ensure that the reduced form equations satisfy the Stationarity properties (Dickey & Fuller, 1979).[5]

4.1 Testing for Unit Root

Augmented Dickey-Fuller Unit Root Test for Stationarity

Variable	t-statistic (Level)	P-Value	t-statistic (First Difference)	P-Value
GDP Growth Rate	-5.592	0.0000	-9.527870	0.0000
Central Debt GDP Ratio	-2.134481	0.2329	-4.237999	0.0019
Total Debt GDP Ratio	-2.694120	0.0849	-3.817108	0.0060
Gross Fiscal Deficit	-3.387503	0.0179	-5.330521	0.0001
Investment GDP Ratio	-0.814421	0.8035	-7.177895	0.0000
Private Investment GDP Ratio	-1.988056	0.2906	-6.394981	0.0000

We find that only the GDP Growth Rate and the Fiscal Deficit (significant at only the 5% and 10% levels) are stationary at level while all other variables are stationary at first difference. Therefore, in our OLS regressions of the reduced form model, we use the first difference for all variables except the GDP Growth Rate (which we use at levels).[6]

4.2 Lag Length Criteria

By running a base line model of Central Government Debt to GDP Ratio, GDP Growth Rate and Total Investment to GDP Ratio, we find that the appropriate lag length as indicated by both the Akaike Schwarz Information Criterion is one. Hence we use a lag of one period in our regressions[7].

We also find that all other tests such as Hannan Quinn Criterion and the Final Prediction Error also yield us a lag lenth of one period. With this, the model is correctly specified and we can go ahead with estimating results

[4]The appropriate Lag Length for all types of models was found to be one using the Akaike Information Criterion and the Schwarz Information Criterion. We also found the system to be Stable.

[5]I do not intend to analyse a long term relationship in this paper and hence do not use any tests for Co-Integration.

[6]The Phillips-Perron Test also yielded the same results for stationarity

[7]All other models which include Private Investments or Total Debt/Fiscal Deficit also yield a lag length of one

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-135.2615	NA	0.435007	7.681196	7.813156	7.727254
1	-38.32793	172.3264*	0.003297*	2.795996*	3.323836*	2.980226*
2	-30.45452	12.68495	0.003553	2.858584	3.782304	3.180987
3	-25.79282	6.733563	0.004658	3.099601	4.419200	3.560177

5 Results

I find that public debt of all types, whether it is the Central Debt to GDP Ratio or Total Debt to GDP Ratio, have adverse effects on GDP Growth. The Fiscal Deficit however is not found to have any statistically significant effect on growth. We also find that public debt of all types including the fiscal deficit have no significant effect on Investments defined in terms of both Private Investment to GDP Ratio and Total Investment to GDP Ratio.

Thus I find that there is no effect of crowding out of Investment (both Total and Private Corporate Investment) in India. This is in stark contrast to the argument of crowding out that classical economists assert. Debt however does has a negative effect on growth.

5.1 Structural Parameter Estimates

Here I provide results of the coefficients of the Structural Parameters in Matrix A which tell us about the presence of any statistically significant contemporaneous relationship between the three endogenous variables.

Model: Central Debt-GDP, GDP Growth Rate & Investment/GDP

Structural Parameter	Coefficient	S.E.	z-Statistic	P-Value
a_{21}	-0.64	0.071	-9.00	0.0000
a_{31}	-0.003	0.071	-0.052	0.9584
a_{32}	0.001	0.134	0.014	0.9883

From our baseline model above (which takes the Central Government Debt to GDP Ratio, GDP Growth and Total Investment/GDP Ratio) we find that an increase in the Central Government Debt/GDP Ratio by 1% leads to a fall in the GDP Growth rate by 0.64% in the current period and this is statistically significant (as given by the coefficient a_{21} and its P-Value). The coefficient for Total Investment to GDP Ratio is not statistically significant (a_{31}) implying that an increase in the Central Government Debt to GDP ratio has no impact on the Total Investment to GDP Ratio.

Model: Total Debt-GDP, GDP Growth Rate & Private Investment/GDP

Structural Parameter	Coefficient	S.E.	z-Statistic	P-Value
a_{21}	-0.54	0.065	-8.268	0.0000
a_{31}	-0.002	0.065	-0.032	0.9739
a_{32}	0.000	0.11	0.004	0.9997

Now, I change the underlying model to one that takes the Total Government Debt to GDP Ratio, GDP Growth and Private Investment to GDP Ratio (in order to further validate our previous results). Here too, I find that an increase in the Total Government Debt/GDP Ratio by 1% leads to a fall in the GDP Growth

rate by 0.54% in the current period and this is statistically significant (as given by the coefficient (a_{21} and its P-Value). The coefficient for Private Investment to GDP Ratio is not statistically significant a_{31}) implying that an increase in the Total Government Debt to GDP ratio has no impact on the Total Investment to GDP ratio.

Model: Fiscal Deficit, GDP Growth Rate & Private Investment/GDP

Structural Parameter	Coefficient	S.E.	z-Statistic	P-Value
a_{21}	-0.21	0.130	-1.633	0.1024
a_{31}	-0.004	0.130	-0.037	0.9700
a_{32}	0.004	0.087	0.046	0.9632

For the sake of completeness and in order to provide robustness to our previous two results, we now take a model whose variables include the Fiscal Deficit, GDP Growth and Private Investment to GDP Ratio. Here however, I find that an increase in the Fiscal Deficit by 1% leads to a fall in the GDP Growth rate by 0.21% in the current period but this is statistically not significant (as given by the coefficient a_{21} and its P-Value). The coefficient for Private Investment to GDP Ratio (a_{31}) is also not statistically significant, given its high P-Value implying that an increase in the Fiscal Deficit has no significant impact on private investment in India.[8]

5.2 Impulse Response Functions

We now analyse the Impulse Response Functions which look at how completely independent and exogenous shocks to structural innovations (the error terms in the structural model) affects other variables of interest. Each shock is defined as a one standard deviation shock to the particular variable and the behaviour of the response variable is plotted across a period of ten years.

5.2.1 Effects of shocks on GDP Growth Rate

I find that shocks to both, Central Government and Total Government Debt to GDP ratio cause a significant decline in the GDP growth rate and this typically dies down by the third or fourth year. This decline in the growth rate remains largely unchanged even if we change the covariate from Total Investment to Private Investment. This enhances the validity of my results.

This however is not the case with the Fiscal Deficit where the impact on the GDP growth rate is extremely small. Even if we change the covariate from Total Investment to Private Investment, it makes little difference in the relationship between Fiscal Deficit and GDP growth.

These Impulse Response results mirror the results obtained in the Structural Parameters above. There too, we saw significant negative effects of debt on growth and no effect of fiscal deficit on growth.

Here I have excluded how shocks to a variable affect itself over a future horizon. Debt may affect the GDP Growth Rate through several channels; it may create financial market instability and exchange rate volatility as was the case with Greece and Argentina, it may an increase in the interest rate for consumer credit or housing, it may also impede the ability of the Government to undertake counter-cyclical fiscal policy and finally, high levels of debt can cause repression of financial institutions like bank and hamper their efficiency.

[8] I get similar insignificant results for growth and investment if I take Total Investment instead of Private Investment.

Figure 4: One S.D. shock to Central Debt/GDP Ratio with Investment/GDP as other variable[9]

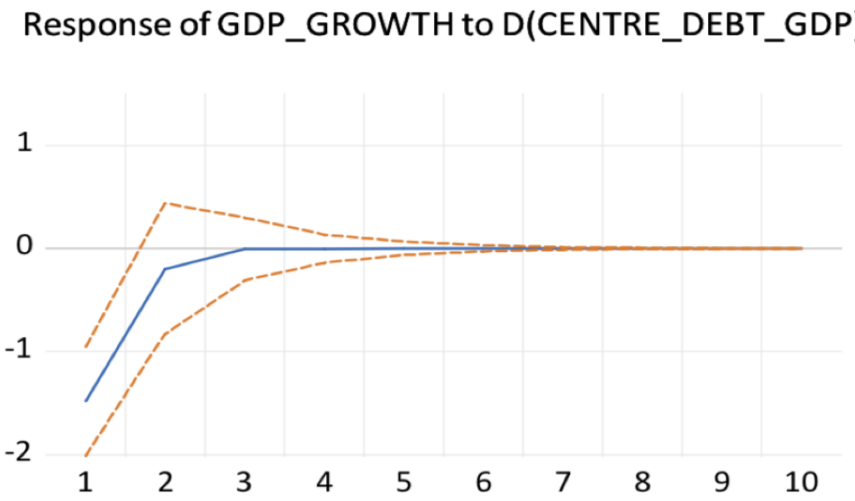


Figure 5: One S.D. shock to Central Debt/GDP Ratio with Private Inv./GDP as other variable

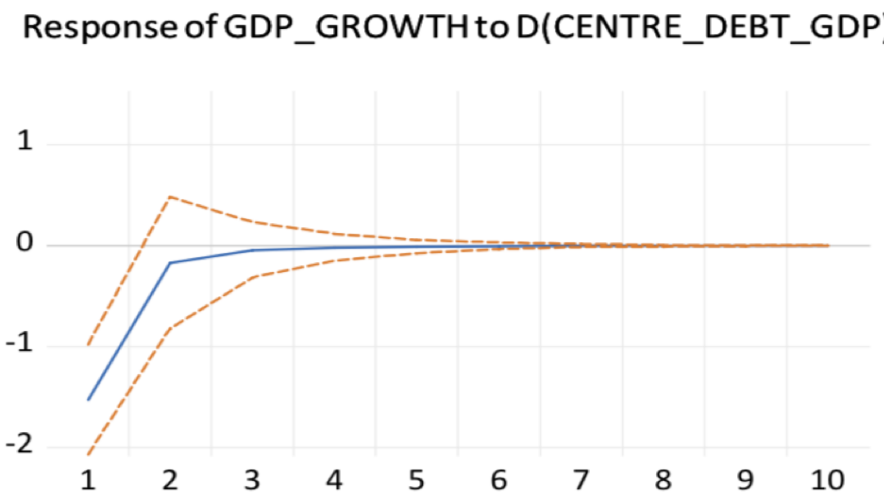
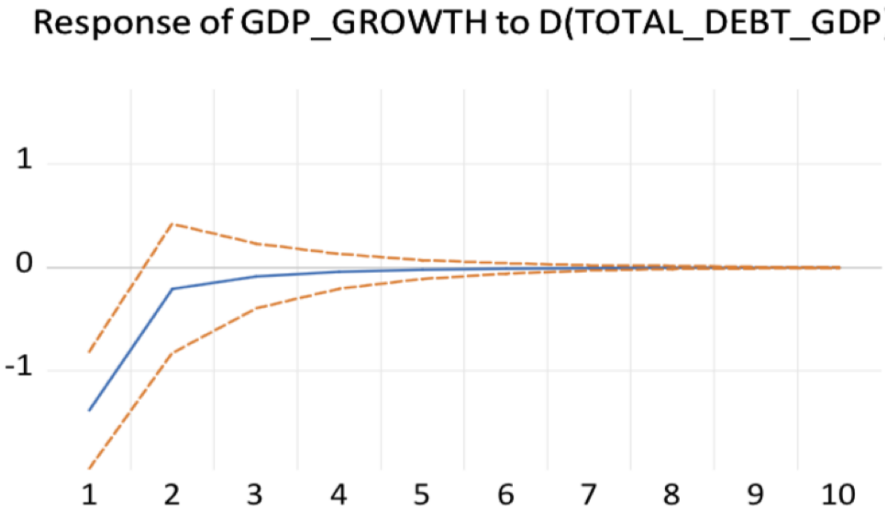


Figure 6: One S.D. shock to Total Debt/GDP Ratio with Private Inv./GDP as other variable



[9]D here refers to the first difference of the variable. Based on the Augmented Dickey Fuller Test, every variable except the GDP Growth is not stationary at levels but is stationary at first difference

Figure 7: One S.D. shock to Fiscal Deficit with Investment/GDP as other variable

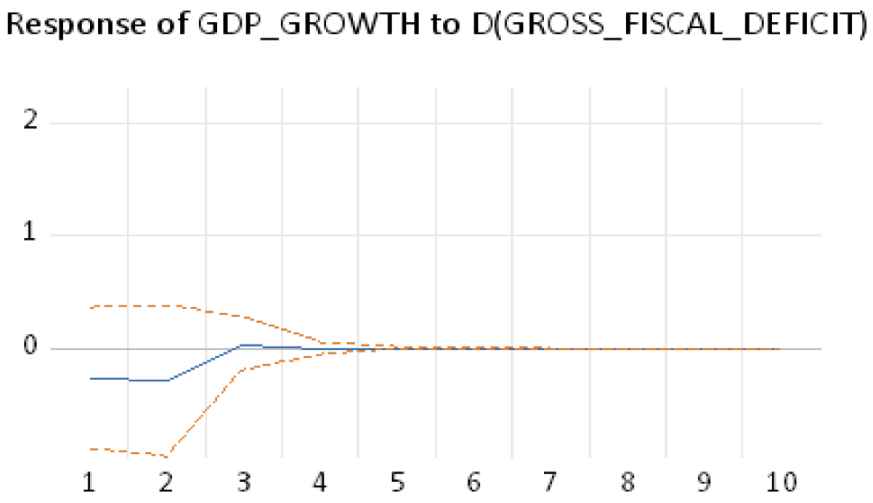
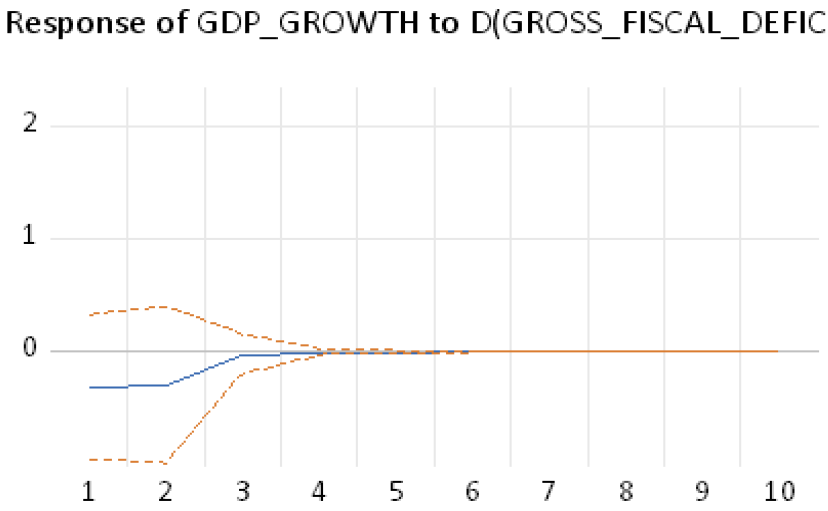


Figure 8: One S.D. shock to Fiscal Deficit with Private Inv./GDP as other variable



5.2.2 Effects on Investment

I find that shocks to the Central Government or Total Government Debt to GDP ratio causes an insignificantly negative movement in Investments (Total or Private). Interestingly, we find that the effect of both types of debt on Private Investment is smaller than Total Investment (which also includes public sector investment). This reaffirms our main result that there is no evidence of any crowding out by fiscal policy, given that it is private investment that is perpetrated as the victim in the crowding out hypothesis.

Even when we take Fiscal Deficit instead of debt as the explanatory variable, the effect on private investment dies out quicker than total investment. There is no effect of Fiscal deficits on any sort of investment (just like debt).

These results also mirror the results obtained in the Structural Parameters above. There too, we saw an insignificant effect of debt and fiscal deficit on investments (total and private).

Figure 9: One S.D. shock to Central Debt/GDP Ratio on Total Investment

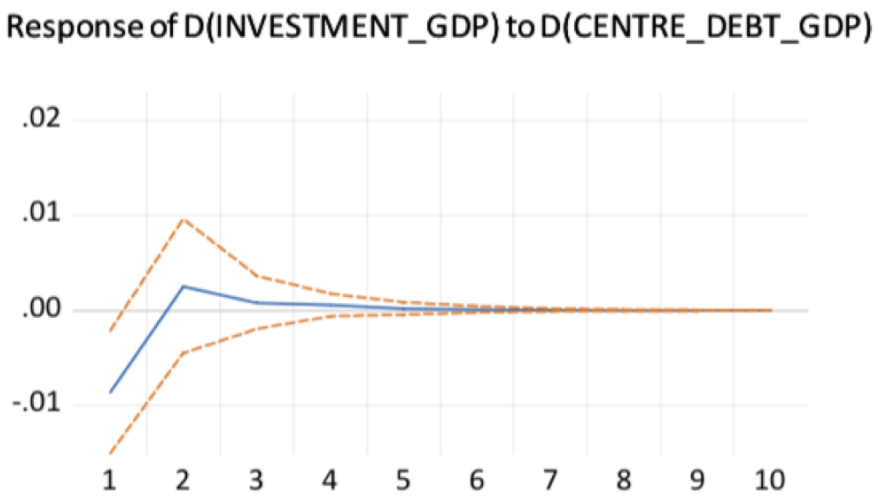


Figure 10: One S.D. shock to Central Debt/GDP Ratio on Private Investment

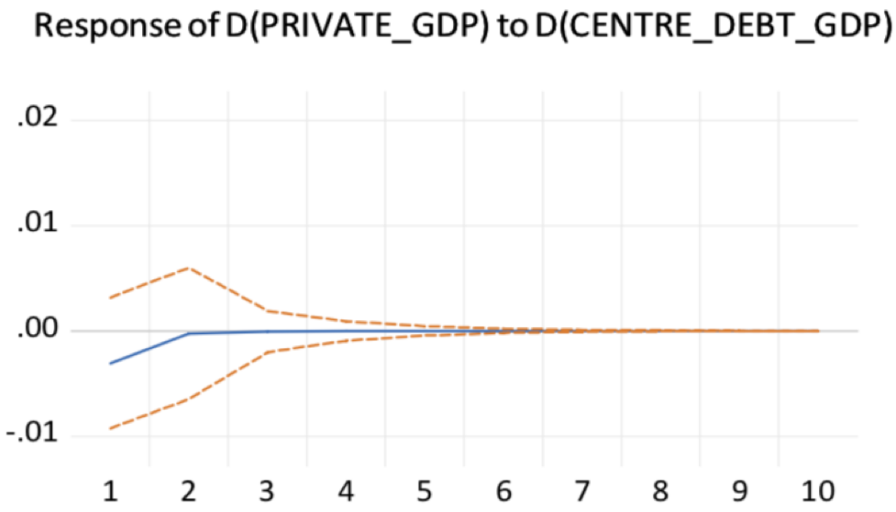


Figure 11: One S.D. shock to Total Debt/GDP Ratio on Total Investment

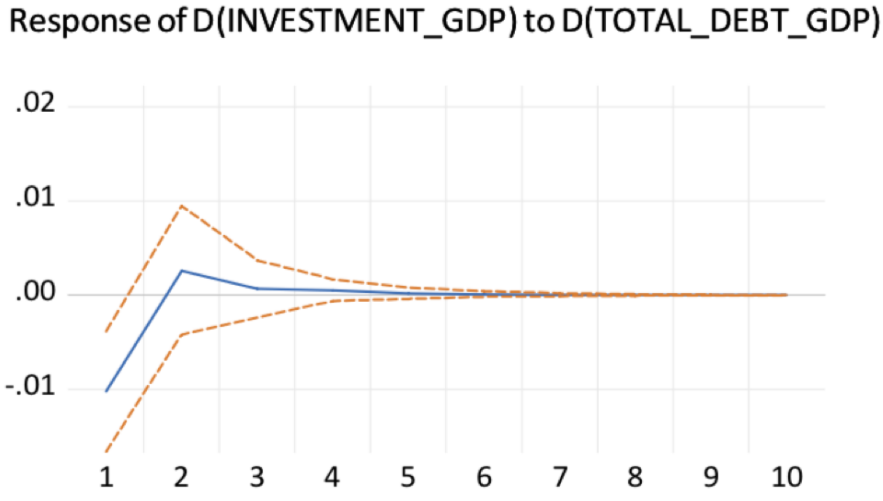


Figure 12: One S.D. shock to Total Debt/GDP Ratio on Private Investment

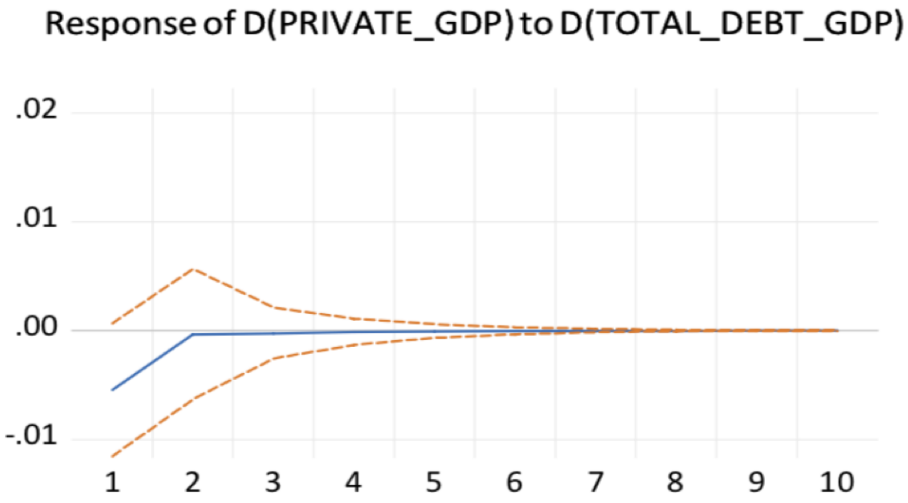


Figure 13: One S.D. shock to Fiscal Deficit on Total Investment

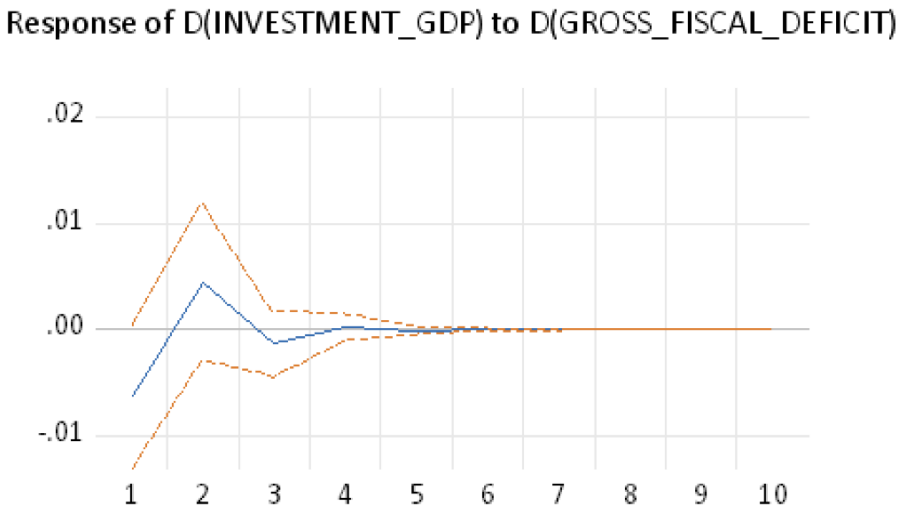
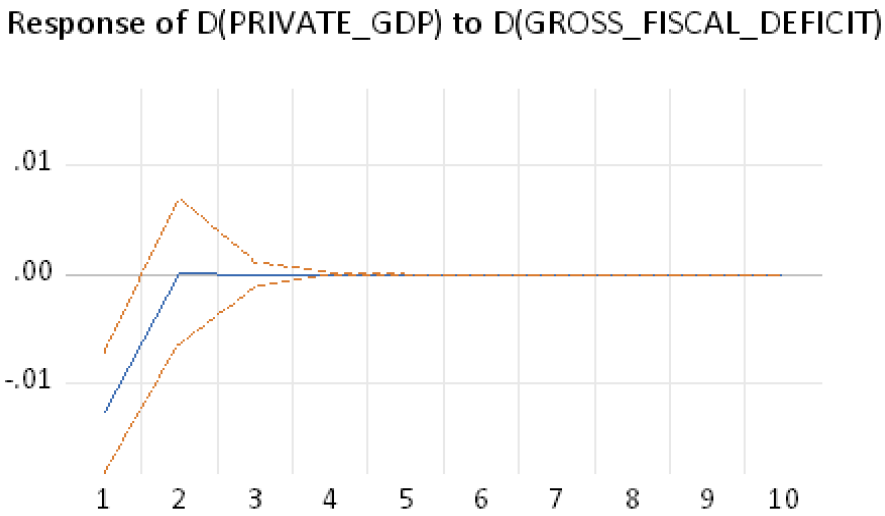


Figure 14: One S.D. shock to Fiscal Deficit on Private Investment



5.3 Variance Decomposition

This section gives us the Structural Decomposition of Forecast Error Variances (in %). It measures the proportion of the movement of a variable due to shocks to itself and to shocks to other variables.

The purpose of a Variance Decomposition Analysis is to provide an alternative method to affirm and validate our previous results. Any variable that significantly impacts another variable should also be able to explain a large percentage of the latter's variance.

It is a useful tool that provides information about the relative importance of each of the shocks in the system. Tables 1 to 6 report the percentage of the forecast error variance of selected variables due to shocks to themselves and to the other variables in the system for one to five year horizons in the future.

5.3.1 GDP Growth Rate

The model from which tables 1&2 are derived include the Central Debt to GDP Ratio, GDP Growth Rate and both types of Investments.[10]

In Tables 1 & 2 we find that about 59%-60% of the variation in GDP Growth Rate can be explained by shocks occurring in the Debt variable. The results are similar irrespective of the investment variable that we have taken (Total or Private Investment). Similarly, 39%-40% of the variation in GDP Growth Rate is explained by its own shock.

Table 1: Structural Decomposition of Forecast Error Variances of GDP Growth (in %)

Lag Period	S.E.	D(CENTRE)	D(GROWTH)	D(Priv)
1	1.962	60.48	39.51	0.00
3	1.971	60.77	39.21	0.01
5	1.971	60.77	39.21	0.01

Table 2: Structural Decomposition of Forecast Error Variances of GDP Growth (in %)

Lag Period	S.E.	D(CENTRE)	D(GROWTH)	D(Inv)
1	1.917	59.58	40.41	0.00
3	1.941	59.20	39.48	1.27
5	1.941	59.20	39.48	1.31

The model from which Tables 3&4 are derived include the Fiscal Deficit, GDP Growth Rate and both types of Investments. In Tables 3 & 4, we find that shocks to the Fiscal Deficit is able to explain only 1%-4% of the variation in the GDP Growth Rate. This is in line with our previous results from Impulse Response Functions as well as from Structural Parameters. 94%-98% of the variation in GDP Growth Rate in these models is explained by its own shock.

Table 3: Structural Decomposition of Forecast Error Variances of GDP Growth (in %)

Lag Period	S.E.	D(Fiscal)	D(GROWTH)	D(Inv)
1	1.907	1.98	98.01	0.00
3	1.941	4.23	94.97	0.79
5	1.941	4.23	94.97	0.79

Table 4: Structural Decomposition of Forecast Error Variances of GDP Growth (in %)

Lag Period	S.E.	D(Fiscal)	D(GROWTH)	D(Priv)
1	1.928	2.62	97.37	0.00
3	1.970	4.88	93.64	1.46
5	1.970	4.88	93.64	1.46

[10] Results are broadly similar if we take Total Debt to GDP Ratio instead of Central Debt to GDP Ratio

5.3.2 Investment

The model from which tables 5&6 are derived include the Central Debt to GDP Ratio, GDP Growth Rate and Total Investment to GDP Ratio.[11]

Interestingly (and validating my earlier results), the shock to the debt variable is able to explain only a small portion of the variation in the Investment variable.[12]

What we can see clearly is that while shocks to the debt variable can explain about 17% of the variation in Total Investments, the same for Private Investments is a meagre 2.6%. This provides further conclusive evidence of no crowding out, especially private sector crowding out. It seems that Private Investment is least responsive to shocks to any of the debt variables while there is at least some responsiveness seen in Total Investments (perhaps because it includes investments made by the Government and Public Sector Enterprises in the form of Capital Expenditure).

Table 5: Structural Decomposition of Forecast Error Variances of Total Investments (in %)

Lag Period	S.E.	D(Centre)	D(GROWTH)	D(Inv)
1	0.020	17.47	1.38	81.13
3	0.021	17.22	6.05	76.77
5	0.021	17.27	6.11	76.60

Table 6:: Structural Decomposition of Forecast Error Variances of Total Investments (in %)

Lag Period	S.E.	D(Centre)	D(GROWTH)	D(Priv.)
1	0.018	2.65	1.48	95.85
3	0.018	2.66	1.48	95.84
5	0.018	2.66	1.48	95.84

6 Conclusion

This paper has tried to analyse how India's public debt and fiscal deficit have affected the GDP Growth Rate and Investments in a comprehensive (by using Structural Parameter estimates, Impulse Response Functions and Variance Decompositions) and robust manner (by producing results from models that include different debt and investment variables).

The results across each model and for each of the three techniques are unambiguous and significant. They tell us that while debt is negative for growth, it does not crowd out investments, especially private investment. The fiscal deficit on the other hand, neither impacts growth nor investments.

This has serious implications for India's fiscal policy as well as for the contours of its FRBMA law (which provides specific direction on how fiscal policy should be conducted). The paper clearly implies that India can take on higher levels of debt without hurting investment sentiment and that perhaps the Indian Government has been conservative rather than profligate with its public debt policy.

There is certainly no evidence of any crowding out in the Indian context and the arguments propounded by Classical and Monetarist theories do not hold good for India. Debt is however negatively impacting growth through other channels and finding out these channels would be an exciting area for future research (given that debt is definitely not affecting growth through investments).

Given the onslaught of the COVID-19 pandemic during the time this paper was written, it makes sense, now more than ever to take on more debt so that there is greater room for counter-cyclical fiscal policy.

[11] Results are broadly similar if we take Total Debt or Fiscal Deficit instead of Central Debt.

[12] Results are similar if we take the Fiscal Deficit, Total Debt or Private Investment in analysing the Variance Decomposition of Investments

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