AUGUST 24, 2022

Role of Public Debt in Indian States in The Post Reform Era

WORKING PAPER

Subaran Roy (PhD)

Professor, Jindal School of Government and Public Policy,
O P Jindal Global University

Anusree Paul (PhD)
Associate Professor, School of Economics and Commerce,
BML Munjal University

Role of Public Debt in Indian States in The Post Reform Era

Subaran Roy (PhD)

Professor, Jindal School of Government and Public Policy,
O P Jindal Global University,
Sonipat Narela Road, Near Jagdishpur Village, Sonipat,
Haryana 131001, India, email: subaran@jgu.edu.in

Anusree Paul (PhD)*
Associate Professor, School of Economics and Commerce,
BML Munjal University,
NH 8, Village, Dharuhera, Gurgaon, Haryana 131001, India,
email: paul.anusree12@gmail.com

*Corresponding Author

Role of Public Debt in Indian States in The Post Reform Era

Abstract

The substantial amount of existing literature investigating the debt-growth association for high-income countries show that debt has a negative impact on economic growth or existence of an inverted-U shaped relationship between these two variables on some occasions. Given the lack of literature involving developing economies in this space, our study entirely focuses on a developing country like India. The study examines the empirical relationship between public debt (internal) and State Gross Domestic Product for India in the post reform era. The panel data extends from year 2000 till 2020. Our random error component model findings indicate a positive and significant impact of debt in enhancing the Indian SGDPs for the above-mentioned period. Results are also confirmed by using alternative estimation technique, namely, fixed effect. Next, we address the issue of endogeneity by employing Generalized Method of Moments (GMM). Our results continue to remain robust. Finally, inclusion of other control variables does not alter our findings.

Keywords: Public Debt, Economic Growth, Panel Data, Endogeneity, GMM estimator

JEL Classifications: H63, H54, O50, C51.

Role of Public Debt in Indian States in The Post Reform Era

Introduction:

Public debt of Central Government of India was Rs. 4,427,127 million in 1990-91 and in 2020-21 the amount has increased to Rs. 180,683,785.9 million.[1] The growth rate of debt (13.3 percent per annum) has outweighed the rate of GDP growth by distant amount during the same period (Figure 1a). The scenario is no different if we focus at state level data (see Figure 1b). The increase in the state level debt is 46 times than it was in 1990-91.

***Figure 1a**: Growth of total debt in India during 1985 to 2019*

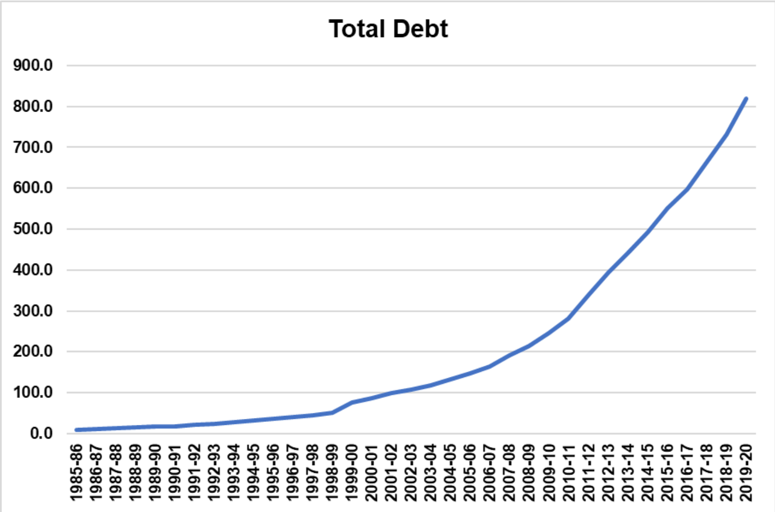
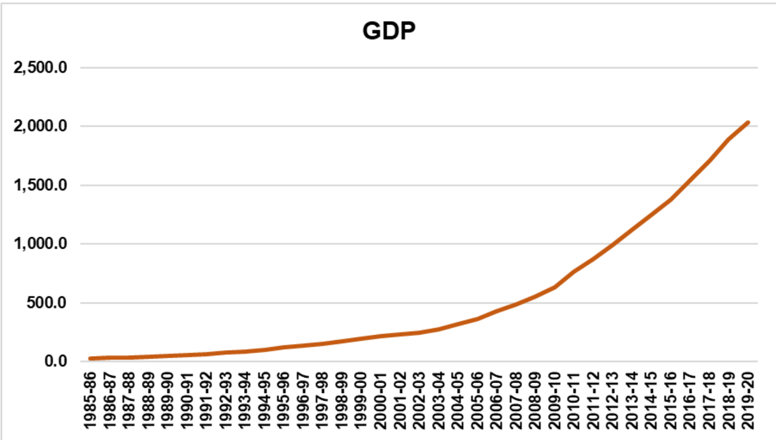


***Figure 1b**: Growth of GDP in India during 1985 to 2019*



Source: RBI database

[1] Source: www.economicoutlook-cmie-com.opj

Thus, a natural and important question is about the role of debt on economic growth or Gross Domestic Product (GDP). There happens to be a substantial amount of literature investigating the debt-growth connection for high-income countries. The inquiry on low and low-middle-income economies is, still, few.

The existing literature primarily highlights on the liquidity constraint hypothesis and debt overhang theory which have previously been used to understand the consequences of debt on economic growth (Krugman 1988, Sachs 1989, and Cohen 1993). These theories postulate that higher debt levels crowd out economic growth because of heightened government internal borrowing. This rise in borrowing will, in turn, increase the interest rate, which makes the cost of borrowing for both investment and consumption more expensive, which is called as crowding out effect. Hence, too much dependence on public debt could impede investment and economic growth. The 'debt overhang' hypothesis mentions that if the anticipated external debt of a country is more than its repayment ability, then the increased cost of servicing debt can hinder investment (Krugman, 1988). Moreover, weak management in developing countries has resulted in borrowing having a negative impact on both the GDP (Gross Domestic Product) and financial sustainability of these countries.

On the other hand, another school of thought is of the view that, if public debt is used in productive activities, such as building new and developed infrastructure, education and health then the economy can expand without generating any macroeconomic instability (Burnside and Dollar, 2000). It is also to be noted that several studies have found an inverse linear relationship between total debt and economic growth both across countries (Reinhart et. al. 2015) and at a single country-level analysis. The empirical works by Mitchell (1988), Barro (1989), and Reinhart and Rogoff (2010, 2011) showed that public debt has a significant impact on economic growth. Results suggest that a fair level of debt should help countries to boost their economic growth.

In Indian context Singh (1999) established a long run relationship between domestic debt and economic growth by employing the Johansen cointegration technique. Kannan and Singh (2007) revealed that public debt and a high level of fiscal deficit had an unfavourable effect on interest rates, output, inflation, and the trade balance in the long run in India. Similarly, Rangarajan and Srivastava (2005) claimed that a large fiscal deficit and interest payments to GDP adversely affected economic growth. They also pointed out that public debt negatively affected the growth of the Indian economy. It is to be mentioned all the above-stated studies are at country level. However, there is not much literature available at state level for India. To mention few studies, include the attempt done by Mohanty and Mishra (2016). Using only 14 states and employing DOLS and FMOLS methods they find the existence of bi-directional causality between public debt and economic growth. With this dearth of literature in state level debt and its impact on SGDP (State Gross Domestic Product) we contribute to the literature primarily by four major ways. First, this study is motivated by the fact that no previous study has empirically investigated the relationship between state level public debt and SGDP in India covering almost all states of India. It is the maiden attempt to cover pan India by including 29 states which covers almost 98 percent of India in a state level study in the context of debt-

SGDP relationship. Secondly, the study entirely focuses on recent past including state level data till 2020 primarily covering the post reform era. Thirdly, even at the state level study we control for local macroeconomic environment by including relevant variables. In our future endeavours we would like to extend the battery of local macroeconomic variables to further enrich our results. Finally, we also address the issue of potential endogeneity at the state level investigation by utilizing appropriate estimation technique.

The rest of this paper is structured as follows. Section 2 discusses the recent literature and sets the stage for the study. Section 3 describes the data, sample period and estimation methodology. Section 4 reports our results and discuss the same. Section 5 concludes.

Literature Review:

In Indian context, among other, studies done by Rangarajan and Srivastava (2003), Akram (2013), Kaur et. al. (2014), Mohanty and Mishra (2016), Sasmal and Sasmal (2020), Husain and Asif (2019), Mohanty and Panda (2020), Das (2017) have documented debt dynamics and debt-growth relationship. With the help of a dynamic model, Rangarajan and Srivastava (2003) have shown the decomposition of debt accumulation into cumulated primary deficits and cumulated weighted excess of growth over interest rates. They have shown that these two factors are majorly contributing to the debt-GDP ratio of India.

Akram (2013) studied the relationship between debt variables and economic growth for the period 1975-2011 for four South Asian economies viz. Bangladesh, India, Sri Lanka and Pakistan. He employed a hybrid model which includes role of public debts into growth equations. The results support “debt overhang” and “crowding out” effects as both economic growth and investment are turned out to be negative. Domestic debt also has a negative impact on economic growth, which reveals that domestic debt is not a risk-free option to finance deficits in these countries. Kaur et. al. (2014) assessed and found a non-linear relation between growth and public debt for the period of 1980-81 to 2012-13. The estimated threshold level of general government debt-GDP ratio is 61 per cent, and beyond which an inverse relationship is seen between debt and growth.

Manik (2016) found unidirectional feedback relationship from external debt to economic growth of India during 1980-81 to 2013-14. But the VEC Granger Causality test shows no feedback relation from internal debt to economic growth. In another study Husain and Asif (2019) have shown that public debt Granger causes economic growth in the long run. In the long run, public debt causes positive growth whereas the short run debt has a negative impact on it. They studied the relationship for the period 1990-2017. Das (2017) investigated how government spending at the subnational level contributes to India's rising debt. Over the course of 34 years (1980–2013), he presided over a panel of 17 non-special category states. The GMM results show that state government borrowings contribute to growth, and that at the subnational level, changes in the debt ratio are more closely related to changes in revenue than changes in capital expenditure. His findings also suggest that the rise in government borrowing, and the expansion of state economies have been influenced by unobserved factors, primarily the capacity and motivation of the politicians in power in these states. With the help of the Dumitrescu Hurlin causality test, Mohanty et al. (2016) examined the relationship between public debt and economic growth for 15 NSC states of India from 1991 to 2015. The test reveals bidirectional causality between these two variables. They identified the endogeneity issues, and to address it along with serial autocorrelation problem, authors have employed Fully Modified OLS model. The results indicate that public debt, total revenue receipts and total credit have favourable effect on economic growth. In an another study, Mohanty and Mishra (2016) have shown significant long-run relationship among log of Gross state domestic product, real public debt, real institutional credit to private sector, and commercial consumption of electricity by using Kao and Pedroni Test of cointegration. Their study also reveals that economic growth is positively and significantly impacted by public debt. This study additionally shows high impact of institutional credit, and low impact of electricity consumption on growth.

Finally, in a more recent study, Mohanty and Panda (2020) have shown public debt, both at the Central Government as well as Combined Governments of both Central and States had an adverse impact on economic growth in India, and when isolating the effect of total public debt into domestic and external, it was found that domestic debt had a more adverse impact than external debt. This is a cause of concern in India since domestic debt constitutes nearly 95 per cent of total public debt in India, becoming a burden on the economy. They concluded no long run relationship between the variables by employing ARDL (Autoregressive distributed lag) model and have used SVAR (Structural Vector Autoregression) framework to study the short run relationship during the period 1980-81 to 2017-18.

Methodology:

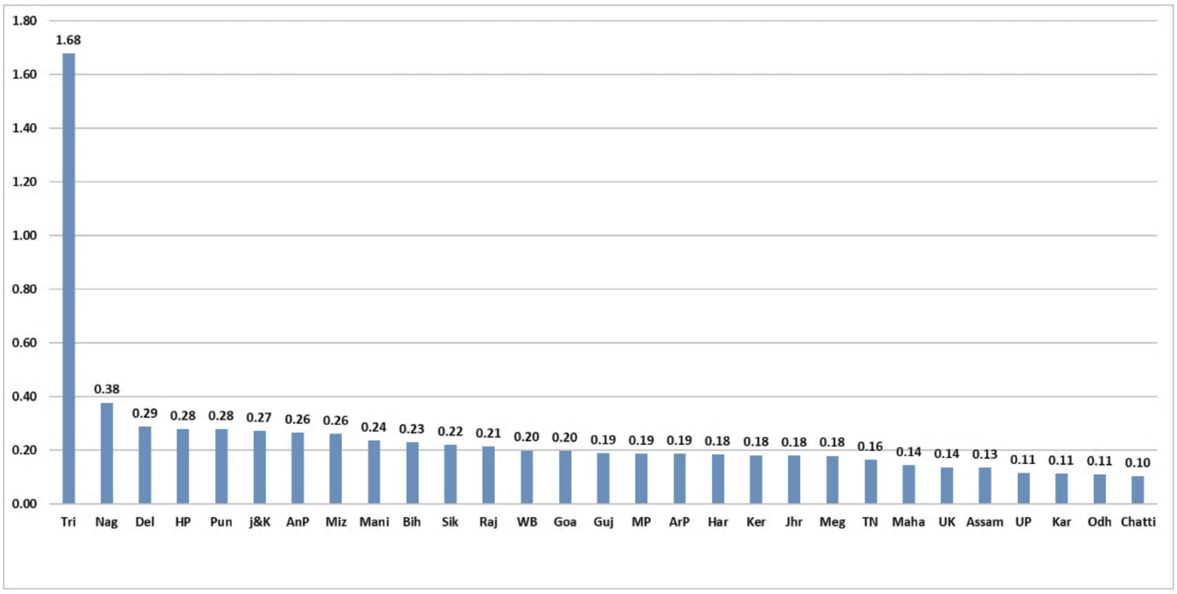
Model Specification and Data:

The classical theory of economic growth has limited scope of the government role where growth is not affected by public debt. Similarly, the Ricardian Equivalence Theorem emphasised that taxes and debt are similar, and they do not impact the real macroeconomic variables differently. On the other hand, Neo-Keynesian and Keynesian theories of economic growth emphasise more on the role of government. The theories talk on the role of public debt in mitigating the deficit arise due to saving – investment mismatch. The “Marshal Plan” strategy after World War II brought a growth enhancing effect of foreign aid in Europe. Thus, the post WWII growth models have incorporated the significant importance of public debt.

From a theoretical standpoint, there is no agreement on the direction of the impact of public debt on output in the short or long run. According to the "conventional" view (Elmendorf and Mankiw, 1999), government debt (manifesting deficit financing) can have a positive effect on disposable income, aggregate demand, and overall output in the short run because output is entirely demand determined in short run. Moderate debt levels are found to have a positive short-run impact on economic growth via a variety of channels like improved monetary policy, strengthened institutions, increased private savings, deeper financial intermediation etc (Abbas and Christensen, 2007).

In this study, we have taken the data of 29 Indian states for our period 2000-2020. The sources are Reserve Bank of India (RBI) and Centre for Monitoring Indian Economy (CMIE) databases. We have taken log of state gross domestic product as our dependent variable throughout the estimation process. The selection of the explanatory variables is based on the existing literature. Our variable of interest is the log of internal debt-SGDP at state level. The state-level mean Debt-SGDP ratio (Figure 2) shows substantial heterogeneity. Tripura is having highest Debt-SGDP ratio (1.68), followed by Nagaland (0.38), Delhi (0.29), Himachal Pradesh and Punjab (0.28). Uttar Pradesh, Karnataka, Odisha, and Chhattisgarh are having the lowest debt-SGDP ratio. In terms of the absolute amount, Maharashtra's mean internal debt is highest, which is equal to Rs. 17192300 billion, followed by Tamil Nādu (Rs.11405900 billion), Gujrat (Rs.11331700 billion), West Bengal (Rs.10115000 and Andhra Pradesh (Rs.994517 billion).

Figure 2: State wise mean Debt-SGDP ratio during 2001-2020



Source: Authors' Calculation from RBI database.

The set of relevant demographic and macroeconomic control variables that we considered in our model are natural logarithm of population, capital expenditure, social sector expenditure, expenditure on infrastructure, interest payment, gross fiscal deficit, and inflation.

Population expansion can have a negative short-run influence on growth. Neoclassical models show that an increase in population growth rate can reduce the steady state output per capita permanently (Solow 1956). On the other hand, the endogenous models state that low population can be detrimental to growth (Romer, 1990). Empirically the relationship between population growth and economic output growth has been extensively examined (e.g., Headey and Hodge, 2009), with contradicting results on the effects of population expansion on economic growth.

Developmental expenditure like social sector expenditure, expenditure on infrastructure, and capital expenditure are always having a growth enhancing effect (Barro 1990; Lucas 1988; Romer 1990). Thus, we include the components of development expenditures mentioned above in our analysis. Finally, low inflation and high economic growth are two major macroeconomic policy concerns where various schools of thought differ in establishing the link between the two (Munir and Mansur, 2009). For instance, monetarists establish a detrimental effect of inflation on growth whereas structuralists believe that it is inevitable for growth (Mallik and Chowdhury, 2001). The descriptive statistics of the dependent and all explanatory variables are given in Appendix.

Empirical Estimations:

Panel Estimation – Fixed and Random Effects

In panel estimation we report results from both fixed effects and random effects models. The estimation methods for each approach are discussed briefly. Let's assume the data on individual state *i* is:

$$y_{it} = \beta_{1i} + \beta_2 x_{2it} + \beta_{3it}\, x_{3it} + \cdots + \beta_{kit}\, x_{kit} + e_{it} \qquad t = 1, \dots, T \qquad (1)$$

Now if we average the entire data over time then we get

$$\frac{1}{T}\sum_{t=1}^{T}(y_{it} = \beta_{1i} + \beta_2 x_{2it} + \beta_{3it}\, x_{3it} + \cdots + \beta_{kit}\, x_{kit} + e_{it}) \qquad (2)$$

We are aware that the parameters do not vary over time, hence one can simplify this as

$$\bar{y}_i = \frac{1}{T}\sum_{t=1}^{T} y_{it} = \beta_{1i} + \beta_2 \frac{1}{T}\sum_{t=1}^{T} x_{2it} + \beta_3 \frac{1}{T}\sum_{t=1}^{T} x_{3it} + \cdots . + \beta_k \frac{1}{T}\sum_{t=1}^{T} x_{kit} + \frac{1}{T}\sum_{t=1}^{T} e_{it}$$

$$= \beta_{1i} + \beta_2 \bar{x}_{2i} + \beta_3 \bar{x}_{3i} + \cdots + \beta_k\, \bar{x}_{ki} + \bar{e}_i \qquad (3)$$

The "bar" notation $\bar{y}_i$ indicates that we have averaged the values of y_{it}across time. Then, by subtracting (3) from (1), term by term to get

$$\begin{aligned} & y_{it} = \beta_{1i} + \beta_2 x_{2it} + \beta_3 x_{3it} + \cdots + \beta_k x_{kit} + e_{it} \\ & -(\bar{y}_i = \beta_{1i} + \beta_2 \bar{x}_{2i} + \beta_3 \bar{x}_{3i} + \cdots + \beta_k\, \bar{x}_{ki} + \bar{e}_i) \end{aligned}$$

$$y_{it} - \bar{y}_i = \beta_2(x_{2it} - \bar{x}_{2i}) + \beta_3(x_{3it} - \bar{x}_{3i}) + \cdots + \beta_k(x_{kit} - \bar{x}_{ki}) + (e_{it} - \bar{e}_i) \qquad (4)$$

In equation (4), we note that intercept parameter β_{1i} has dropped off. These data are are termed as "deviation from the individual's mean" form, and we repeat this process for each country, then we have a transformed model

$$\tilde{y}_{it} = \beta_2 \tilde{x}_{i2t} + \beta_3 \tilde{y}_{3it} + \cdots + \beta_k \tilde{y}_{kit} + \tilde{e}_{it} \qquad (5)$$

where $\tilde{y}_{it}$ = $y_{it} - \bar{y}_i$. Writing the fixed effects model in terms of deviations from individual means emphasize one important characteristic of the fixed effects estimator: the coefficient estimates depend only on the variation of the dependent and explanatory variables within individuals. We exploit this feature given our dataset while estimating the model. We also report results of error component model as mentioned above. We discuss briefly the method in the following paragraph.

In the fixed-effects model we assume that all individual differences are captured by differences in the intercept parameter. The intercepts β_{1i} were considered to be "fixed" parameters that we could estimate directly using the least squares estimator. In the error component model, we again assume all individual differences are captured by the intercept parameters, but we also recognize that the individuals in our sample are randomly selected, and thus we treat the individual differences as random rather than fixed. Random individual differences can be included in the model by specifying the intercept parameters β_{1i} to consist of a fixed part that represents the population average, $\bar{\beta}_1$, and random individual differences from the population average, u_i. In equation form the breakdown is

$$\beta_{1i} = \bar{\beta}_1 + u_i \qquad (6)$$

The random individual differences u_i, which are commonly termed as random effects, are analogous to random error terms, and we make the standard assumptions about them – namely that they have zero mean, are uncorrelated across individual observations, and have a constant variance σ_u^2, so that

$$E(u_i) = 0, \;\; cov(u_i, u_j) = 0 \;\; i \neq j, var(u_i) = \sigma_u^2, \qquad (7)$$

Now if we substitute (6) to (1) we obtain

$$y_{it} = \beta_{1i} + \beta_2 x_{2it} + \beta_{3it} x_{3it} + \cdots + \beta_{kit} x_{kit} + e_{it}$$

$$=(\bar{\beta}_1 + u_i) + \beta_2 x_{2it} + \beta_{3it} x_{3it} + \cdots + \beta_{kit} x_{kit} + e_{it} \qquad (8)$$

In this expression $\bar{\beta}_1$ is a fixed population parameter, and u_i is a random effect. We can rearrange (8) to make it look like a familiar regression equation,

$$=(\bar{\beta}_1 + \beta_2 x_{2it} + \beta_{3it} x_{3it} + \cdots + \beta_{kit} x_{kit} + (e_{it} + u_i)$$

$$= \bar{\beta}_1 + \beta_2 x_{2it} + \beta_{3it} x_{3it} + \cdots + \beta_{kit} x_{kit} + v_{it} \qquad (9)$$

where now $\bar{\beta}_1$ is the intercept parameter and the error term is $v_{it}$is composed of a component u_i that represents a random individual effect and the component e_{it} which is the usual regression random error. The combined error is

$$v_{it} = e_{it} + u_i \qquad (10)$$

Because the random effects regression in (10) has two components, one for the individual and one for the regression, the random effects model is also known as error components model.

Finally, we employ the dynamic panel model by using GMM estimation. The model that we have estimated is as follows:

$$y_{it} = \sum_{j=1}^{\rho} \rho_j y_{it-j} + x'_{it}\beta + e_{it} + u_i \qquad (11)$$

where,

y_{it} is log of SGDP

$|\rho| < 1$

x_{it} is $(k-1) \times 1$ vector of regressors

i is the number of Indian states, $i = 1, \ldots., N$

t is time period, $t = 1, \ldots., T$

u_i is unobserved time-invariant error, and $e_{it} \sim iid(0, \sigma_e^2)$ is the idiosyncratic error.

Now, several econometric issues can be cropped up while estimating equation (11): a). issues related to endogeneity of the regressors; b). time invariant state characteristics (u_i, fixed effects) may be correlated with the regressors; c). the presence of lagged dependent variable (y_{it-j}) gives rise to autocorrelation; d). the panel dataset has small t with large i.

To address the endogeneity issue, and covariance of u_i with x_{it}, we usually use the fixed effect instrumental variable approach (FEIV) or two stage least square (2SLS) method. But many of the cases, if the chosen instrument (s) are weak, the FEIV estimators become biased. Hence, we have used Arellano – Bond (AB, 1991) difference GMM method, which was first proposed by Holtz-Eakin, Newey and Rosen (1988). In this method, the lagged levels of endogenous regressors are also taken, which makes the endogenous variables predetermined and thus not correlated with u_i in equation (11).

Thus, the difference GMM uses first-differences to transform equation (11) into

$$\Delta y_{it} = \sum_{j=1}^{\rho} \rho_j \Delta y_{it-j} + \Delta x'_{it}\beta + \Delta e_{it} \qquad (12)$$

Here the first-differenced lagged dependent variable (c) is also instrumented with its past levels. Lastly, AB estimators address small *t* and large *i* cases effectively (d).

Results and Discussion:

We initiate our regression analysis with pooled cross section estimation as it has been often used to detect the relationship between variables at the onset of any analysis. Column (1) of table 1 includes only debt in the regression along with the constant. It reports the binary regression result. The coefficient on debt turns out to be significant and positive. The statistical significance of the coefficient is at 0.01 level and the magnitude of the coefficient is 0.88. The positive and statistically significant coefficient implies that at state level in India the debt contributes to SGDP. However, the coefficient seems to be high in absence of other control variables. In the next column the capital expenditure amount by each state is introduced. The coefficient on debt drops to 0.48 and it is statistically significant at 0.01 level. The coefficient of the capital expenditure is 0.58 and statistically highly significant. It reflects the fact that states with higher amount of capital expenditure ends up with the higher SGDP. In the following column the gross fiscal deficit is added to the regression. There is no change in the value of the coefficient of debt. And the statistical significance remains the same. Similarly, there is no change in magnitude and direction of the capital expenditure variable. The coefficient of gross fiscal deficit itself is statistically insignificant. In column (4) we use social expenditure by states in presence of debt variable only. Results indicate that doubling debt by state will increase the SGDP by 4.2 percent, if spending the debt on productive processes. The coefficient of the social expenditure turns out be as high as 0.62 with a significance level of 0.01. Thus, there seems to be tremendous importance of social expenditure in the context of the SGDP of Indian states. Although this does not undermine the importance of debt towards the contribution of India's SGDPs.

Table 1: Pooled Regressions

VARIABLES	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
DEBT	0.884***	0.489***	0.489***	0.429***	0.368***	0.306***	0.278***	0.279***
	(0.0210)	(0.0468)	(0.0470)	(0.0485)	(0.0505)	(0.0404)	(0.0470)	(0.0472)
KEXP		0.589***	0.598***					
		(0.0605)	(0.0647)					
GFD			-1.26e-06					
			(4.29e-06)					
SCEXP				0.622***	0.462***	0.103***	0.168***	0.169***
				(0.0566)	(0.0514)	(0.0381)	(0.0410)	(0.0411)
INFRAEXP					0.241***	0.153***	0.139***	0.137***
					(0.0448)	(0.0323)	(0.0318)	(0.0319)
POPULATION						0.644***	0.628***	0.628***
						(0.0330)	(0.0324)	(0.0324)
INTPAYMENT							0.114**	0.116**
							(0.0536)	(0.0529)
INFLATION								-0.00128
								(0.00238)
CONSTANT	2.969***	1.793***	1.737***	1.778***	2.001***	2.269***	1.998***	1.997***
	(0.221)	(0.203)	(0.278)	(0.188)	(0.180)	(0.133)	(0.177)	(0.177)
R-squared	*0.750*	*0.810*	*0.810*	*0.815*	*0.825*	*0.894*	*0.895*	*0.895*
F-Stat	*1775.26*	*1497.92*	*999.72*	*1655.01*	*1182.09*	*2327.18*	*1945.28*	*1628.46*
Prob > F	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
Observations	*551*	*551*	*551*	*551*	*551*	*551*	*551*	*551*

All variables are in natural logarithm form
Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1.

In column (5) in addition to social expenditure we introduce the infrastructure expenditure as described in the data section. After controlling for these variables, the coefficient of debt drops by 6 basis points. The magnitude of the coefficient of debt is 0.36 and remains statistically significant at 0.01 level. Both social expenditure and infrastructure variables are positive and highly significant (at 0.01 level). Specifically, the coefficients of social expenditure and infrastructure expenditure are 0.46 and 0.24 respectively. Results indicate that social and infrastructure expenditures are major contributors towards the SGDP. In the last three columns of table 1 we add population, interest payment and inflation respectively. The coefficient of the debt variable has now dropped to 0.27 compared to value of 0.88 at the beginning. The infrastructure variable continues with its positive sign and high statistical significance. The population variable is positive and significant. Probably it may be capturing the size of the labour force to some extent. The direction of interest payment coefficient is somewhat surprising as it turns out to be positive. Also, the rate of inflation is statistically negative with expected negative sign. Overall, the big picture from the table (1) is that debt contributes positively to Indian SGDPs. However, we recognize that there may be state specific effects and random effects affecting states which needs to be included in the estimation method to improve our results.

In table (2) we report results from the fixed effect panel estimation method. We continue with same battery of explanatory variables. In column (1) the result of binary regression between SGDP and debt is provided. First thing to note is the drop in the coefficient of debt variable compared to the coefficient of debt in table 1. But debt retains its positive direction with 0.01 level of significance. The coefficient shows that only 13 percent variation in SGDP can be explained by debt which seems to us more realistic compared to the previous values. In next column we add the capital expenditure as an explanatory variable. The coefficient of the debt further drops to 0.07 while the magnitude of the capital expenditure coefficient turns out to be 0.16. Both these variables are statistically highly significant at 0.01 level signifying the importance of these variables towards the contribution of SGDP. With inclusion of gross fiscal deficit in the set of control variables nothing changes. In column (4) we run the regression with debt and social expenditure variables only. The coefficient of debt is positive and significant at 0.01 level of significance The social sector expenditure is also positive at 0.19 with same level of significance. The results indicate that both social expenditure and debt has a positive significant role in rising the SGDP.

Table 2: Panel Estimation Results (FE)

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
DEBT	0.131***	0.0754***	0.0778***	0.0435***	0.0268*	0.0283*	0.0208*	0.0219*
	(0.0312)	(0.0243)	(0.0227)	(0.0155)	(0.0162)	(0.0162)	(0.0163)	(0.0164)
KEXP		0.160***	0.138***					
		(0.0261)	(0.0297)					
GFD			2.86e-06					
			(1.74e-06)					
SCEXP				0.191***	0.133***	0.146***	0.0973**	0.0981**
				(0.0225)	(0.0225)	(0.0249)	(0.0413)	(0.0414)
INFRAEXP					0.108***	0.105***	0.103***	0.0975***
					(0.0320)	(0.0325)	(0.0311)	(0.0332)

POPULATION						-0.0965	-0.141	-0.133
						(0.110)	(0.123)	(0.122)
INTPAYMENT							0.0720	0.0723
							(0.0448)	(0.0446)
INFLATION								-0.0014*
								(0.000738)
CONSTANT	10.48***	9.645***	9.791***	9.593***	9.457***	10.29***	10.37***	10.31***
	(0.311)	(0.227)	(0.272)	(0.230)	(0.244)	(1.058)	(1.133)	(1.126)
R-squared	*0.356*	*0.531*	*0.538*	*0.618*	*0.697*	*0.694*	*0.701*	*0.704*
F-Stat	*17.72*	*47.33*	*40.51*	*47.64*	*36.45*	*36.36*	*36.97*	*35.62*
Prob > F	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
Observations	*551*	*551*	*551*	*551*	*551*	*551*	*551*	*551*

All variables are in natural logarithm form
Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1.

In column (5) the measure for infrastructure is included. The debt coefficient is now at 0.02 with 0.10 level of significance. It shows that debt continues to affect SGDP positively even after accounting for the social and infrastructure measures. This again reinstates the significance of debt in enhancing the SGDP. The positive coefficients of social expenditures and infrastructure expenditures reflect the fact that both these variables play a very important role at state levels to increase the SGDPs via various channels. In column (6) population measure is included which turns out to be insignificant. Our variable of interest remains positive and statistically significant with magnitude 0.02 at 0.10 percent level of significance. There is not much of change in the coefficient of social expenditure. This is also true for the infrastructure expenditure variable. Both variables remain positive and statistically significant at 0.01 level of significance. In the last two columns we add interest payment and inflation in the existing set of control variables. The significance level of debt marginally drops but the direction and magnitude remain the same. Results still confirm the fact that debt if used productively can leave a positive and significant impact on SGDP. Both social and infrastructure expenditures are equally important in raising the SGDP levels for Indian states. The inflation variable correctly enters the regression with negative coefficient at 90 percent confidence level. This indicates that higher inflation rate is not conducive for the enhancement of the SGDP. However, the main finding from this table echoes the result of the previous table with some corrections in terms of the size of the coefficient. Results confirm that debt itself is not bad for Indian states if it is used productively. In fact, debt has a positive and beneficial impact on SGDP if used productively in presence of healthy amount of social and infrastructure expenditure.

Table 3: Panel Estimation Results (RE)

VARIABLES	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
DEBT	0.145***	0.0806***	0.0826***	0.0478***	0.0292*	0.0249*	0.0190*	0.0204*
	(0.0335)	(0.0247)	(0.0230)	(0.0159)	(0.0165)	(0.0158)	(0.0156)	(0.0158)
KEXP		0.172***	0.151***					
		(0.0281)	(0.0314)					
GFD			2.72e-06					
			(1.77e-06)					
SCEXP				0.200***	0.137***	0.0782***	0.0392**	0.0419**

				(0.0237)	(0.0228)	(0.0294)	(0.0465)	(0.0465)
INFRAEXP					0.113***	0.110***	0.108***	0.102***
					(0.0315)	(0.0327)	(0.0314)	(0.0335)
POPULATION						0.438***	0.414***	0.407***
						(0.114)	(0.111)	(0.113)
INTPAYMENT							0.0554	0.0562
							(0.0457)	(0.0453)
INFLATION								-0.00157**
								(0.00072)
CONSTANT	10.34***	9.487***	9.633***	9.465***	9.355***	5.731***	5.710***	5.781***
	(0.480)	(0.397)	(0.453)	(0.382)	(0.375)	(1.067)	(1.086)	(1.102)
R-squared	0.3563	0.5313	0.5383	0.6184	0.6974	0.6632	0.6689	0.6734
F-Stat	18.64	89.90	118.41	95.23	111.53	105.72	135.46	153.94
Prob > F	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
Observations	*551*	*551*	*551*	*551*	*551*	*551*	*551*	*551*

All variables are in natural logarithm form
Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1.

In table 3 we showcase the results from our error component model. Just like previous tables we start our random effect estimation with debt as the only explanatory variable in. In column (1) we get to see that the coefficient on debt is 0.14 and its significant at the 0.01 level of significance. The coefficient is similar to the result that we obtained in the previous table with fixed effect estimation. The positive and significant coefficient of debt variable again confirms the fact that debt has beneficial effect on SGDP. In column (2), we control for the capital expenditure done by respective states. The coefficient of debt variable drops to more conservative level of 0.08 while keeping its statistical significance unchanged. Thus, a hundred basis point increase in debt will contribute to SGDP by 8 basis points as per the estimated coefficient in presence of capital expenditure. The coefficient of the capital expenditure variable is 0.17 and statistically significant at 0.01 level of significance. The coefficient is almost similar to the one which we estimated using the fixed effect model. Gross fiscal deficit is the next candidate in the set of our control variables which gets included in the regression. Like previous there is no significant change in the debt coefficient. It remains positive and statistically significant at 0.01 level of significance with 0.08 as magnitude. The capital expenditure coefficient marginally drops from 0.17 to 0.15 but there is no change in the statistical significance. The coefficient of gross fiscal deficit itself remains statistically insignificant. In column (4) social expenditure variable enters with positive sign. It reiterates that social expenditure is an important variable at the state level to increase the SGDP. Specifically, the coefficient of the social expenditure is 0.20 and is statistically very significant. The debt variable remains positive with coefficients 0.04 and 0.01 level of significance. In the next column following the sequence of previous tables we control for the infrastructure expenditure. After controlling for both social and infrastructure expenditures the coefficient of debt turns out to be 0.02 with 0.10 level of significance. This implies that if debt increases by 100 basis points the SGDP should increase by 2 basis points. The magnitude of the effect in random effect model is however less compared to the results obtained in the fixed effect model. The coefficients of social expenditure and infrastructure expenditures are 0.13 and 0.11 respectively with 0.01 level of significance. In the next three columns population, interest payment and inflation are added in step wise fashion. The coefficient of the debt variable in all three occasions are positive and is consistent around the magnitude 0.02. Other than one case in all scenarios the debt variable retains statistically significant. After introduction of interest payment social expenditure loses its significance although the measure of the infrastructure expenditure remains positive and retains its statistical significance at 1 percent level. The population variable enters the table with positive coefficient and high statistical significance. As mentioned earlier the strong positive effect of population may be arising from partially capturing the labour force of states. The interest payment variable fails to attain any statistical significance. Inflation has a correct negative sign with 0.05 level of significance, but the magnitude is too small. So overall results from this table too suggests a positive and substantial effect of debt on SGDPs in presence of significant amount of social and infrastructure expenditure.

Next, as explained in the methodology section, we use GMM approach to estimate the dynamic panel data model to further enhance our empirical results. Table 4 is enumerated the results of the different specifications of the model.

Table 4: GMM Results (One Step)

VARIABLES	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
LGSDP	0.855***	0.752***	0.752***	0.677***	0.516***	0.516***	0.507***	0.779***
	(0.0696)	(0.0534)	(0.0536)	(0.0640)	(0.0615)	(0.0632)	(0.0611)	(0.0657)
DEBT	0.0627***	0.0524***	0.0539***	0.0374***	0.0245*	0.0242*	0.0225*	0.0216*
	(0.0159)	(0.0147)	(0.0141)	(0.0144)	(0.0130)	(0.0127)	(0.0127)	(0.0074)
KEXP		0.0498***	0.0403***					
		(0.0165)	(0.0155)					
GFD			9.15e-07					
			(7.59e-07)					
SCEXP				0.0686***	0.0588***	0.0677***	0.0475*	0.0230*
				(0.0170)	(0.0182)	(0.0247)	(0.0294)	(0.0175)
INFRAEXP					0.0749***	0.0736***	0.0715***	0.0214*
					(0.0114)	(0.0114)	(0.0118)	(0.0118)
POPULATION						0.0628	0.0936*	0.0680*
						(0.0792)	(0.0656)	(0.0372)
INTPAYMENT							0.0326*	0.0334*
							(0.0247)	(0.0209)
INFLATION								-0.0068***
								(0.000552)
Wald chi2(7)	*951.13*	*994.90*	*1005.57*	*837.01*	*586.85*	*575.27*	*667.09*	*3013.93*
Prob > chi2	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
AR2 (Z stat)	*2.5278*	*2.2839*	*2.3467*	*2.614*	*2.373*	*2.3081*	*2.3619*	*.15966*
Prob > z	*0.0115*	*0.0224*	*0.0189*	*0.0089*	*0.0176*	*0.0210*	*0.0182*	*0.8731*
Observations	*493*	*493*	*493*	*493*	*493*	*493*	*493*	*493*
Number of states	*29*	*29*	*29*	*29*	*29*	*29*	*29*	*29*

All variables are in natural logarithm form
Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1.

In the dynamic panel estimation, we have used the similar specifications with same set of regressors, which we mentioned in tables 1-3 in columns 1 to 8. In all specifications we found that lag SGDP is highly significant at 1 percent level of significance. In the first four specifications, we find that the coefficients of debt variable are positive and highly significant at 1 percent level, although the magnitudes have reduced after controlling the endogeneity as compared to its FE/ RE counterparts. This result echoes the positive impact of debt on SGDP at state levels. That is, after controlling the endogeneity, SGDP increases by 6 basis point (column 1), when we use lag of debt as single instrument. This magnitude decreases further, as we use more control variables and their lags as instruments (columns 2-8). In column 8, we have taken all other important explanatory variables, and their lags as instruments to control endogeneity. In this case, we see that SGDP increases by 1.2 basis point with a 100-basis point increase in internal debt, which is very weakly significant at 20 percent level of significance.

In columns (2) and (3), we controlled for capital expenditure and gross fiscal deficit. Capital expenditure remains the major explanatory variable in determining the growth of SDGP along with debt variable in a dynamic panel setup. In column (4) we further added social sector expenditure, and in column (5) to (8) we have sequentially added infrastructure expenditure, population, interest payments and inflation. The significance of most of these controls remains unchanged as before (see Table 2). But after controlling the endogeneity, their magnitude has reduced substantially as compared to our FE results (table 2). The prominent deviating results that we find in the dynamic panel specification are as follows: the magnitude of the infrastructure expenditure variable's coefficient has reduced significantly but the variable remains significant as before. Inflationary impact on SGDP become more adverse, that is the coefficient has increased from -0.0016 (Table 2) to -0.0068 (column 8). Population has significant negative impact on SGDP after controlling of endogeneity (columns 7 and 8) although weakly. Social sector expenditure (columns 7 and 8) becomes weakly significant, and unlike FE/RE results interest payment is found positively impacting SGDP but it is weakly significant.[2]

Conclusion

The high escalating debt of India has raised major concerns among academia, policy makers and popular press about its implications on aggregate economic activities. The surge in the public debt over time has posed an unavoidable question of how public debt affects GDP? Existence of debt overhang theory and crowding out effect clearly states the negative impact of public debt on GDP. Prevailing literature also try to establish a non-linear relationship

[2] To check the robustness of the above results, we also run the two-step GMM. As we know the two-step GMM increases the efficiency of the GMM estimators. In case of our model, we find that the above results are similar under two-step GMM method, hence we have omitted the results for brevity in the main text. Results are reported in Appendix.

between these debt and growth. Specifically, an inverted U-shaped relationship has also been presented as stylized facts to showcase the fact that debt at low level is beneficial for growth but beyond a threshold there exists a negative relationship between debt and growth. However, all these studies have been broadly concentrated around developed economies. In recent times we have seen some investigations that are done on developing economies as well. But there still exists a huge gap in terms of literature between these two groups. And there is absolute dearth in literature in conducting studies involving country and its states/counties/provinces etc.

This paper has tried to advance the debate on the nexus between debt and growth in significant ways for a developing country like India. The study is conducted at the state level. Our dataset represents over 98 percent of India which is comprised of 29 states and Union Territories (UTs). The data extends from the year 2000 to 2020. In our econometric analysis we do control for the state level macroeconomic environments to the best possible ways. And we try to address the issue of potential endogeneity between debt and SGDP by implementing GMM estimator. Our findings indicate public debt at state level for India has contributed positively towards increasing SGDPs. Unlike some previous studies (albeit for different time periods and number of included states in their studies), we report a beneficial role of public debt in enhancing SGDPs. The primary channel through which the debt impacts is not consumption but expenditures on productive purposes. Immediate consumption based on debt is detrimental to increase SGDP over time. But if debt is used for constructive purposes like education, skill enhancement, clean water, sanitation, health care, childcare, road and railway expansion, telecommunication improvements/penetration, electrification etc., then the productive capacity of the economy flourishes. This in turn can benefit the economy. To conclude we state that debt can play a pivotal role in growing an economy if it is used to efficiently to expand the absorption and productive capacity of the economy.

Appendix:

Descriptive statistics:

Variable		Mean	Std. Dev.	Min	Max	Observations
LGSDP	overall	11.8	1.6	8.5	14.3	N = 551
	between		1.6	8.9	14.0	n = 29
	within		0.2	11.3	12.4	T = 19
DEBT	overall	10.0	1.5	5.3	12.8	N = 551
	between		1.4	7.4	11.9	n = 29
	within		0.7	7.5	12.8	T = 19
KEXP	overall	8.7	1.2	5.9	11.4	N = 551
	between		1.1	6.6	10.5	n = 29
	within		0.5	7.3	10.5	T = 19
GFD	overall	8076.8	9675.7	-3809.8	55554.8	N = 551
	between		7825.4	237.4	24938.8	n = 29
	within		5864.1	-20240.3	48078.7	T = 19
SCEXP	overall	9.2	1.3	6.3	11.9	N = 551
	between		1.2	7.0	10.9	n = 29
	within		0.5	8.1	10.6	T = 19
INFRAEXP	overall	7.7	1.4	4.0	10.5	N = 551
	between		1.3	5.2	9.7	n = 29
	within		0.6	5.8	9.9	T = 19
POPULATION	overall	9.7	1.6	6.3	12.3	N = 549
	between		1.6	6.4	12.2	n = 29
	within		0.1	9.5	10.1	T = 18.931
INTPAYMENT	overall	12.4	1.5	9.0	15.1	N = 551
	between		1.4	9.8	14.3	n = 29
	within		0.5	11.2	13.7	T = 19
INFLATION	overall	3.4	6.4	-66.5	14.8	N = 551
	between		0.9	0.0	3.6	n = 29
	within		6.3	-63.2	18.2	T = 19

Source: Authors' Calculation from RBI database.

Table 5: GMM Results (Two Step)

VARIABLES	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
LGSDP	0.854***	0.750***	0.750***	0.675***	0.511***	0.507***	0.501***	0.798***
	(0.0707)	(0.0555)	(0.0554)	(0.0674)	(0.0651)	(0.0686)	(0.0660)	(0.0761)
DEBT	0.0629***	0.0530***	0.0543***	0.0375**	0.0238*	0.0243*	0.0227*	0.0119*
	(0.0169)	(0.0172)	(0.0165)	(0.0165)	(0.0138)	(0.0143)	(0.0135)	(0.00928)
KEXP		0.0494***	0.0404**					
		(0.0190)	(0.0177)					
GFD			9.49e-07					
			(1.02e-06)					
SCEXP				0.0692***	0.0602***	0.0687*	0.0477*	0.0202*
				(0.0180)	(0.0196)	(0.0362)	(0.0343)	(0.0201)
INFRAEXP					0.0753***	0.0743***	0.0732***	0.0216*
					(0.0123)	(0.0139)	(0.0143)	(0.0131)
POPULATION						0.0600	0.0838	0.0481
						(0.172)	(0.0723)	(0.0564)
INTPAYMENT							0.0311	0.0282*
							(0.0291)	(0.0219)
INFLATION								-0.0069***
								(0.000580)
Wald chi2(7)	*864.19*	*880.25*	*896.45*	*751.17*	*453.76*	*491.33*	*483.83*	*1968.80*
Prob > chi2	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
AR2 (Z stat)	*2.5289*	*2.3124*	*2.3737*	*2.6192*	*2.315*	*2.2473*	*2.2716*	*.15636*
Prob > z	*0.0114*	*0.0208*	*0.0176*	*0.0088*	*0.0206*	*0.0246*	*0.0231*	*0.8757*
Observations	*493*	*493*	*493*	*493*	*493*	*493*	*493*	*493*
Number of states	*29*	*29*	*29*	*29*	*29*	*29*	*29*	*29*

All variables are in natural logarithm form
Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1.

Reference

1. Abbas S.M.A. and J. E. Christensen, 2007. The role of domestic debt markets in economic growth: An empirical investigation for low–income countries and emerging markets. Working Paper 07/127. Washington, DC: International Monetary Fund.
2. Akram, N, 2013. Empirical examination of debt and growth nexus in South Asian countries. Asia-Pacific Development Journal 20(2): 29-52.
3. Arellano, M. and S. Bond, 1991. Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. The Review of Economic Studies 58: 277–297.
4. Barro, R. 1989. A cross-country study of growth, saving, and government. National Bureau of Economic Research Working Paper no. 2855. Cambridge, MA.
5. Barro, R. J. 1990. Government spending in a simple model of endogeneous growth. Journal of Political Economy 98(S5): 103-125.
6. Burnside, C., and D, Dollar. 2000. Aid, Policies, and Growth. American Economic Review. 90 (4): 847-868.
7. Cohen, D. 1993. Low Investment and Large LDC Debt in the 1980s. American Economic Review 83(3):437–49.
8. Das, P. 2017. Debt dynamics, fiscal deficit, and stability in government borrowing in India: a dynamic panel analysis, in: Naoyuki Yoshino & Peter J. Morgan (ed.), Central and Local Government Relations in Asia, chapter 11, pages 371-394, Edward Elgar Publishing.
9. Elmendorf, D.W., and G.N. Mankiw. 1999. Government debt. In Handbook of macroeconomics, in: volume 1 of handbook of macroeconomics , ed. J.B. Taylor, and M. Woodford, pages 1615–69. Elsevier.
10. Headey, D.D., and A. Hodge. 2009. The effect of population growth on economic growth: A meta-regression analysis of the macroeconomic literature. Population and Development Review 35 (2): 221–48.
11. Holtz-Eakin, D., W. Newey, and H. Rosen. 1988. Estimating vector autoregressions with panel data. Econometrica 56(6): 1371–95.
12. Husain, S. and M. Asif, 2019. Impact of Public Debt on Economic Growth in Case of India: A Co-Integration Based Study. International Journal of Management Studies VI(1(2)): 102.
13. Kannan, R., and B. Singh, 2007. Debt-deficit dynamics in India and macroeconomic effects: A structural approach. MPRA Paper No. 16480. Online at https://mpra.ub.uni-muenchen.de/16480/
14. Kaur, B., and A. Mukherjee, N. Kumar and A. P. Ekka, 2014. Debt Sustainability at the State Level in India. RBI Working Paper Series No. 07. Reserve Bank of India.
15. Krugman, Paul R. 1988. Financing vs. Forgiving a Debt Overhang, NBER working paper 2486.
16. Lucas, Robert E. 1988. On the mechanics of economic development, Journal of Monetary Economics 22(1):3-42.
17. Mallik, G., and A. Chowdhury., 2001. Inflation and Economic Growth: Evidence from South Asian Countries. Asian Pacific Development Journal 8(1): 123-135.

18. Manik, N., 2016. Causal Nexus between Public Debt and Economic Growth : The Case of India. International Affairs and Global Strategy 46:36–46.
19. Mitchell, B. R., 1988, British Historical Statistics, Chapter XVI (CUP 1988).
20. Mohanty, A. R. and Mishra, B. R., 2016. Impact of Public Debt on Economic Growth: Evidence from Indian States Vilakshan: The XIMB Journal of Management 13(2):1–21.
21. Mohanty, Asit et al. (2016) 'An Empirical Analysis of Effect of Public Debt on Economic Growth in India in the Post-Reform Era', Asian Economic and Financial Review, 6(11): 692–705.
22. Mohanty, R. K. and Panda, S., 2020. How Does Public Debt Affect the Indian Macroeconomy? A Structural VAR Approach Margin: The Journal of Applied Economic Research 14(3):253–284.
23. Munir, Q., and Mansur, K., 2009. Non-Linearity between Inflation Rate and GDP Growth in Malaysia Economics Bulletin 29(3):1555-1569.
24. Rangarajan, C and D. K. Srivastava. 2003. Dynamics of Debt Accumulation in India: Impact of Primary Deficit, Growth and Interest Rate. Economic and Political Weekly 38(46): 4851-4858.
25. Rangarajan, C., & Srivastava, D. K. 2005. Fiscal Deficits and Government Debt: Implications for Growth and Stabilization. Economic and Political Weekly 40: 2919-2934.
26. Reinhart, C. M., and K. S. Rogoff, 2010. Growth in a Time of Debt. American Economic Review 100 (2): 573-78.
27. Reinhart, C. M., and K. S. Rogoff. 2011. From Financial Crash to Debt Crisis. American Economic Review, 101 (5): 1676-1706.
28. Reinhart, C.M., V. Reinhart, and K. S. Rogoff, 2015. Dealing with debt. Journal of International Economics 96(1): S43-S55.
29. Romer, P., 1990. Endogenous Technological Change. Journal of Political Economy 98(5):S71-102.
30. Sachs, J.D., 1989. Conditionality, Debt Relief, and the Developing Country Debt Crisis in Jeffrey D. Sachs. ed. Developing Country Debt and the World Economy. University of Chicago Press. ISBN: 0-226-73338-6: 275-284.
31. Sasmal J, and R. Sasmal., 2020. Public Debt, Economic Growth and Fiscal Balance: Alternative Measures of Sustainability in the Indian Context. Global Business Review 21(3):780-799.
32. Singh, C., 1999. Domestic Debt and Economic Growth in India. Economic and Political Weekly 34(23):1445–53.
33. Solow, Robert M., 1956.A Contribution to the Theory of Economic Growth. The Quarterly Journal of Economics 70(1): 65–94.