Indian Public Policy Review 2023, 4(3): 43-66
https://doi.org/10.55763/ippr.2023.04.03.002

IPPR

Sustainability and Threshold Value of Public Debt of Centre and All State Governments in India

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Abstract

This study examines the sustainability and the threshold level of public debt of the Centre and all State Governments in India, using the latest data from 1990-91 to 2020-21, and using statistical methods and threshold regression method. The results suggest that the current levels of public debt of both the Centre and all States are unsustainable, and the debt sustainability threshold is about 40% for the Centre and 22% for all States. There is a greater need for the Centre and all States to control their debt levels as they are currently growth reducing. The simulation exercises based on the debt dynamics suggest that the Indian economy (nominal GDP) should grow at 12%, and the fiscal deficit target should be 2% each for the Centre and all States from 2023-24 onwards, for the Centre to attain the debt sustainability target before 2027-28 and all States to do so in 2030-31. The relevant policy strategy for all governments is revenue augmentation and containing public expenditures, including unproductive subsidies.

Keywords: Sustainable Debt, Bohn Model, Penalized Spline, threshold model

JEL Codes: E52; E63; E65

Publication Date: 31 May 2023

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[#] Acknowledgement: The earlier version of the paper was presented at the two-day National Conference on Issues in Public Finances, at Madras School of Economics, January 20-21, 2023. We thank the participants of the conference for their useful comments.

1. Introduction

Public debt sustainability is an important public policy issue for any national or sub-national government. The Government borrows when its revenues fall short of its expenditure commitments. The fiscal deficit in the budget reflects the net borrowing or debt of the Government. The public debt is the total debt (or liabilities) or accumulation of debt over the years. Many economists believe that debt is one way to raise money for development. Borrowing can enable the government to finance important development programs/projects (Hakura, 2020).

If a government productively employs its borrowings to finance social and infrastructure development projects, which can trigger economic growth and bring higher income in the future, it will be able to service its debt with such increased income. In such a case, the public debt is not at all an issue for the government. This is, in fact, true in many developed countries, with high debt-GDP ratios. For instance, as per the World Development Indicators of World Bank, the five year (2017-2021) average debt-GDP was 244.43% in Japan, 126.04% in Singapore, 117.87% in the USA, and 104.16% in France. These countries also have high tax-GDP ratios.

In other countries, the situation is entirely different. They find it difficult to service their debt obligations. If the government is able to meet all its current and future debt obligations without external financial assistance or going into default, the debt is considered as sustainable (IMF, 2011). Alternatively, if the debt growth over the period is less than the interest-growth differential, then the debt is not considered detrimental. Another definition is that the debt is sustainable if the current level of debt is not exceeding the present value of all future primary surpluses [1](Blanchard et al., 1991).

If the debt-GDP ratio exceeds certain prudent limits, it becomes unsustainable, and this will lead to an excessive burden of debt servicing for the future. Excessive debt (i.e., debt overhang) will lead to debt trap, which is bad for growth, development, and stability; it can negatively affect the capital stock accumulation and economic growth through higher long-term interest rates, higher distortionary tax rates, inflation, and a general constraint on countercyclical fiscal policies (Rugy and Salmon, 2020). In the worst case, it can lead to government default, which can cause the borrowing government to lose market access and suffer from higher cost of future borrowing.

Debt unsustainability is not a new phenomenon. Recent decades have also witnessed the debt crises of many economies: the East Asian Economic Crisis (1997-2001), the Russian Economic Crisis (1992-97), the Latin American Debt Crisis in Mexico, Brazil and Argentina (1994-2002), the Euro-Sovereign Debt crisis (2008 onwards), and the Global Financial crisis of 2008 (Srinivas, 2018) – with Sri Lanka and Pakistan being the latest examples.

The spread of the COVID-19 virus has caused recession in the world economy, and also pushed up the overall amount of debt worldwide to unprecedented levels (Kose et al., 2021). India is no exception to this trend. The recurring episodes of the pandemic and corresponding increased public spending, coupled with an output contraction in the post-pandemic period, has resulted in a surge in its public debt-GDP ratio.

According to the Economic Survey of India (2021-22), the Centre's debt relative to GDP would reach 60.2%, and all States' debt ratio would reach about 30% at the end of 2022-23. The New Fiscal Responsibility and Budget Management (FRBM) Review Committee suggested a 40% debt-GDP limit for the Central Government and 20% for all States together. Studies such as Srivastava et al., (2021) and Tiwari (2012) show that the combined debt of Central and State Governments in India today is unsustainable.

Against this backdrop, this study attempts to empirically analyse the debt sustainability conditions of the Centre and all States together in India from 1990-91 to 2020-21. The rest of this study proceeds as follows: Section 2 briefly reviews both theoretical and empirical studies on public debt sustainability; Section 3 discusses the trends in total outstanding liabilities of Centre and States over the years; Section 4 presents and discusses the empirical results of debt sustainability and debt threshold value; Section 5 provides a few simulation results using the debt dynamics of the Centre and all States, to find out when they will achieve the debt sustainability target; finally, Section 6 suggests policy strategies to control debt and achieve the sustainable level of debt in both, the Centre and all States.

2. A Brief Review of Literature

2.1 Theoretical Literature

Conceptually, debt sustainability is a situation where the debt does not accumulate at a rate considerably exceeding the government's capacity to service it (IMF, 2011). On the theoretical front, there are three schools of thoughts on debt/deficit financing in the literature: (i) Classical or Ricardian Equivalence theorem, (ii) Keynesian theorem, and (iii) Neo-classical theorem.

The Ricardian Equivalence theorem argues that the fiscal deficit does not matter except for smoothing the adjustment to expenditure or revenue shocks. Given that households are forward-looking, they will realize that they need to pay higher taxes in the future so that their total tax burden remains unchanged. As a result, they will reduce their consumption and increase savings to meet their future tax burden. This view rests on the inter-temporal budget constraint of the government and on the permanent income hypothesis.[2]

The Keynesian theorem envisages that deficit financing can boost aggregate demand and thereby stimulate economic growth. That is, an increase in government spending financed by borrowing would cause the output to expand through a multiplier process; financing of this kind predominantly implies a re-allocation of resources from taxpayers to bond-holders. Hence, this is beneficial for the economy.

The neo-classical view considers that deficit financing will adversely affect the economy as the component of revenue deficit in the fiscal deficit implies Government dis-saving, which – if not offset by the corresponding increase in private savings – will pull down the overall savings, exerting pressure on the interest rates, which will eventually distort the rate of growth.

Thus, there is no consensus among economists on whether deficit financing is good, bad, or neutral (Rangarajan and Srivastava, 2005). It needs to be resolved empirically, i.e., it is necessary to examine whether public debt is beneficial or not – and if beneficial, then up to what level? However, on the empirical front also, there is no universal agreement on how public debt sustainability can be assessed (Akhmadev et al., 2018).

2.2 Literature on Empirical Approaches

(i) Traditional Domar Approach: Traditional studies employed the Domar (1944) stability condition: "As long as the real economic growth (g) is greater than the real interest rate (r), the Government can have a positive primary deficit, such that its debt will not rise, and so the debt is sustainable". This debt dynamic equation is given as:

$$d_t = p_t + d_{t-1}\left[\frac{(1+r)}{(1+g)}\right] = f_t + d_{t-1}\left[\frac{1}{(1+g)}\right] \quad (1)$$ where:

- d_t is the debt-GDP ratio at year t,
- p_t is the primary balance relative to GDP, and
- f_t is the fiscal deficit-GDP ratio.

When the primary deficit is zero and r=g, the debt-GDP ratio remains constant; if r>g, the debt-GDP ratio will rise and is unsustainable.

This approach was extended later by considering the inter-temporal budget constraint (IBC) of the Government (i.e., outstanding debt today must be equal to the current value of future primary surpluses) and also additional indicators (growth, liquidity, creditworthiness, fiscal burden, fiscal space, etc.) and renamed as "Indicator approach" (Blanchard et al., 1991; Pattnaik et al., 2003).[3] However, this approach was criticized as it applied the condition on a year-to-year basis, and didn't validate whether IBC of the Government was satisfied or not.

(ii) Modern Time Series Approach: This approach on debt sustainability utilizes statistical/econometric tests. The pioneer of this approach was the seminal work of Hamilton and Flavin (1986). It introduced the unit root test (using the popular Augmented Dickey-Fuller Test) to check whether the public debt series (in the US) was stationary or not (i.e., whether the series of public debt contains a bubble term), which was later widely adopted to examine the mean reversal process of debt series (Feve and Henin, 2000; Makrydakis et al., 1999; Uctum and Wickens, 2000). Uctum, Thurston, and Uctum (2006) used the unit root test to check debt sustainability in G7 countries and selected Latin American and Asian countries, and found that the debt was sustainable only in G7 countries.

Trehan and Walsh (1991) employed another test to analyse whether a quasi-difference of public debt [$(D_t - \nu D_{t-1})$ with $0 \leq \nu < 1 + r$, where r is the interest rate] is stationary, and whether

public debt and primary surpluses (S_t) are cointegrated. If the public debt is quasi-difference stationary and public debt and primary surpluses are co-integrated (or alternatively, if total expenditure and revenue receipts are co-integrated), then the public debt is sustainable (Greiner and Fincke, 2009).[4] The co-integration approach gained popularity as a test for debt sustainability, and was greatly accepted in literature (Quintos, 1995; Martin, 2000; Goyal et al., 2004; Lusinyan and Thornton, 2009; Gabriel and Sangduan, 2011).

Despite their wider applicability, the time series approaches were criticised because:

i. the unit root test is very sensitive to structural breaks, and the results could be misleading when structural breaks are present (Uctum et al., 2006);

ii. rejecting a unit root in real debt or in the debt-to-GDP ratio is a very difficult task, and

iii. the IBC may well be satisfied even if the components of the budget are not co-integrated, and even if debts or deficits, revenues, or spending are differencing stationary (Bohn, 2007).

(iii) Bohn's Model-Based Approach: In order to overcome some of the drawbacks of time series approaches, Bohn (1995) constructed a general equilibrium model with a stochastic version of IBC. Following this stochastic framework, he formulated a model-based approach in 1998 to test whether the primary surplus-GDP ratio (s_t) is positive and, at least, a linearly rising function of the debt-GDP ratio (d_t) as:

$$s_t = \alpha + \psi\, d_t + \varepsilon_t \qquad (2)$$

Where:

- s_t is the primary surplus-GDP ratio in year t
- d_t is the debt-GDP ratio in year t
- ε is the random error, and
- α and ψ are parameters to be estimated.

A positive and statistically significant value of ψ indicates that debt is sustainable, i.e., the initial stock of debt is equal to the sum of the present discounted values of the primary surpluses.

Later, Bohn (1998) utilized the Barro (1979) tax-smoothening hypothesis, according to which public deficits should be used in order to keep tax rates constant, which in turn minimizes the excess burden of taxation. Hence, normal expenditure can be financed by regular revenues, and deficits will be incurred only as a result of financing unexpected spending. Based on this, he derived the following fiscal rule or reaction function:

$$s_t = \alpha + \psi\, d_t + \phi_1 yvar_t + \phi_2 gvar_t + \varepsilon_t \qquad (3)$$

Where, in addition to the terms in (2) above:

- $yvar$ accounts for fluctuations in revenues, and reflects the deviation of real GDP from its trend, computed using the Hodrick-Prescott (HP) filter -- positive values indicate booms, and negative values indicate recessions. [5]
- $gvar$ reflects the deviation of real primary spending from its normal value -- positive values indicate expenditures above the normal level, and negative values indicate expenditures below the normal level (Greiner and Fincke, 2009). [6]

This model received great attention in the literature because of its intuitiveness (*i.e.,* if Governments run into debt today, they would have to take corrective actions in the future by increasing the primary surplus) and robust statistical properties (the positive response of primary surplus to public debt implies a mean reverting process).[7] It was later extended by researchers by adding other determinants of primary balance, incorporating unobserved heterogeneity factors using panel data structures, and specifying non-linearity and time-varying coefficients in the model.

In the non-linear context, the Bohn model (for usual time series data) can be re-written as:

$$s_t = \alpha + \psi_t \, d_{t-1} + \phi_1 yvar_t + \phi_2 gvar_t + \varepsilon_t \qquad (4)$$

In (4), the reaction coefficient ψ_t is time-varying. Mathematically, any non-linear model can be approximated by a linear model with time-varying coefficients.

This approximation holds good under certain smoothness assumptions. Empirical estimations using these linear approximations employ the popular penalized spline (p-spline) method.[8] The functional forms or smoothness can be shaped by deviation on individual points (i.e., changing points which are termed as knots). To avoid the endogeneity issues, Greiner and Fincke (2009) replaced d_t with d_{t-1}.

(iv) Debt Sustainability Threshold Model: Ghosh et al. (2013) introduced the concept of 'fiscal fatigue'. It happens when public debt achieves some threshold, and departs from this threshold value when the primary balance does not adjust to debt. Therefore, it is essential to test for the responsiveness of primary balance to lagged levels of debt (relative to GDP) in different regimes, using the threshold regression method. The threshold model allows coefficients of region-varying variable(s) to differ across regions. Those regions are identified by a threshold variable being above or below a certain value. It uses the conditional least squares method to estimate the parameters of the model. The threshold value is estimated by minimizing the SSR obtained for all alternate thresholds.[9]

Later, some authors argued that higher debt amounts may lead to higher growth or welfare, if the debt amounts are invested in development projects (Ghosh, 1998; Greiner and Fincke, 2015). They suggest testing whether the public debt is growth-inducing or not, using either a threshold regression method or an estimation quadratic model, where the dependent variable is real growth and independent variables are debt-GDP ratio and its squared term, or spline method (Greiner and Fincke, 2009).

2.3 Empirical Studies

Some empirical studies have used the above approaches to verify whether the public debt is sustainable or not in various countries. For instances, Kaur et al., (2014) used the indicator approach to verify the debt sustainability of Indian states; Hakkio and Rush (1991) and Jha and Sharma (2004) analysed the sustainability by verifying the cointegrating relationship between public revenue and expenditure.

Abiad and Ostry (2005) employed the extended version of the Bohn model to test the debt sustainability of 31 emerging market countries from 1990 to 2002. Greiner and Kauermann (2008) used the p-spline method and found that debt is sustainable in Germany and not in Italy. Griener and Fincke (2009) used the Bohn framework and p-spline technique to analyse the debt sustainability issue of the USA and 6 Euro countries (Austria, France, Germany, Italy, The Netherlands, Portugal) and 6 developing countries (Botswana, Costa Rica, Mauritius, Panama, Rwanda, and Tunisia). The debt was sustainable in the USA and 5 Euro countries, the exception being France. In the developing countries, debt was sustainable in only Botswana and Rwanda.

Tiwari (2012) used the Bohn framework and spline methodology and found that debt is unsustainable in India from 1970 to 2009. Shanmugam and Renjith (2021) used panel version of Bohn framework and p-spline technique to test the debt sustainability of 20 Indian states. Lixin (2019) employed the threshold estimation and found that from 1985 to 2015, China's public and external debt were both sustainable.

Srivastava et al., (2021) estimate the sustainability threshold for the general government debt-GDP ratio for India using a threshold regression, in which the primary balance-GDP ratio (s_t) is the dependent variable, and is related to the lagged debt-GDP ratio (region-varying variable) and other determinants of s_t (region-invariant variables). It shows a 59.3% threshold level for India. Since the debt-GDP exceeded this level, the debt was unsustainable.

Shanmugam and Shanmugam (2022) show that the sustainable debt threshold limit for Tamil Nadu state is 18.36%. Afonso (2005), Neck and Sturm (2008), Fincke and Greiner (2011) and D'Erosmo et al., (2016) further provide a review of empirical studies.

Studies examining the debt-growth relationship at the international, national, and sub-national levels provide four alternative conclusions on the effect of debt on economic growth:

i. growth is independent of debt (e.g., Paniza and Presbitero, 2014),
ii. growth is a positive function of debt (e.g., Fincke and Greiner, 2015),
iii. growth is a negative function of debt (e.g., Hussain et al., 2015), and
iv. the relationship between public debt and economic growth is positive when the debt level is low; if the debt exceeds the sustainability threshold, the relationship is negative (Kumar and Woo, 2010; Megarsa, 2015).That is, the relationship is non-linear (Reinhart and Rogoff, 2010). The advantage of this last approach is that it is useful for computing the threshold level of public debt. [10]

In the Indian context, the debt-growth relation was studied by many researchers mainly under two schools: the orthodox school (Rakshit, 2000; Patnaik, 2001) and the Keynesian school (Buiter and Patel, 1992; Lahiri and Kannan, 2002). Studies such as Bal and Rath (2014) and Manik and Khan (2018) assessed the debt-growth relation in the Indian context for different time periods, with no uniformity in their results.

3. Trends in Public Debt of Centre and All States Together in India

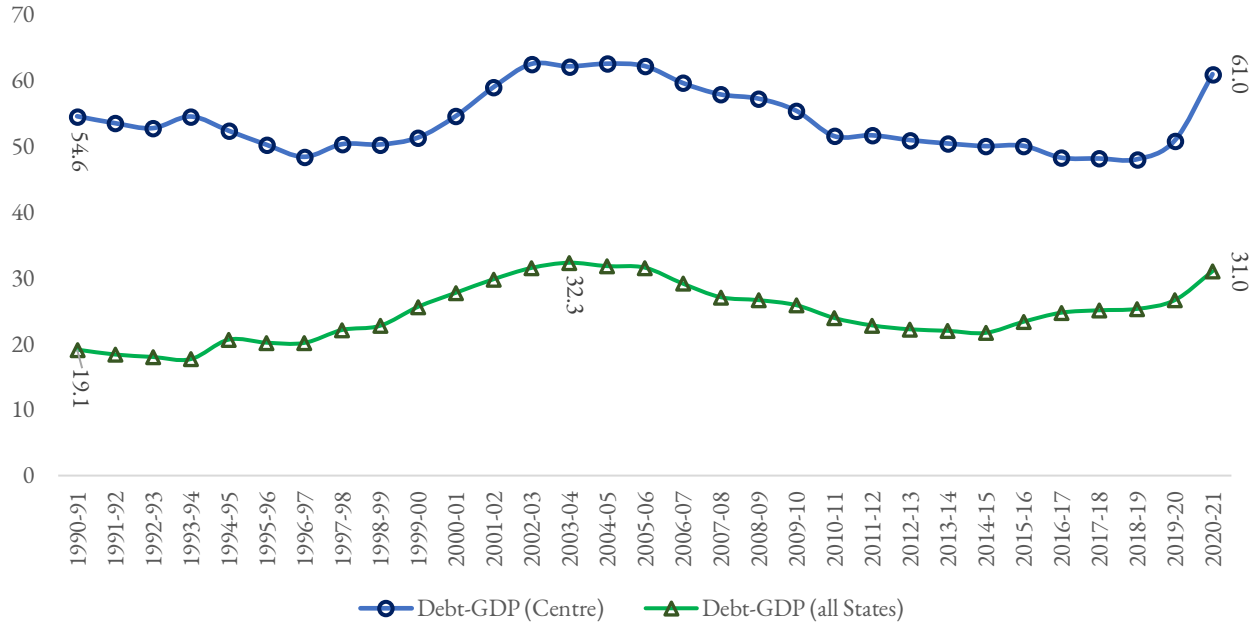
India is a federal country with a central government and many state governments. The Indian Constitution assigns different borrowing powers to central and state governments. The central government debt comprises domestic debt and external debt. [11] The public account liabilities are also considered as central debt, which includes the national small savings funds (NSSF), provident funds, reserve funds of railways, post, and telecommunication, etc.

State governments are allowed to borrow only from the domestic market, and to raise loans and advances from the central government. They have no power to raise loans outside India except loans for externally-aided projects intermediated by the central government. [12] The public account debt of the state includes small savings, provident funds, reserve funds, deposits bearing interest, deposits not bearing interest, etc.

The outstanding liabilities (or debt) of the central government was Rs. 3,14,558 crore in 1990-91, and increased to Rs. 6,75,676 crore in 1996-97. It further increased to Rs. 19,94,421 crore in 2004-05, Rs. 62,42,519 crore in 2014-15, and further to Rs. 120,79,018 crore in 2020-21.[13] In 1990-91, all States' debt was Rs. 1,10,289 crore; it increased to Rs. 2,81,207 crore in 1996-97, Rs. 10,14,065 crore in 2004-05, and further to Rs. 27,03,759 crore in 2014-15. In 2020-21, it reached Rs. 61,49,126 crore.

The debt-GDP ratio (using 2011-12 series GDP) of the Centre declined from 54.60% in 1990-91 to 48.44% in 1996-97, but the debt-GDP of all States increased marginally from 19.14% to 20.16% (Figure 1). Government finances have deteriorated since the mid-1990s in India due to reform-induced loses in revenues from customs and excise duties, poor tax performance and low tax buoyancy, and increased government spending, particularly due to implementation of the recommendations of the Fifth Pay Commission. As a result, the debt-GDP ratio of the Centre started increasing continuously, reaching a peak of 62.59% in 2005-06, and that of States to 32.34% in 2003-04.

Figure 1: Outstanding Liabilities to GDP of Centre and All States (1990-91 to 2020-21)



Thereafter, both started to decline continuously due to various fiscal measures, notably including the implementation of the FRBM Act in 2003 by the Government of India and subsequently by all State Governments (starting from Karnataka in 2002 to Sikkim in 2010). The Centre's debt-GDP ratio declined to 50.07%, and States' to 21.69% in 2014-15. The Centre's debt-GDP ratio continued to decline to 48.06% in 2018-19, while the States' continued to increase to 25.33%. The COVID-19 pandemic created further trouble, with these ratios rising further to 61.00% and 31.05% respectively in 2020-21 (Figure 1).

The interest burden of the Centre relative to GDP increased from 3.77% in 1990-91 to 4.44% in 2003-04. At the same time, the States' interest-GDP ratio increased from 1.51% to 2.90%. After that they declined to 3.08% and 1.69% respectively in 2018-19; however, they increased to 3.43% and 1.99% in 2020-21(Figure 2). The path of interest-to-GDP ratio changes clearly indicates that it increased (decreased) whenever the debt-GDP ratio increased (decreased), in the case of both the centre and all states.

The trends in revenue receipts and total expenditures (primary expenditure+ interest payment) relative to GDP of centre and states together, as shown in Figure 3, explain the movement of debt-GDP ratio of the centre and states over the years.

- The gap between the total expenditures-GDP ratio and the revenue receipts-GDP ratio of Centre was larger from 1996-97 to 2003-04. This was the period when the debt-GDP ratio started increasing continuously.
- After that, the gap declined till 2007-08, before starting to increase again. During this period, the debt-GDP ratio of the Centre decreased continuously.
- The gap between revenues and total expenditure increased in 2019-20 and again significantly in 2020-21 due to the pandemic.

- For all states, a more or less similar trend exists.

Figure 2: Interest-GDP Ratio of Centre and All States (1990-91 to 2020-21)

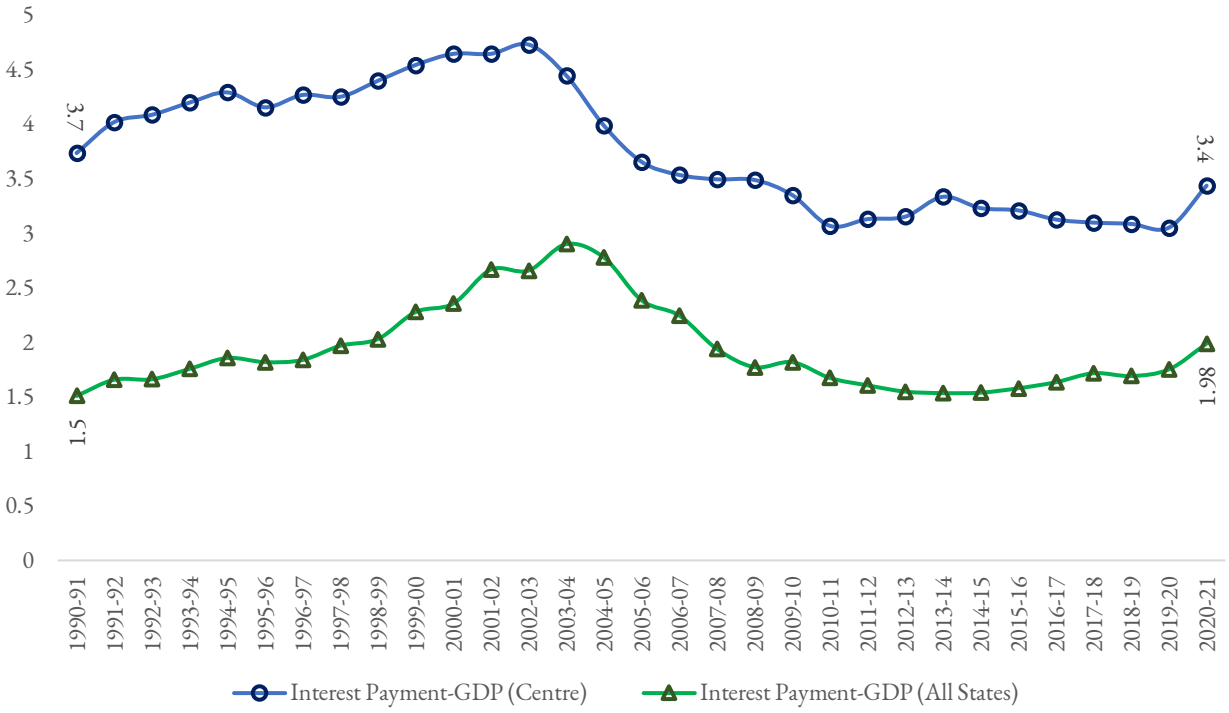
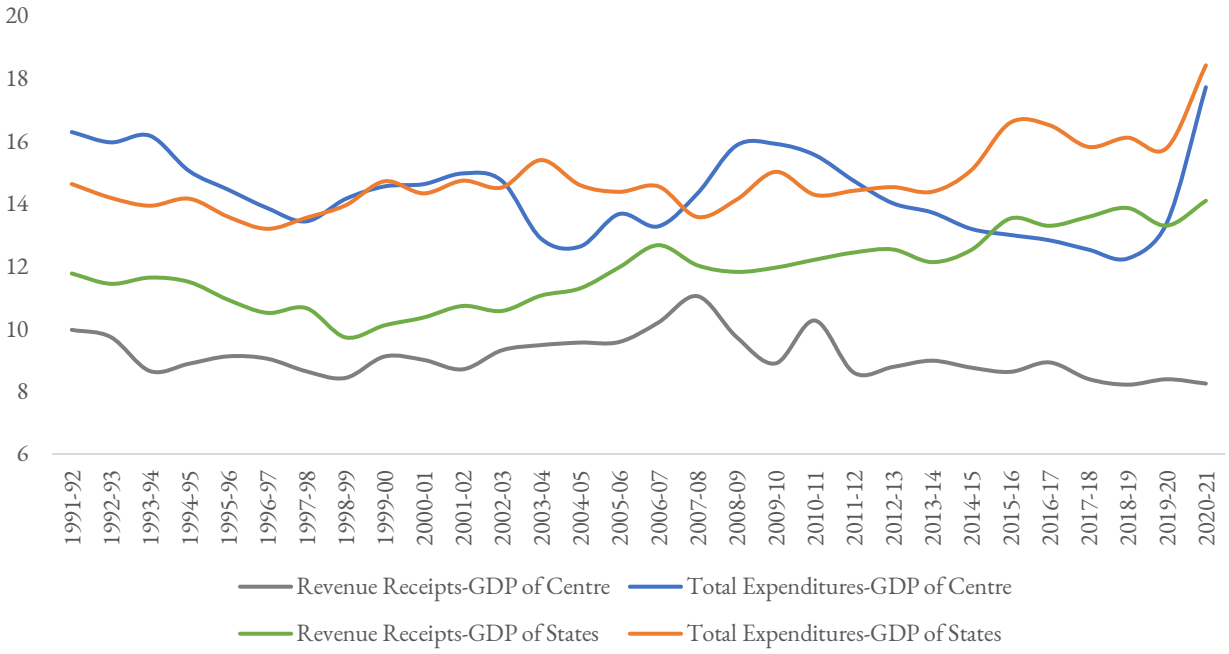


Figure 3: Revenue Receipts and Total Expenditures Relative to GDP: Centre and All States (1991-92 to 2020-21)



4. Empirical Analyses of Debt Sustainability and Debt Threshold

(i) ***Unit Root Test*****:** The simplest modern statistical test on debt sustainability is to check whether the debt-GDP series is stationary or not. Table 1 reports the Augmented Dicky-Fuller (ADF) test results. The debt-GDP ratios of both the centre and all states have unit root, i.e., both are not stationary, indicating that the public debt of the centre and all states in India is unsustainable.

Table 1: Stationary (ADF) Test Results for Debt-GDP Ratio (1991-92 to 2020-21)

Augmented Dickey-Fuller Test Statistics	Centre		All States	
	t-statistics	Prob*	t-statistics	Prob*
	-2.1598	0.2244	-2.8950	0.0607
Test Critical Values	1% level	-3.689		-3.738
	5% level	-2.972		-2.992
	10% level	-2.625		-2.636

*Mackinnon (1996) one-sided p-values

(ii) ***Co-integration Test*****:** It examines whether the government revenues and total expenditures relative to GDP are co-integrated or not. It basically examines whether they move together such that the resultant of their relationship produces a stationary series (Hamilton and Flavin, 1986). Table 2 indicates that these two series for the centre are not co-integrated at 5% level of significance. Two series for all States are also not co-integrated. These results imply that the debt is not sustainable in the case of both the centre and all states.

Table 2: Results of Johansen's Cointegration (Rank) Test*

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistics	0.05 Critical Value	Prob.**
		(i) Centre		
None	0.2924	12.1851	15.4947	0.1483
Atmost 1	0.0854	2.4995	3.8415	0.1139
		(ii) States together		
t-statistics	0.3258	11.3796	15.4947	0.1892
t-statistics	0.0121	0.3409	3.8415	0.5593

Trace test indicates no cointegration at the 0.05 level for the centre and all states; * Max test also provides similar results (not reported).

** Mackinnon (1996) p-values.

(iii) ***Bohn Model-Based Non-linear Test*****:** As discussed in Section 2 (equation 4) above, this test is basically to test whether the primary surplus-GDP ratio (s_t) is positive and, at least, a linearly rising

function of the debt-GDP ratio (d_{t-1}). Table 2 presents the penalized spline estimation results of both the central and state governments. As expected, the parameter of business cycle variable *yvar* is positive and significant, and that of *gvar* is negative and significant at 1% level of significance, indicating that the GDP above its normal value has increased the primary surplus, while the primary spending above its normal value has reduced the primary surplus of Indian states. In the case of the centre, *yvar* is positive and *gvar* is negative as expected, but only the parameter of *gvar* is statistically significant at 5% level.

As expected, the parameter associated with the lagged debt-GDP ratio is positive in both cases, but it is not statistically significant at 5% level, implying that the public debt is unsustainable in both the centre and states. Thus, all the three modern statistical tests confirm that the public debt of both central and state governments in India is not sustainable. This result deserves policy intervention.

Table 3: p-spline Estimation Results of Debt Sustainability Equation for Central and States Governments in India

(Dependent variable: Primary Deficit to GDP%, s_t)

Variables	Notation	Central Govt Co-efficient (t-value)	All States Govt Co-efficient (t-value)
(1)	(2)	(4)	(5)
Intercept	$\hat{\alpha}$	-3.6150 (-2.445)	-1.483 (-0.805)
Lagged Debt-GDP	${d^c}_{t-1}$	0.0238 (1.735)	-
ratio (%)	${d^s}_{t-1}$		0.0238 (0.690)
Real GDP gap	$yvar_t$	0.00001 (1.514)	0.00001 (3.596)
Real Primary	${gvar^c}_t$	-0.00001 (-5.372)	-
Expenditure Gap	${gvar^s}_t$		-0.00001 (-3.903)
edf (ref. edf)		1.500	6.539
F [p-value]		9.680 [0.027]	6.237[0.000]
R-sq.(adj)		0.758	0.773
GCV		0.490	0.173
DW Statistics		1.870	1.837
N		30	30

(iv) ***Debt Sustainability Threshold***: Table 4 presents threshold regression results, in which the lagged debt-GDP ratio (d_{t-1}) is the threshold variable. This model considers a single threshold, dividing the sample into two regimes or regions. It considers that the behaviour of the primary deficit relative to GDP may change if the debt-GDP ratio crosses a certain threshold.

The sustainable debt-GDP threshold for Centre is 48.44%, which is higher than the 40% norm given by the new FRBM Review Committee for the Centre. It is noted that the current level of debt of the Centre is about 61% of GDP. This is significantly higher than the threshold level. It is observed from Table 4 that when debt-GDP of the Centre increased by one unit, the primary balance increased by about 3.2 units in region 1 (where the debt level was below the threshold) and by 0.03 unit in

region 2 (where the debt exceeded the threshold). However, parameters associated with this variable in both regions are not significant. *yvar* and *gvar* are regime-invariant variables in this model. As expected, they have positive and negative coefficients respectively, and both effects are significant.

Table 4: Threshold Regression Results for Centre and States (1991-92 to 2020-21)

Dependent Variable: Primary Deficit to GDP % (s_t)

Threshold Variable: Lagged Debt-GDP ratio % (d_{t-1})

Variables	Notation	Centre Govt		States Govt	
		Coefficient	t-stat.	Coefficient	t-stat.
Region 1		**$d_{t-1} < 48.4419$**		**$d_{t-1} < 21.999$**	
Lagged Debt-GDP ratio	d_{t-1}	3.2835	0.912	0.1537	3.464
Constant	$\hat{\alpha}$	-161.225	-0.929	-	-
Region 2		**$48.4419 \leq d_{t-1}$**		**$21.999 \leq d_{t-1}$**	
Lagged Debt-GDP ratio	d_{t-1}	0.0361	1.307	0.1073	3.387
Constant	$\hat{\alpha}$	-2.7936	-1.853	-	-
Region Invariant Variables					
Real GDP gap	yvar	0.000002	3.576	0.000001	3.400
Real Primary Expenditure Gap	gvar	-0.00001	-4.764	-0.00001	-4.589
Constant	$\hat{\alpha}$	-	-	-3.8523	-4.568
Sum Squared Resid.	SSR	9.312		6.449	
Akaike Info Criterion	AIC	2.068		1.634	
R Square	R^2	0.8094		0.5629	
Durbin-Watson Statistics	d stat	1.764		1.666	

In the case of all states, the sustainable debt-GDP threshold is 21.99%, which is slightly higher than the 20% norm given by the new FRBM Review Committee. The current level of debt-GDP of the States is about 31%. This is significantly higher than the threshold level. It may trigger suitable responses by policymakers to reduce the primary deficit-GDP ratio if the debt-GDP ratio crosses the prudent norm of 22% (in our case).

In Table 4, when debt-GDP of the States increased by one unit, the primary balance increased by 0.15 unit in region 1 (where the debt level was below the threshold) and by about 0.11 unit in region 2 (where the debt exceeded the threshold). As expected, *yvar* and *gvar* have similar effects as in Table 3.

(v) Debt-Growth Relationship and Debt Threshold: To examine the impact of debt-GDP ratio on (real) growth of the economy, the growth rate (in percentage terms) is regressed on debt-GDP and its squared term. This non-linear form is useful to find out the debt threshold, wherein a value up to this debt-GDP ratio is growth-inducing, and beyond which it is not.

Table 5 depicts the non-linear relation between growth and debt-GDP ratios for both the centre and all states from 1991-92 to 2020-21. The debt-GDP coefficient is positive, while its squared term's coefficient is negative in both cases.

The threshold level is computed using the formula: threshold = Coefficient of Debt-GDP / 2 x Coefficient of Debt-GDP^2 = 0.3467/ (2 x 0.0044) = 39.4% for the Centre, which is closer to the debt sustainability threshold value of 40% given by the new FRBM committee.

For the States the threshold value is = 0.5573/(2 x 0.0126) = 22.12%, which is nearly equal to the debt sustainability threshold value of 21.99% given in the threshold regression model in Table 4.

Table 5: Non-Linear Relation Between Growth and Debt-GDP: Centre and States

(Dependent variable: Real GDP Growth)

	Central Govt		States Govt	
Variables	Coefficient	t-statistics	Coefficient	t-statistics
Debt-GDP	0.3467	3.063	0.5573	4.007
Debt-GDP Square	-0.0044	-2.136	-0.0126	-2.419
Intercept	0.0000	0.000	0.0000	0.000
R Square				
Debt Threshold	39.4		22.12	

5. Simulation Models: Examining the Period of Attaining the Debt Threshold Target

The above analyses clearly indicate that the current levels of debt of the centre and all states are unsustainable, and that they are significantly higher than the debt sustainability threshold level of 40 (≈39.4)% and 22% respectively. These are growth-reducing levels of public debt. There is a need to cut down the debt ratio by about one-third in both cases. This section examines whether the Centre and all States will attain the sustainable level of debt or not, and if so, when they will they reach these thresholds?

For this purpose, it employs the following debt dynamic equation given in (1) above:

$$d_t = f_t + d_{t-1}\left[\frac{1}{(1+g)}\right]$$

In this equation, the debt-GDP ratio (d_t) at the end of a fiscal year depends on

i. fiscal deficit-GDP ratio (f_t),
ii. previous year debt-GDP ratio (d_{t-1}), and
iii. nominal growth rate (g_t).

Subtracting d_{t-1} on both sides, we get:

$$d_t - d_{t-1} = f_t + d_{t-1}\left[\frac{1}{(1+g)}\right] - d_{t-1} = f_t - d_{t-1}\left[\frac{g}{(1+g)}\right] \quad (5)$$

The left side is the change in debt-debt ratio between two successive years (i.e., between year t and previous year t-1). Using this standard debt dynamic formula, we simulate debt-GDP level in future period, given assumptions on f_t, g_t, and previous year debt (d_{t-1}). With different assumptions on these three components, when will the centre and all states achieve the sustainable level of debt?

The following initial values of debt to GDP, fiscal deficit, and nominal growth of Indian economy from the recent RBI and MOSPI documents are used:

For the centre:

i. debt to GDP ratio for 2020-21: 61%;
ii. fiscal deficit for 2021-22: 6.9%.

For all states:

i. debt-GDP for 2020-21: 31.1%;
ii. fiscal deficit for 2021-22: 3.7%.

For both: nominal growth for 2020-21: -1.3646% and for 2021-22: 19.51%.

In fact, the average real GDP growth was 6.31% during 2016-17 to 2019-20, 6.41% during 2011-12 to 2019-20 and 6.8% during 2004-05 to 2019-20 (Table 6). From 2004-05 to 2010-11, the average rate was 7.29% and from 2009-10 to 2016-17 it was 7.14%. Thus, the recent trend indicates 6 to 7% average (real) growth of the Indian economy.

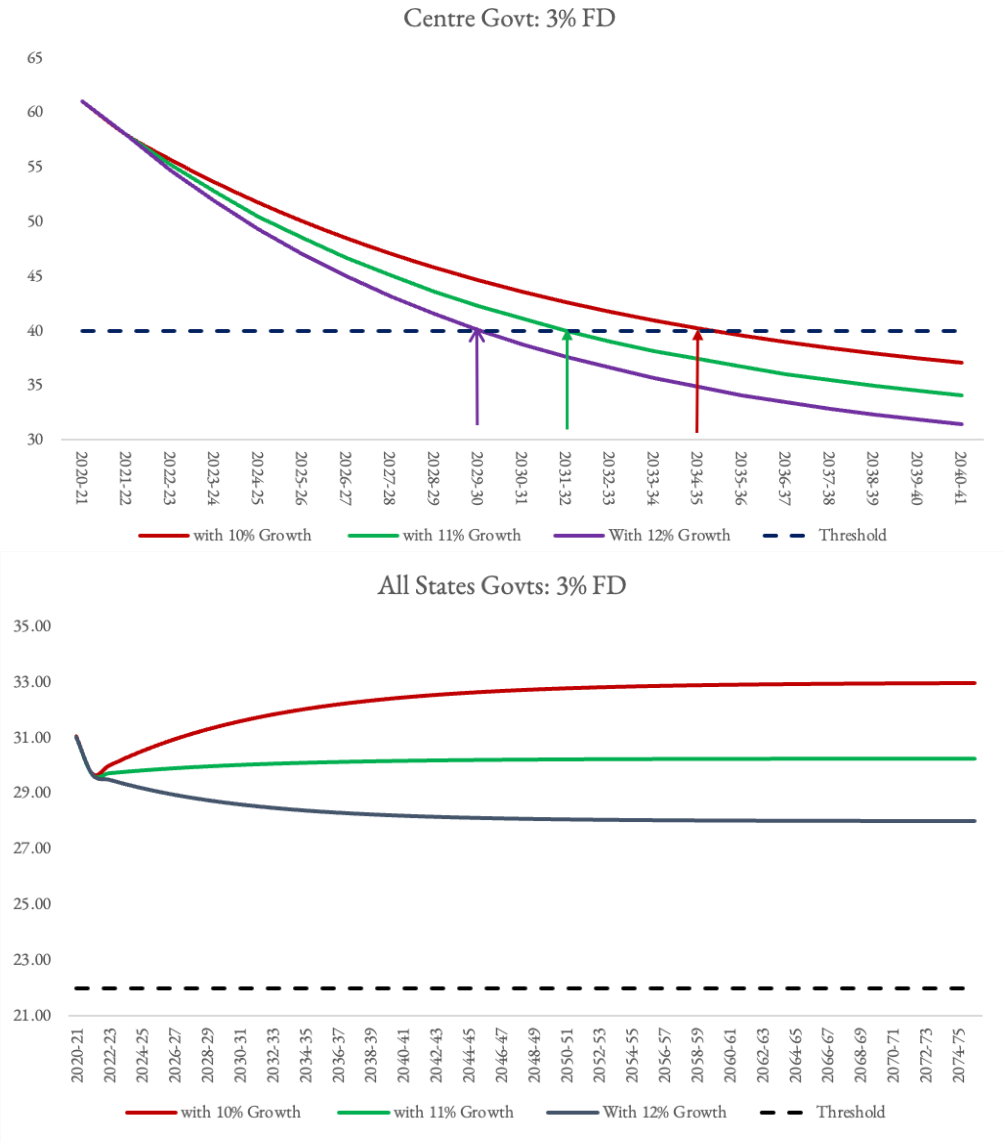
Assuming an inflation of 4%, the nominal growth will be 10-11%. Given the global scenario, it is difficult to push beyond 12%. While both the central and all state governments gave up on compliance in recent years, the FRBM norm of 3% fiscal deficit level for the Centre and 3% for all States can be assumed.

Table 6: Average Annual GDP (Real) Growth in India

Period	2017-18 to 2020-21	2016-17 to 2020-21	2016-17 to 2019-20	2011-12 to 2019-20	2004-05 to 2019-20	2004-05 to 2010-11	2009-10 to 2016-17
GDP Growth	2.60	3.73	6.31	6.41	6.80	7.29	7.14

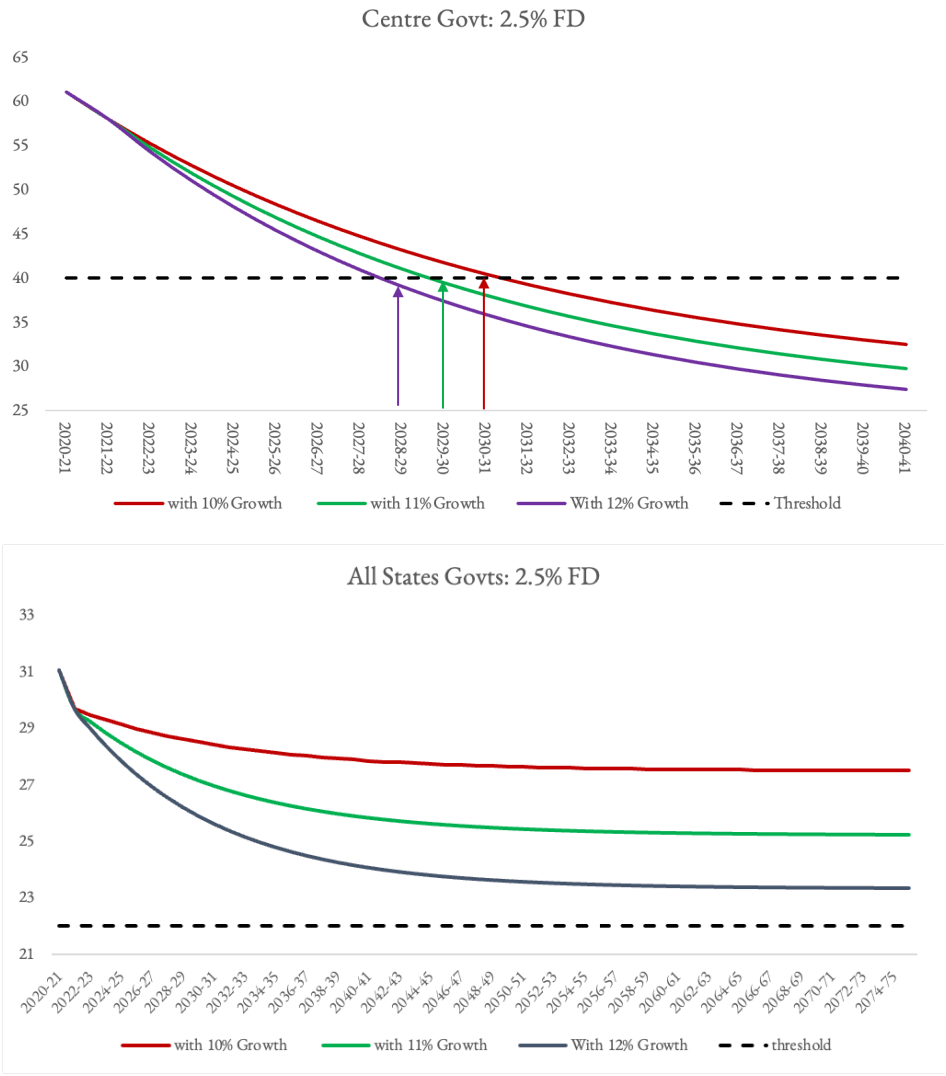
In exercise 1, the nominal annual growth rate is assumed to be 10% from 2022-23 onwards, and the fiscal deficit is assumed at 3% each for centre and also for all states from 2022-23 onwards. The centre's debt-GDP ratio will continuously decline, and reach the sustainability threshold level of 40% in 2034-35 (i.e., after 13 years). [14] All states' debt-GDP ratio, however, will start increasing and will marginally increase every year even after 2074-75, i.e., even after 53 years with 10% growth (Figure 4). In fact, it will stabilize from 2090-91 at 33% (not shown). Figure 4 also shows that the centre's Debt-GDP ratio will reach the threshold level in 2031-31 with 11% growth, and in 2029-30 with 12% growth.

Figure 4: Simulation Results of Debt-GDP Ratio of centre and all states (Exercise 1)



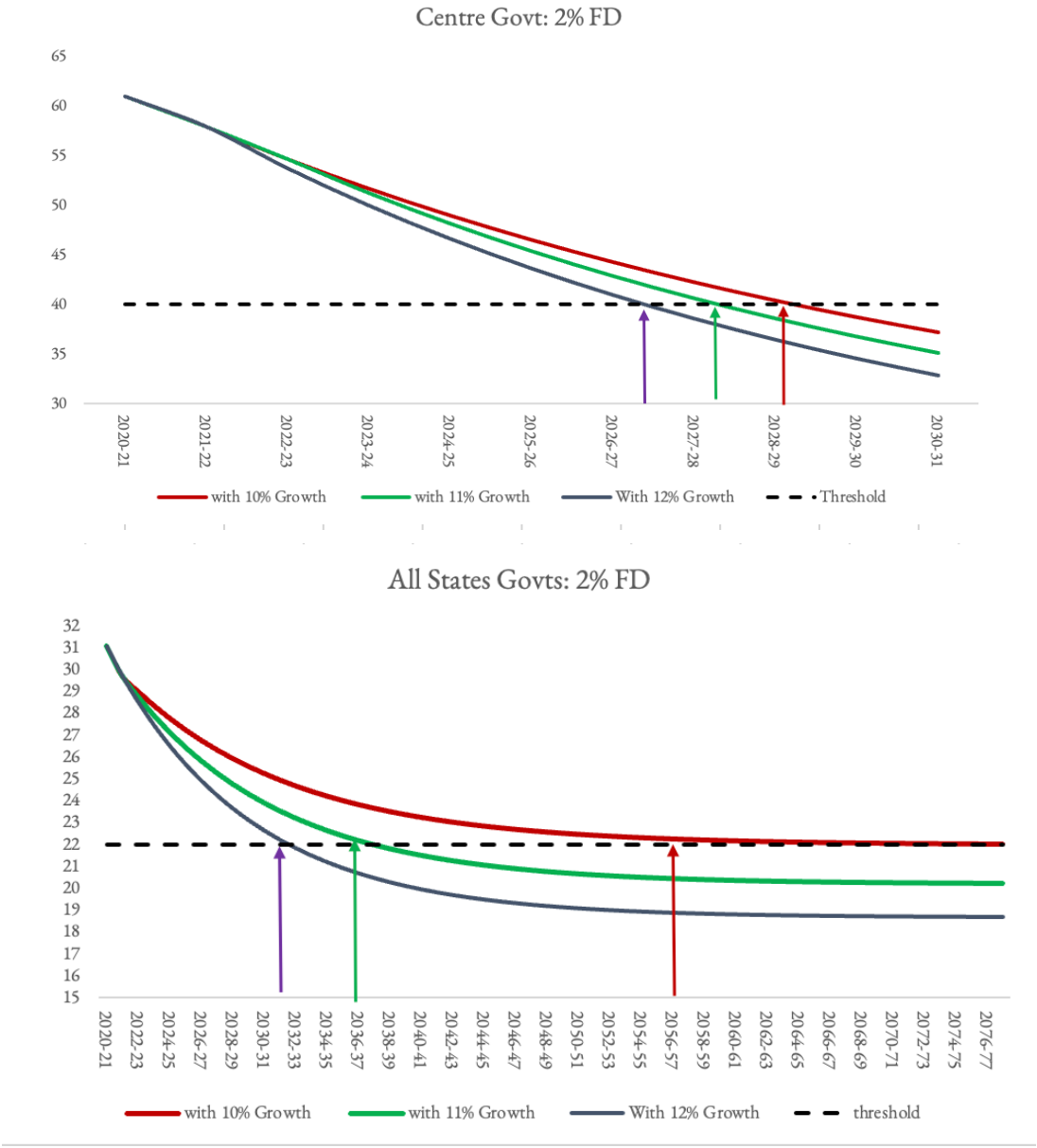
In exercise 2, three alternative growth rates are assumed, but 2.5% fiscal deficit each for centre and all states is assumed. The centre's debt-GDP ratio will reach the target level in 2030-31 with 10% nominal growth, in 2029-30 with 11% nominal growth, and in 2028-29 with 12% growth (Figure 5). All states' debt-GDP ratio starts declining, but till 2074-75 it will not reach the threshold level in these three alternative growth scenarios.

Figure 5: Simulation Results of Debt-GDP Ratio of centre and all states (Exercise 2)



In exercise 3, 2% fiscal deficit is assumed for the centre as well as for all states. The centre's debt-GDP ratio will reach the target level before 2029-30 with 10% growth, before 2028-29 with 11% growth, and before 2027-28 with 12% growth (Figure 6). All states' debt-GDP ratio will achieve the target level of 22% in 2031-32 with 12% growth, 2035-36 with 11% growth, and around 2050-51 with 10% growth.

Figure 6: Simulation Results of Debt-GDP Ratio of centre and all states (Exercise 3)



Therefore, by targeting at least 12% nominal growth and 2% fiscal level, the centre will achieve its sustainable threshold debt level before 2027-28, and all states will do so around 2030-31. In order to use the fiscal deficit for investment purposes, both the centre and all states should target a revenue surplus from 2022-23 onwards.

6. Strategies to Control Debt and Reach the Sustainable Level

The results of the study suggest the following policy viewpoints:

(i) Our analysis clearly indicates that the sustainability threshold level of debt is about 40% for the Centre and 22% for all States. Beyond these levels, debt is growth-reducing. Maintaining a sustainable

level of debt will be growth-inducing, which will help the country to increase its own revenues further, if they are buoyant;

(ii) The reduction of debt-GDP ratio will automatically reduce the interest relative to GDP for both the Centre and all States. This will obviously further improve the fiscal status of the country, as this saving can be spent on growth-inducing investments.

(iii) The country should aim to attain 12% or above nominal growth rate to create buoyancy in tax revenues and additional resources to control the debt level. This requires critical analysis of component (or sector) wise GDP, and clear short term and long-term growth-inducing strategies/interventions on high-weightage components to sustain growth at a higher level. Increasing the share of manufacturing in the total GDP, strengthening the contribution of services sector, increasing export share, and attracting more FDI will help the country to grow faster. It is also noticed that India's economic performance depends on world economy. The global environment for trade is becoming increasingly a matter of concern. Many international agencies including OECD also forecast a secular slowdown in growth in developed countries. Environmental considerations can also act as a dampener on the growth path, even of developing countries.

(iv) Apart from aiming for higher growth, debt sustainability is possible only if the fiscal deficit is brought down to 2% of GDP from 2023-24 onwards for the centre as well as for all states. Therefore, the appropriate policy strategy is revenue augmentation and/or containing (wasteful) expenditures, including unproductive subsidies, by both the centre and states. Fiscal stability is critical for sustained growth. Since the tax-GDP ratio of our country is about half of developed countries' tax-GDP ratio, there is a greater scope to increase revenues by increasing rates of all taxes. Otherwise, major reforms are required to increase the tax base so as to increase the tax-GDP ratio. As many states are providing various subsidies and freebies, they need to restructure their subsidies to avoid wasteful expenses.

(v) Considering the fact that the Public Sector Undertakings are already fiscally stressed, which could have been one of the reasons for higher level of debt, it is absolutely necessary to restructure their finances so that the debt sustainably is achieved.

We hope that this study is useful to policymakers, and other stakeholders to understand the debt dynamic, in both the centre and all states at aggregate level in India, and take appropriate policy strategies to attain and maintain debt sustainability, so that the economy can grow faster and fiscal stability is maintained.

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NOTES

[1] Primary deficit is the excess government spending (GE), excluding the interest payment, over the receipts (R) of government. If GE is less than R, then there is a primary surplus.

[2] The first principle of public finance states that public debt must be sustainable in the sense that outstanding debt today must be equal to the present value of Government's future surpluses. The second principle states that the households do not base their consumption on current income but on permanent income so that they will not raise consumption as long as their income increases temporarily.

[3] The IBC is $d_t^* = \sum_{j=1}^{\infty} \frac{1}{(1+r)^j} E_t \left[s_{t+j}\right]$, where $d_t^* = (1 + r_t).\, d_{t-1}$ is the stock of the debt-output ratio in the beginning of period t, $E_t\,[.]$ denotes the expectation operator conditional on the information available at time t, and s_t is the primary surplus-GDP ratio. The IBC of the Government requires that the present value of public debt asymptotically converges to zero, and the interest rate r is resorted to in order to discount the stream of public debt, and this plays an important role.

[4] If total expenditures and revenues establish long run relationship, then they are co-integrated. Since the deviation between these components leads to deficit and debt, the co-integration between total expenditure and revenues is in general consistent with the co-integration between primary balance and public debt.

[5] The Hodrick-Prescott (HP) filter is a data smoothing technique. It removes short-term fluctuations associated with the business cycle. Removal of these short-term fluctuations reveals the long term trend.

[6] *yvar* and *gvar* are business cycle variables accounting for fluctuations in GDP and primary spending respectively. They are considered as the other determinants of primary surplus.

[7] Because higher debt ratios lead to an increase in the primary surplus relative to GDP, making the debt ratio decline and return to its mean.

[8] This allows to estimate the reaction coefficient ψ_t in equation (4) as a function of time showing how that coefficient evolves over time. Suppose we specify s_t which depends on d_t and other variables in a flexible non-parametric form: $s_t = \alpha + f_1(d_t) + f_2(yvar_t) + f_3(gvar_t) + \varepsilon_t$; where *f(n=1,2,3...)* are considered smooth non-parametric functions which are kept unspecified and estimated from the data. For estimation purposes, this procedure, however, uses the following parametric form: $f(d_t) = d_t\beta_d + Z(d_t)\gamma$; where Z is a high-dimensional basis in d (for instance a cubic spline basis) and γ is a corresponding coefficient. This high dimensionality restricts the use of OLS. So, one can impose an additional penalty term on γ, shrinking its value to 0. One can also obtain an estimate by minimizing the penalized OLS criteria:$\sum\{s_t - d_t\beta_d - Z(d_t)\gamma\}^2 + \theta\gamma^T P\gamma$; where θ is smoothing the penalty parameter and $\gamma^T P\gamma$ is the penalty. The penalty prevents over fitting.

[9] In the threshold model. The threshold variable may be one of the region-varying variables or a region-invariant variable. If the dependent variable is a function of its own lags, the model is called threshold auto-regression model (TAR). If the lagged dependent variable is used as the threshold variable, the model

becomes self-exciting threshold model (SETAR). The thresholds are estimated sequentially as follows. Let $\gamma_1^*,...,\gamma_m^*$ represent the m thresholds. The first threshold (γ_1^*) is estimated assuming a model with two regions. Conditional of the first threshold, the second threshold is estimated as the value that yields the minimum sum of squared errors (RSS) over all observations in that model excluding the first threshold. The estimator of the second threshold γ_2^* is obtained by minimizing the least squared of the regression with three regions conditional on the first estimated threshold. In general, the ith threshold minimizes the RSS conditional on the i-1 estimated thresholds.

[10] The threshold level of debt is obtained from the regression: Growth rate= $\alpha+\beta$ debt-GSDP $+\gamma$ debt-GSDP^2 or from threshold regression model.

[11] Domestic debt of Centre includes market loans-dated securities, floating rate debt, inflation index bonds, treasury bills, 14-day intermediate treasury bills, cash management bills, securities issued to international financial institutions, market stabilization scheme, compensation and other bonds, securities against small savings etc. The external debt is from multilateral agencies like Asian Development Bank etc.

[12] The internal debt of state Government consists of market loans, loans from Financial Institutions like commercial banks, NABARD, LIC, NCDC etc. (mostly project funding), ways and advances from RBI (and overdraft), special securities issued to NSSF etc. The loans and advances comprise non-plan loans, loans for state/union territory plan schemes, loans for central plan schemes, loans for centrally sponsored schemes, loans for special schemes and other loans.

[13] The data sources for the study are: (i) For all fiscal variables, Indian Public Finance Statistics till 2015-16 and RBI from 2016-17 onwards; and (ii) GDP data from MOSPI (NAS).

[14] Assuming 4% fiscal deficit, the Centre's debt-GDP will not reach the threshold even after 100 years with 10% nominal growth, but will reach the threshold in 2072-73 with 11% growth and in 2038-39 with 12% growth.