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Public Debt of Kerala State and Related Risk Analysis: An Econometric Study

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Abstract

The growing fiscal obligations of Kerala are increasingly met from debt liabilities. This has led to a significant increase in the market borrowings of the state during the last decade. The increased reliance on market borrowings results in public debt accumulation and high debt servicing costs. To secure government's low-cost funding over the medium and long term while avoiding excessive risk, an assessment of public debt is crucial. This study empirically analysed the present debt profile of Kerala in terms of costs, maturity, and potential risk factors. In addition, this study determined the dynamic relationship between the public debt and economic growth of the state by using the autoregressive distributed lag (ARDL) models. Our results reveal that public debt exerts a nonlinear impact on economic growth in both the long and short run in Kerala, and this impact may be described by an inverted U-shaped relationship.

Keywords: Autoregressive Distributed Lag Models, Kerala State, Market Borrowings, Public Debt, Time Series Regression

Introduction

Public debt has increased globally in the aftermath of the global financial crisis, highlighting the importance of prudent fiscal management and debt management strategies in preventing financial shocks to the country. The level of debt has substantially increased at national and subnational levels following the severe COVID-19 pandemic. In particular, the pandemic has exerted a heavy toll on the finances of states in India. Moreover, the states

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borrowed substantial amounts of money from the open market to mitigate the effects of the pandemic. Rising public debt levels have limited the ability of governments to mobilise resources for achieving sustainable development goals. With the growth of public debt levels, governments are likely to spend more on debt servicing and less on public goods, such as health, education, and infrastructure. This study highlights the public debt of Kerala state in India and the associated risks, emphasising the relationship between public debt and economic growth.

Kerala is among the economically developed states of India and leads many other Indian states in terms of the per capita gross domestic product, poverty eradication, and human development index. Although Kerala has achieved remarkable progress in many socioeconomic development indicators, its fiscal performance has not been impressive in recent years. The fiscal space of Kerala for meeting revenue expenditure, particularly salaries, pensions, and interest payments, out of own revenue receipts is shrinking. The market borrowing of the state significantly increased during the last decade because of the high reliance on debt liabilities to meet the day-to-day obligations of the government. Thus, the analysis of public debt and debt issuance is critical for Kerala for fiscal consolidation and better debt management. Against this background, this study investigated the public debt of Kerala to determine the trade-off between costs and risks associated with public debt.

Public debt exerts a crucial effect on the economy in both short and long terms. Whether public debt is useful or harmful towards economic growth remains one of the most prevailing debates in the literature, and no consensus has been reached on this topic. This study employed econometric models to examine the long and short run effects of public debt on the economic growth of Kerala. To the best of our knowledge, this is the first state-specific study to recommend effective debt management strategies for Kerala and thus aid in transitioning it into a developed economy. The rest of the paper is organized as follows: We begin with a detailed review of literature on the microstructure of subnational public debt and its impact on economic growth. Following this, we provide an overview of Kerala state finances and discuss the data and methodology implemented in this study. Next, we present our empirical findings on the public debt of Kerala and the associated risks, describing the econometric framework used to determine the dynamic relationship between public debt and the economic growth of Kerala. Finally, we conclude the paper with our major findings and recommendations.

Literature Review

Few studies have analysed public debt and the associated risks for Indian state governments. However, numerous empirical studies have explored the government borrowing programme, examined the main debt-raising channel, and identified the determinants of costs of borrowings from a cross-country perspective as well as the Indian context. Beck et al. (2017) and Bellot et al. (2017) have conducted an up-to-date literature survey on the cross-country analysis of the determinants of costs of open market borrowings. In the Indian context, Bose et al. (2011) performed panel data analysis to identify the determinants of Indian state government securities yield from 2006-07 to 2010-11. Furthermore, Rangarajan and Prasad (2013) focused on states' borrowing and debt restructuring processes underpinned by the move towards a rule-based framework and market discipline. Dey and Nair (2013) examined the effect of the deregulation of government securities market on the cost of market borrowings of major Indian states. Pandey (2016) analysed the trend of state debt as well as discussed the sources of state borrowing and problems related to state debt. Saggar et al. (2017) evaluated the spreads of government securities of all Indian states relative to those of central government securities in auctions conducted during 2015-16 and 2016-17. Kanungo (2018) provided detailed insights into state government borrowings and problems pertaining to risk asymmetries across states in the borrowing cost. Nath et al. (2019) reviewed the existing literature on the determinants of sub-sovereign bond yield spreads and examined the yield spreads of 22 Indian state governments by using a panel data framework. In addition, they developed a model for the efficient valuation of nontraded state securities in the Indian securities market. Jangili et al. (2022) developed a composite index of states' fiscal performance and determined whether the constructed index can explain the yield spread of state government securities.

Dholakia et al. (2004), Goyal et al. (2004), Rajaraman et al. (2005), Nayak and Rath (2009), Misra and Khundrakpam (2009), Makin and Arora (2012), and Dasgupta et al. (2012) have addressed fiscal deficits and their implications for public debt sustainability at the sub-national level in India. However, most of these studies have focused only on sub-national debts at the consolidated level. Kaur et al. (2018) and Misra et al. (2023) have conducted an up-to-date literature survey on the debt sustainability of subnationals in India.

Numerous studies have investigated the impact of public debt on economic growth both for a panel of multiple countries and individual countries. However, most of the studies have investigated the nonlinear relationship between public debt and growth nexus and estimated the

threshold of public debt share to gross domestic product (GDP) (See Smyth and Hsing, 1995; Blavvy, 2006; Reinhart and Rogoff, 2010; Cecchetti et al., 2011;
Reinhart et al., 2012; Checherita-Westphal and Rother, 2012; Furceri and Zdzienicka, 2012; Herndon et al., 2013; Woo and Kumar, 2015; Chen et al., 2017). In addition, many studies have examined the linear relationship between public debt and economic growth and problems related to debt sustainability from the Indian context (Singh, 1999; Rangarajan and Srivastava, 2005; Kannan and Singh, 2007; Goyal, 2011; Bal and Rath, 2014; Barik and Sahu, 2022). However, no study has evaluated the impact of public debt on economic growth at the sub-national level in India. This paper attempts to fill this research gap. The major contributions of this study are two-fold. First, we analysed costs and risks associated with the public debt of Kerala state to better understand the trade-off between costs and risks associated with outstanding debt. Second, we examined the nonlinear relationship between public debt and economic growth in Kerala to determine the turning point or threshold of public debt above which the public debt exerts an inverse effect on economic growth.

Overview of Kerala State Finances

Following the philosophy of growth-inductive fiscal management, the Government of Kerala enacted the Fiscal Responsibility and Budget Management (FRBM) Act in 2003 to reduce the stock of debt and deficits, mainly revenue and fiscal deficits, by eliminating non-productive expenditures. Adherence to this legislation was supported by the implementation of the Debt Swap Scheme from 2002-03 to 2004-05 and the Debt Consolidation and Relief Facility from 2005-06 to 2009-10. Subsequently, each finance commission recommended curtailing the revenue deficit and restricting the fiscal deficit to 3 per cent of the gross state domestic product (GSDP). Under the fiscal consolidation path prescribed by the 13th Finance Commission, Kerala had to achieve zero revenue deficit by 2014-15 and restrict its fiscal deficit to 3 per cent of the GSDP from 2013-14 onwards.

Total Revenue								
Own Revenue	6.3	8.4	8.2	8.2	7.9	7.7	7.1	7.6
From Centre	2.1	3.8	3.7	3.6	3.9	3.4	5.5	5.3
Total Expenditure	12.0	15.5	16.1	15.7	15.2	14.1	18.0	18.0
Revenue	11.4	14.0	14.3	14.2	14.0	12.9	16.0	16.1
Capital	0.6	1.5	1.8	1.5	1.2	1.2	2.0	1.9

Revenue Deficit	3.0	1.7	2.4	2.4	2.2	1.8	2.6	2.3
Fiscal Deficit	3.7	3.2	4.2	3.8	3.4	2.9	4.6	4.1
Interest payments	2.2	2.0	1.9	2.2	2.1	2.4	2.7	2.6
Primary Deficit	1.6	1.2	2.3	1.7	1.3	0.6	1.8	1.5
Total Debt	23.0	28.0	29.4	30.0	29.9	32.0	38.5	37.0
GSDP Growth (%)	5.0	9.6	13.0	10.5	12.4	3.1	-5.2	17.6

Item	2000-01	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22
	8.4	12.3	11.9	11.8	11.8	11.1	12.7	12.9

Table-1: Profile of Kerala State Finances (Accounts as per cent of GSDP at current prices)

Source: Kerala state budget documents

The ratio of revenue receipts to GSDP of the state increased from 8.4 per cent in 2000-01 to 12.9 per cent in 2021-22 (Table-1). Although the state's own revenue increased in absolute terms, the ratio of its own revenue to GSDP declined from 8.4 per cent in 2015-16 to 7.6 per cent in 2021-22. The ratio of total expenditure to GSDP increased from 12.0 per cent to 18.0 per cent during 2000-01 to 2021-22. Furthermore, the ratio of capital expenditure to GSDP marginally increased from 0.6 per cent to 1.9 per cent during the same period. Revenue expenditure accounted for 89.6 per cent of the total expenditure, whereas capital expenditure accounted for only 10.4 per cent of the total expenditure in 2021-22. On average, interest payments grew by approximately 15 per cent each year from 2011-12 to 2021-22 because of increased dependency on debt liability. The expenditure on interest payments as a percentage of GSDP stood at 2.6 per cent in 2021-22. Because a sizeable percentage of fiscal deficit was accounted for by revenue deficit, the fiscal deficit has consistently risen over the years. The ratio of the outstanding debt to GSDP increased from 23.0 per cent in 2000-01 to 37.0 per cent in 2021-22.

Data and Methodology

This section discusses the data and methodological framework adopted for the empirical analysis of the public debt of Kerala and the related risks, including the dynamic relationship between public debt and economic growth in Kerala.

Data

The main sources of data were 'State Budget Documents' for various years published by the Government of Kerala and 'State Finances: A Study of Budgets' and 'Handbook of Statistics on Indian States' for various years published by the Reserve Bank of India (RBI). The time series statistics on Kerala state finances, market borrowing program, and outstanding public

debt were compiled from information provided in the aforementioned publications. Data on GSDP were obtained from the State Economics and Statistics Department of Kerala. The econometric analysis performed in this study covered the sample period from 1982-83 to 2021-22.

Methodology

In this subsection, we describe the theory underlying debt dynamics and risk measures, the outline of the econometric approach, and the specification of the model used in this study.

Debt Dynamics

Debt dynamics can be expressed in terms of the government's intertemporal budget constraint. Debt is sustainable if the intertemporal solvency condition is satisfied, where the expected present value of the future primary balances covers the existing stock of debt. Building on the debt evolution formula and assuming for simplicity that there is no foreign currency denominated debt:

$$E_t + i\ D_{t\ t-1} - R_t = D_t - D_{t-1}$$

...(1) where E_t is the government's primary expenditure, $R_{t \text{ and } t}$ is the government

revenues and D_t is the stock of debt at time t.

The primary balance at time t, $PB_t = R_t - E_t$.

The substitution of PB_t in (1) provide us with an evolution of debt formula:

$$D_t = +(1\ i\ D_t)_{t-1} - PB_t$$

...(2)

where $(1+i_t)$ equals nominal interest rate at time t. Then

the intertemporal budget constraint for $t = N$

$$D_N = +(1\ i)^N D_0 - \sum_{j=1}^{N} (1+i)^{N-j}\ PB_j$$

...(3)

To obtain the solvency condition, divide both sides of (3) by $(1+i)^N$ and solving for D_0:

$$D_0 = \sum_{j=1}^{N} \frac{1}{(1+i)^j} PB_j + \frac{1}{(1+i)^N} D_N \quad \ldots(4)$$

Then, take the limit as $N \to \infty$ and impose the transversality (No-Ponzi scheme) condition:

$$\lim_{N\to\infty} \left(\frac{1}{1+i}\right)^N D_N = 0$$

Then, the solvency condition becomes,

$$D_0 = \sum_{j=0}^{\infty} \frac{1}{(1+i)^j} PB_j \quad \ldots(5)$$

If the transversality holds, the outstanding initial debt should be covered by the present value of future primary balances.

Further, the primary balance at time t, $PB_t = E_t - R_t$.

Hence, $D_t = (1+i_t) D_{t-1} + PB_t$ ...(6)

Dividing both sides of (6) by Gross Domestic Product (GDP), Y_t

$$\frac{D_t}{Y_t} = (1+i_t)\frac{D_{t-1}}{Y_t} + \frac{PB_t}{Y_t}$$

$$\frac{D_t}{Y_t} = (1+i_t)\frac{D_{t-1}}{Y_{t-1}}\frac{Y_{t-1}}{Y_t} + \frac{PB_t}{Y_t}$$

$$\frac{D}{Y}$$

Then, $d_t = +(1\ i\ d_t)\ _{t-1}\square\ ^{t-1}\square + pb_t$

$\square\ Y_t\square$

$\frac{(1+i_t)}{(1+G_t)}$ Therefore, $d_t = d_{t-1} + pb_t$

...(7)

where G_t is the GDP growth, defined as $G_t = \frac{Y^t - Y^{t-1}}{Y_{t-1}}$.

The fiscal policy is unsustainable when $G_t = i_t$ or $G_t < i_t$; because d_t grows linearly when $G_t = i_t$ and explosively when $G_t < i_t$. Debt is sustainable when $G_t > i_t$. The last condition is considered as a necessary condition for sustainability, based on the assumption that the faster income grows, the lighter will be the burden on debt.

Risk Measures

The price (P) of a security with face value 100, annual coupon rate C , number of coupon payment remaining n , frequency of coupon payment f (1 for annual, 2 for half-yearly, etc.) and annual yield-to-maturity y can be expressed as the sum of the present values of future cash flows as follows:

$$P = \sum_{j=1}^{n} \frac{C/f}{(1+y/f)^{w+j-1}} + \frac{100}{(1+y/f)^{w+n-1}} \qquad ...(8)$$

where w $(0<w\leq 1)$ represents the ratio of the number of days from the settlement date to the next coupon date to the number of days in the coupon period in which the settlement date falls.

The weighted average coupon and weighted average maturity of outstanding government securities are conventional risk measures that represent the debt servicing cost and refinancing risk of the government.

The weighted average coupon (the weight is the amount outstanding of individual securities) of an outstanding stock of securities represents the average interest costs of market loans to the government. The higher the

weighted average cost, the higher the debt servicing cost to the government and it will squeeze government budgets. Similarly, the weighted average maturity (the weight is the amount outstanding of individual securities) is the average residual time to maturity of debt instruments that make up the debt. A longer weighted average maturity indicates that debt instruments are rolled over less frequently, and therefore, there is a lower refinancing risk and less uncertainty regarding future debt cost.

Duration and convexity are simple tools for measuring the interest rate sensitivity of a security (Srimany and Gayen, 2009). The duration of a security is a linear approximation of its price change after a small change in its yield. The longer the duration of a security – measured in years – the more interest rate-sensitive it is. Since the price-yield relationship for securities is not linear but convex, a measure of convexity is also used to account for small changes in yields. Convexity is a second-order effect that describes how duration changes as yield changes. Mathematically, the duration/convexity method uses a Taylor expansion to approximate the relative change in government securities price dP / P , following a small change in the yields of government securities dy . D^* and C^* denote the modified duration and convexity of government securities, respectively.

$$\frac{dP}{P} = -D^* dy + C^* (dy)^2 \quad \text{...(9)}$$

where $D^* = -\frac{1}{P}\frac{dP}{dy}$ and $C^* = -\frac{dD^*}{dy}$. ...(10)

Time Series Regression Framework

To investigate the nonlinear effect on the relationship between government debt and growth nexus in Kerala, we used a simple linear model describing the link between economic growth and public debt while controlling for other growth determinants. According to previous studies, this model takes the form of a neo-classical growth regression equation augmented with the government debt variable:

$$G_t = \beta_0 + \beta_1 D_t + \varepsilon_t, \quad \text{...(11)}$$

where G_t is the annual real GSDP growth rate and D_t is the ratio of debt to GSDP. β_0 and β_1 are regression coefficients, and $\{\varepsilon_t\}$ is an independent and identically distributed error term with zero mean and constant variance.

Because this study determines whether a nonlinear relationship exists between government debt and economic growth, the following model specification that accounts for the polynomial trend of the debt variable is considered.

$$G_t = \beta_0 + \beta_1 D_t + \beta_2 D_t^2 + \varepsilon_t, \quad \text{...(12)}$$

In this equation, a squared term of debt, D_t^2, is introduced as an additional regressor to capture the nonlinear relationship between economic growth and public debt.

To estimate long- and short-run dynamics between the variables of interest in equation (12), we adopted the autoregressive distributed lag (ARDL) bound testing approach to cointegration developed by Pesaran, Shin, and Smith (2001). Equations (11) and (12) are reformulated into a combined ARDL and quadratic polynomial function framework as follows:

$$\Delta G_t = \beta_0 + \beta_1 G_{t-1} + \beta_2 D_{t-1} + \sum_{i=1}^{p} \eta_i \Delta G_{t-i} + \sum_{i=1}^{q} \theta_i \Delta D_{t-i} + \varepsilon_t, \quad \text{...(13)}$$

and

$$\Delta G_t = \beta_0 + \beta_1 G_{t-1} + \beta_2 D_{t-1} + \beta_3 D_{t-1}^2 + \sum_{i=1}^{p} \eta_i \Delta G_{t-i} + \sum_{i=1}^{q} \theta_i \Delta D_{t-i} + \sum_{i=1}^{r} \delta_i \Delta D_{t-i}^2 + \varepsilon_t \quad \text{...(14)}$$

where β_i, $i = 1, 2, 3, \ldots$, are long-term parameters; η_i, θ_i, and δ_i's are short-term parameters; and p, q, and r represent the number of lags of the first differentiated variable.

In the ARDL framework, the test for determining the presence of a cointegration relationship between variables was performed by testing the joint significance of lagged-level variables $(G_{t-1}, D_{t-1}, D_{t-1}^2)$ in equation (14) by conducting the Wald coefficient restriction test (F test). The null

hypothesis of no cointegration is $H_0: \beta_1 = \beta_2 = \beta_3 = 0$ against the alternative $H_1: \beta_1 \neq \beta_2 \neq \beta_3 \neq 0$. A significant F test statistic for testing the joint significance of lagged-level variables indicated the existence of a longterm relationship. According to equation (14), the long-term parameters capturing the long-term effects of explanatory variables on the dependent variable are normalised on β_1 and calculated as $\gamma_0 = -\beta_0/\beta_1$; $\gamma_2 = -\beta_2/\beta_1$; and $\gamma_3 = -\beta_3/\beta_1$. The model with long-term coefficients is derived as follows:

$$G_t = \gamma_0 + \gamma_2 D_t + \gamma_3 D_t^2 + \upsilon_t. \quad \ldots(15)$$

Once the long-term relationship is established between the dependent and explanatory variables, the short-term impact of independent variables can be estimated using the corresponding ARDL error correction model:

$$\Delta G_t = \eta_0 + \sum_{i=1}^{p} \theta_i \Delta G_{t-i} + \sum_{i=1}^{q} \delta_i \Delta D_{t-i} + \sum_{i=1}^{r} \mu_i \Delta D_{t-i}^2 + \mu ECM_{t-1} + \varepsilon_t, \quad \ldots(16)$$

where μ is the coefficient of the error correction term, which measures the speed of adjustment of the model towards the long run equilibrium. Its value is expected to be negative and lie in the interval $(-1,0)$.

To determine whether a nonlinear relationship exists between public debt and economic growth, equation (15) is used and the coefficients of linear and quadratic debt terms are calculated. If the coefficients of linear and quadratic debt terms, that is γ_2 and γ_3, are significantly different from zero, then a nonlinear relationship exists between public debt and growth; the nature of nonlinearity is determined by the signs of the two coefficients. If γ_2 is negative and γ_3 is positive, the relationship between the two variables follows a U-shaped pattern. If γ_2 is positive and γ_3 is negative, an inverted U-shaped relationship exists between the two variables.

To calculate the critical point corresponding to the growth-enhancing debt level, the first-order partial derivative of equation (15) is computed with respect to D_t and is set to zero. Thus, the critical point of public debt above which the marginal impact of debt becomes negative is obtained as $D_t^* = -\gamma_2 / 2\gamma_3$. The aforementioned specification follows works by

Blake (2015); Sanusi, Hassan and Meyer (2019); Bhatta and Mishra (2020); and Rutayisire (2021) who employ the same methodology combining the ARDL bound testing approach to cointegration and the quadratic polynomial function to investigate the nonlinear effects of public debt on economic growth.

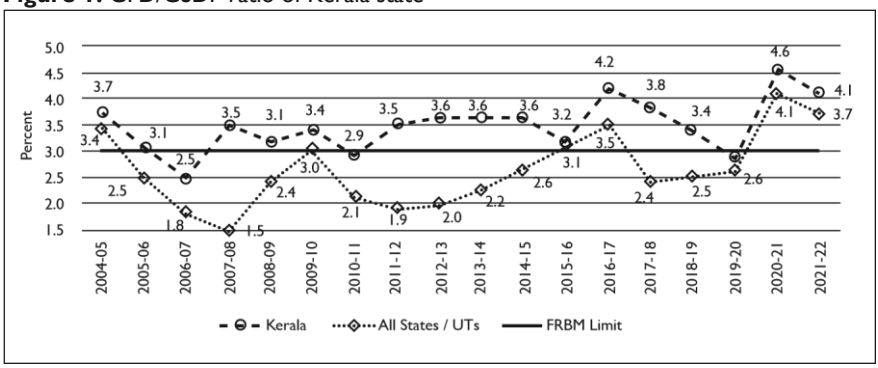
Empirical Results and Discussion

This section discusses the public debt of Kerala state to better understand the dynamics of costs and the associated risks.

Trend in Gross Fiscal Deficit

The fiscal position of state governments in terms of gross fiscal deficit (GFD) significantly improved after the implementation of fiscal rules through the enactment of the state's fiscal responsibility legislation (FRL). However, because the Kerala Fiscal Responsibility Act 2003 mandated that the state should maintain the fiscal deficit to 3 per cent of GSDP by 2017-18, Kerala still has to manage its finances to reach the prescribed limit. To provide a historical perspective of the fiscal position of Kerala, Figure-1 compares GFD as a percentage of GSDP (GFD/GSDP) of Kerala with all states and union territories (UTs) together for the period from 2004-05 to 2021-22. The GFD/GSDP ratio of Kerala remained above the FRBM limit, except for a few years after the implementation of the FRBM Act 2003. The GFD increased to 4.6 per cent of GSDP in 2020-21, which was the highest since 2004-05; this increase resulted from a shortfall in revenue receipts and higher revenue expenditure on healthcare and other social services due to the COVID-19 pandemic. Furthermore, in 2021-22, the fiscal deficit level decreased to 4.1 per cent of GSDP.

Figure-1: GFD/GSDP ratio of Kerala state



The deficits and debts of Indian states have been rising, resulting in rapid growth in states' market borrowings, which are increasingly becoming comparable to those of the central government (Saggar *et al*., 2017). Even with the rising combined deficits of states, open market borrowing has remained the predominant source of financing. Table-2 depicts the financing pattern of Kerala's fiscal deficit. In terms of the sources of financing, over the years, the share of special securities issued to national small savings fund (NSSF) in financing the fiscal deficit has significantly decreased and the dependency on market borrowings and provident funds has increased.

Table-2: Composition financing the fiscal deficit of Kerala (in per cent)

Item	2004-05	2017-18	2018-19	2019-20	2020-21	2021-22
Market Borrowings	30.9	60.4	51.9	52.9	65.5	48.6
Loans from Centre	-1.0	-0.5	-0.9	6.0	1.5	-0.1
Special Securities issued to NSSF	58.9	3.9	3.9	7.5	6.9	7.3
Loans from NABARD, LIC etc.	8.9	-0.1	-0.6	0.2	-0.3	-0.3
Provident Funds	13.3	26.9	35.7	34.7	32.8	49.4
Reserve Funds	2.8	0.7	6.8	-6.4	0.5	-0.7
Deposits and Advances	-1.8	1.0	1.5	2.2	1.4	4.8
Suspense and Miscellaneous	2.2	4.5	-2.8	-0.3	-6.2	-7.0
Remittances	0.5	-0.6	-0.2	0.5	0.1	-1.2
Others	-14.7	3.8	4.8	2.5	-2.3	-0.9
Total	100.0	100.0	100.0	100.0	100.0	100.0

'Others' include loans from other institutions, compensation bonds, appropriation to contingency fund, interstate settlement, contingency fund and draw-down of cash balance.

Source: State Finances: A Study of Budgets and Kerala State Budget Documents

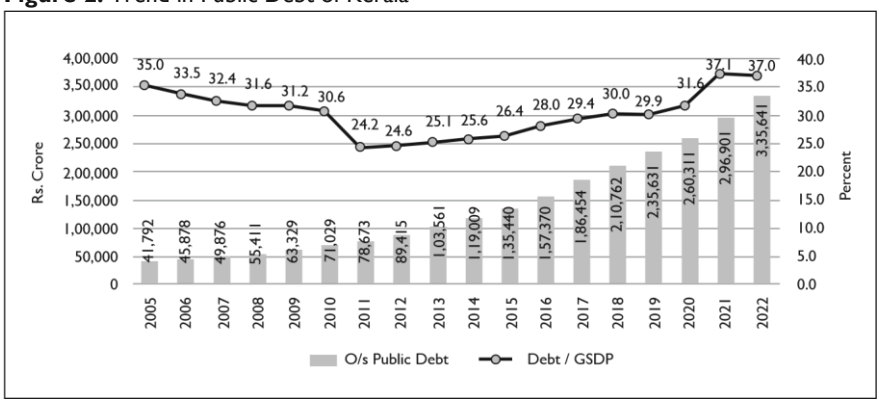
The proportion of market borrowing in financing reached a peak level of 65.5 per cent for Kerala in 2020-21 from approximately 31 per cent in 2004-05. Furthermore, in 2021-22, the share of market borrowings in financing the deficit decreased to 48.6 per cent and the share of provident funds increased to manage the reduction in market borrowings. The change in composition helped in reducing the burden of interest payments and is a movement towards fiscal consolidation through interest rates determined by the market.

Profile of Public Debt in Kerala

The FRBM Review Committee (2017) suggested a ceiling of 60 per cent of GDP for general government debt (both centre and states) by 2022-23. Within this overall limit, a ceiling of 40 per cent was adopted by the centre and 20 per cent by the states. However, the prolonged COVID-19 crisis has worsened the fiscal positions of central and state governments, as indicated by increasing debt levels. The outstanding public debt of Kerala

stood at Rs. 3,35,641 crore at the end of March 2022 against Rs. 41,792 crore in 2005. The debt to GSDP ratio steadily increased during 2011 to 2022 and stood at 37.0 per cent at the end of March 2022 against 24.2 per cent at the end of March 2011 (Figure-2). With the growing fiscal obligations of Kerala being increasingly met by debt instruments, the share of market loans in outstanding public debt consistently increased over the years from 23.0 per cent at the end of March 2005 to 54.7 per cent at the end of March 2022.

Figure-2: Trend in Public Debt of Kerala



The state has witnessed structural transformation in the composition of debt liabilities (Table-3). Market loans accounted for nearly 20 per cent of total public debt in 2000; this proportion steadily increased to 54.7 per cent by the end of March 2022. On average, the share of special securities issued to NSSF increased from 0.6 per cent during 1990-91 to 1999-2000 to nearly 14.6 per cent in 2000-01 to 2009-10; then, it started to decline and reached 6.7 per cent at the end of 2021-22. The share of loans from banks and financial institutions in outstanding debt stood at 1.5 per cent at the end of March 2022.

Table-3: Composition of Kerala State Debt (as percent of o/s debt)

Components	Market Loans	NSSF	WMA from RBI	Loans from Banks and Financial Institutions	Loans and Advances from Centre	rovident Funds, etc.	Out-standing debt
1990-91 to 1999-2000	20.4	0.6	1.0	4.1	39.6	34.3	100.0

2000-01 to 2009-10	26.8	14.6	0.8	7.8	15.4	34.6	100.0
2010-11 to 2014-15	46.9	11.3	0.0	5.2	6.5	30.0	100.0
2015-16	53.9	8.0	0.0	3.2	4.6	30.3	100.0
2016-17	53.4	7.2	0.0	2.8	4.1	32.5	100.0
2017-18	54.9	6.9	0.0	2.5	3.5	32.2	100.0
2018-19	55.8	6.7	0.0	2.2	3.5	31.9	100.0
2019-20	57.9	6.2	0.0	1.9	3.6	30.3	100.0
2020-21	55.7	6.7	0.0	1.7	3.1	32.8	100.0
2021-22	54.7	6.7	0.0	1.4	2.7	34.5	100.0

Source: State Finances: A Study of Budgets and Kerala State Budget Documents

The composition of loans and advances received from the central government exhibits structural changes (Table-3). The crucial components of this source are nonplan loans, loans for state plan schemes, loans for central plan schemes, and loans for centrally sponsored schemes. The share of provident funds in the outstanding public debt of Kerala is almost stable at approximately 32 per cent throughout the study period.

Cost of Outstanding Public Debt

The public debt management strategy is based on two broad pillars: low cost and risk mitigation. Table-4 lists the weighted average cost of public debt across the various categories of outstanding debt of Kerala. Market borrowings form the most crucial component of the public debt of state governments. Because the cost of market borrowings is driven by the market, the weighted average cost is mainly a function of the interest rate environment. The weighted average cost for issuances made in 2021-22 stood at 7.11 per cent, which was higher than that in 2020-21. The cost of market borrowings in outstanding public debt gradually declined from 2019-20 to 2021-22 and stood at 7.72 per cent at the end of March 2022. However, the costs of borrowings from other sources, such as NSSF, and financial institutions or banks were above the market-determined rates. NABARD lends at subsidised rates for agriculture-allied projects. Thus, the cost of borrowings from NABARD is below that of market loans.

Table-4: Weighted Average Cost of Public Debt (in per cent)

	Raised during			**Outstanding Stock**		
Market Borrowings						7.72
Special Securities issued to the NSSF	8.20	7.40	7.30	8.38	7.97	7.60

Borrowings from Financial Institutions/Banks	13.87	9.25	11.61	10.01	10.70	11.53
Borrowings from NABARD	3.76	2.84	2.75	6.18	6.08	4.23
WMA/OD from RBI	6.68	4.60	3.40	4.40	-	-
Small Savings	5.42	5.42	4.00	5.42	5.42	5.46
Provident Funds	7.80	7.10	7.10	7.80	7.10	7.10
Category	**2019-20**	**2020-21**	**2021-22**	**2020**	**2021**	**2022**
the fiscal year (end March)	7.43	6.41	7.11	8.20	7.84	

Source: Kerala State Budget Documents

During the course of year, if temporary mismatches occur between the receipts and expenditure of a state, the RBI offers a ways and means advance (WMA) that is capped. If a state requires additional temporary assistance, the RBI offers an overdraft (OD) facility that is limited by the number of days. The cost of borrowings from the RBI is the repo rate for WMA and repo rate + 2 per cent for the OD facility. The costs of borrowings from small savings and state provident funds are notified on regular basis. The cost of outstanding borrowings from small savings and state provident funds stood at 5.46 per cent and 7.10 per cent, respectively, at the end of March 2022. The low cost objective is attained by adopting debt portfolio management practices and creating a prudent debt structure by containing potential risks.

Risk Metrics of Market Loans of Kerala

Risk analysis focuses on metrics such as the weighted average cost, average time to maturity, redemption profile, and duration/convexity of securities. To determine the risk dynamics of the market loans of Kerala, we calculated the risk metrics (Table-5). Despite increased borrowings over the years, the trend of the weighted average cost exhibited a downward movement after 2015. The weighted average cost stood above 8.00 per cent until 2019-20 and decreased significantly to 7.72 per cent by the end of March 2022, mainly because of the issuance of market loans with shorter tenures in 2020-21. The weighted average residual maturity of the outstanding stocks of Kerala market loans declined significantly as of end March 2021 due to the issuance of loans with short tenure in 2020-21. Thus, the weighted average maturity of outstanding Kerala market loans declined from 6.48 years at the end of March 2020 to 5.89 years at the end of March 2021, which is an alarming signal. Furthermore, at the end of March 2022, the weighted average maturity increased to 6.65 years

mainly due to the issuance of securities with longer tenures in 2021-22. The elongation of portfolio maturity is the preferred strategy for limiting the refinancing risk of government debt.

Table-5: Risk Metrics of Market Loans of Kerala

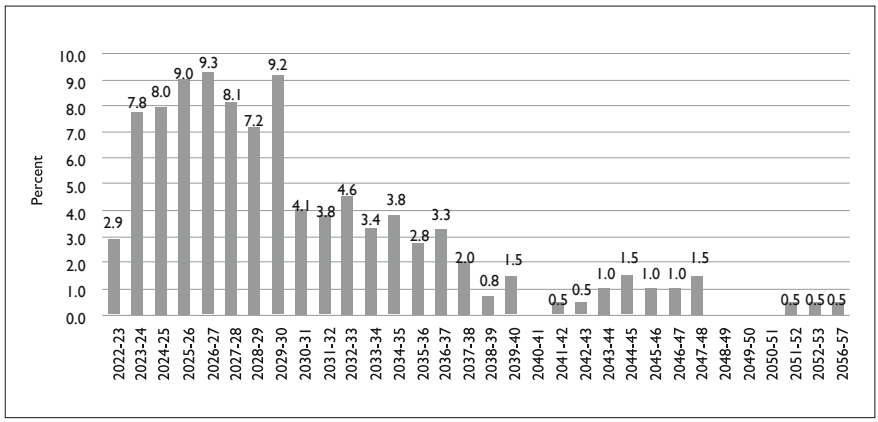
As end March	Wtd. Avg. Cost	Wtd. Avg. Maturity	Macaulay's Duration	Modified Duration	Convexity
2013	8.26	7.02	3.97	3.81	23.52
2014	8.53	8.09	4.16	3.98	25.04
2015	8.58	6.59	4.27	4.10	27.41
2016	8.56	6.43	4.45	4.29	29.55
2017	8.41	6.29	4.54	4.39	30.71
2018	8.27	6.83	4.54	4.37	30.28
2019	8.31	6.78	4.61	4.45	30.81
2020	8.20	6.48	4.61	4.46	32.30
2021	7.84	5.89	4.17	4.05	29.89
2022	7.72	6.65	4.32	4.18	34.43

Source: Database on Indian Economy and Author's calculation

The relatively stable duration and convexity of outstanding loans indicate that interest rate sensitivity has remained almost stable over the years for the market loan portfolio of Kerala. However, the magnitude of convexity is directly related to the immunisation risk inherent in the loan portfolio. The risk is proportional to portfolio convexity. Thus, portfolio convexity may be accounted for in pricing. These facts should be considered when formulating the market borrowing strategy.

The maturity profile of state borrowings is a crucial indicator of rollover risks and debt servicing costs, which reduces the efficacy of debt management strategies. The bunching of the maturity profile of Kerala state borrowings around the 10-year bucket has aggravated redemption pressure on the state starting from 2022-23 and peaking in 2026-27 (Figure-3), warranting the development of strategies for the elongation of maturities. As of December 31, 2022, approximately 61.5 per cent of Kerala's outstanding market loans will be required to be repaid in the coming 7 years, which increases the roll-over risk of Kerala's borrowings. The state government must ensure additional revenue resources and devise a well-considered debt management strategy to meet this repayment burden.

Figure-3: Maturity profile of Kerala State Government Securities (in per cent) as on December 31, 2022



Impact of Public Debt on Economic Growth

Before performing regression analysis, we performed the unit root test to determine the order of integration of variables to prevent spurious regression. The results of the augmented Dickey-Fulle R_t r unit root test revealed that the variables were either I (0) or I (1) at level, but they were all stationary at the first difference. Thus, none of them were integrated on an order higher than one. The fact that the variables were integrated of different orders at level makes the ARDL bound testing approach appropriate for empirical estimation.

Table-6: Results of ADF Unit Root Test

Variables	Level		First difference	
	Constant	Constant & Trend	Constant	Constant & Trend
Growth	-4.6036 (0.0007)	-4.5892 (0.0039)		
Debt	-1.6196 (0.4630)	-2.1320 (0.5121)	-4.4950 (0.0009)	-4.4313 (0.0058)

Source: Author's estimates

The null hypothesis of no cointegration is rejected at the 5 per cent significance level (Table-7) because the value of the computed *F* test from the parsimonious ARDL model, which is 5.6017, is greater than the upper bounds of critical values tabulated by both Pesaran, Shin and Smith (2001). This indicates the existence of a long-term equilibrium relationship between economic growth and public debt.

Table-7: Results for ARDL Bounds Testing for Cointegration

Calculated *F*-Test Statistic: 5.6017	
Critical values at 5% significance level	
Lower bound value I(0)	Upper bound value I(1)
2.72	3.83

Source: Author's estimates

The normalised long-term coefficients derived from the parsimonious ARDL model are listed in Table-8. With regard to the public debt variable inputted in the model, empirical analysis focuses on the nonlinearity of the relationship between this variable and economic growth. "As explained in Section", the nature of nonlinearity depends on the significance and the signs of the debt and debt squared terms in the model. The debt term, debt, and the squared debt term, $debt^2$, are statistically significant (Table-8). The debt term is positive, whereas the squared debt term is negative. These results indicate the nonlinear relationship between public debt and economic growth can be described by an inverted U-shaped curve. The peak of the quadratic function identifies the turning point or threshold above which the impact of additional public debt on economic growth shifts from positive to negative.

Table-8: Long-run and Short-run Coefficients from ARDL and ARDL-ECM Models

Long-run coefficients

Variables	Coefficient	Std. Error	t-Statistic	Prob.
Debt	0.5923	0.1791	6.7297	0.0000
$Debt^2$	-0.9403	0.0059	-4.0637	0.0003

Short-run coefficients

Variables	Coefficient	Std. Error	t-Statistic	Prob.
D(GROWTH(-1))	0.1127	0.1273	0.8854	0.3832
D(DEBT)	0.6227	0.4032	-2.7775	0.0094
D(DEBT(-1))	0.5886	0.5119	1.9314	0.0629
$D(DEBT^2)$	-0.8090	0.4921	-1.6827	0.0328
$D(DEBT^2(-1))$	0.0060	0.0326	0.1851	0.8544
ECM(-1)*	-0.9038	0.2132	-4.2384	0.0002

Source: Author's estimates

The final step of the ARDL model is error correction for estimating the short-term parameter with speed of adjustment. Table-8 presents the results of the error correction model. The short run results present the nonlinear relationship between public debt and economic growth, as

described by long run coefficients. In the final stage, to examine the validity of the short and long run ARDL models, we evaluated the stability of regression coefficients by using the cumulative sum (CUSUM) test. Figure-4 and 5 clearly show that the critical values do not exceed the 5 per cent level of significance. This finding indicates the absence of instability in regression coefficients and provides additional support for the robustness of the long and short run models.

Figure-4: CUSUM Stability Test

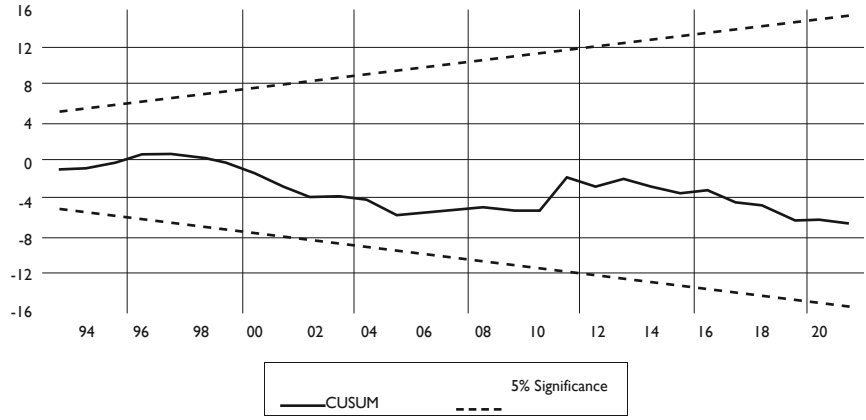
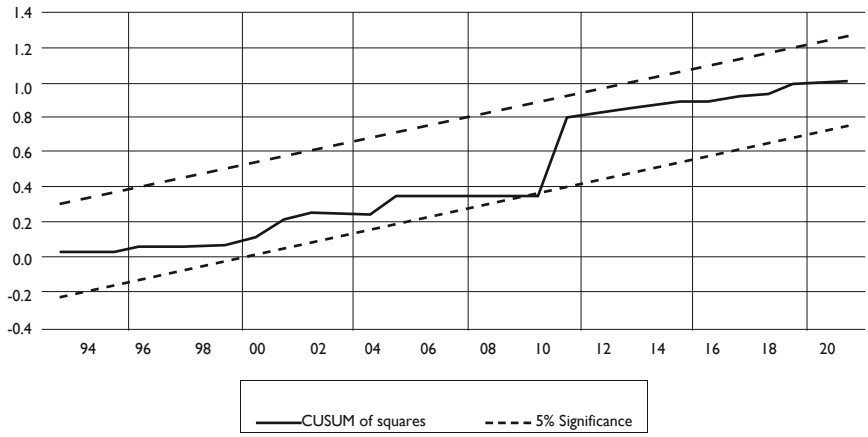


Figure-5: CUSUMSQ Stability Test



Concluding Remarks

Maintenance of fiscal discipline by state governments is vital not only from the perspective of macroeconomic stability but also to ensure adequate funding for essential social and economic services as well as building the foundation for long-term economic growth. However, the fiscal anatomy of Indian states is plagued by numerous structural deficiencies, such as high budget deficits and debt, unhealthy expenditure

patterns, limited resources, and adoption of populist fiscal measures. Over the years, the fiscal deficit and share of market borrowings in financing fiscal deficits have been increasing across Indian state governments. Moreover, the rising public debt level has limited the ability of state governments to mobilise resources to achieve sustainable development goals. Kerala is no exception to this general trend. In this context, we perform this empirical study to assess the efficiency of public debt management in Kerala.

The growing fiscal obligations of Kerala are increasingly met from debt liabilities. This has led to a significant increase in the market borrowings of the state during the last decade. The increased reliance on market borrowing has resulted in public debt accumulation and high debt servicing costs. To secure the government's low-cost funding for medium and long terms while avoiding excessive risk, an assessment of public debt is important. This study empirically analysed the present debt profile of Kerala in terms of costs, maturity, and potential risk factors. In addition, we determined the dynamic relationship between public debt and economic growth by using ARDL models. The findings of this study reveal that public debt exerts a nonlinear effect on economic growth in both the long and short term, and this effect may be described by an inverted U-shaped relationship.

According to the recommendations of the 14th Finance Commission, the state government amended the Kerala Fiscal Responsibility Act by enacting the Kerala Fiscal Responsibility (Amendment) Act 2018, with the fiscal target of maintaining zero revenue deficit and fiscal deficit to 3 per cent of the GSDP. This study emphasised that the state government should control revenue and fiscal deficits to achieve the targets set in the Kerala Fiscal Responsibility Act. Market borrowings are the only source of financing where the quantum of inflows can be controlled. Small savings inflows depend on rates set by the central government, whereas other sources are primarily associated with projects. This leaves very little space for manoeuvring these states. In the case of Kerala, over the years, dependency on market borrowings and provident funds has increased for financing the fiscal deficit. During the study period, the proportion of market borrowings for financing the state's fiscal deficit reached a peak level of 65.5 per cent in 2020-21 and 48.6 per cent in 2021-22 from approximately 30 per cent in 2004-05. Moreover, the share of market loans and provident funds in outstanding public debt stood at 54.7 per cent and 34.5 per cent, respectively, at the end of March 2022. The increased reliance on market borrowing leads to debt accumulation and high interest payments. These interest payments contribute to debt. Kerala's ratio of

interest payments to revenue receipts stood at 21.5 per cent and 20.0 per cent in 2020-21 and 2021-22, respectively. Such high outflows for interest payments would squeeze out space for productive government spending and reduce capital formation and growth.

The redemption profile of the Kerala state market debt reveals that redemptions would be at an elevated level in the coming 7 years. As of December 31, 2022, approximately 61.5 per cent of Kerala's outstanding market loans need to be repaid before the end of March 2030, which increases the roll-over risk of market borrowings. Moreover, the state government has to ensure additional revenue resources in coming years to repay this debt. The analysis of the trade-off between costs and risks indicates that the state government should adopt a strategy for elongating maturity to reduce redemption pressure in the near term. To reduce the borrowing cost, borrowing requirements should be estimated, and the said amounts should be borrowed through the issuance of the borrowing calendar; this can reduce the opportunity cost.

This study investigated the impact of Kerala's public debt on its economic growth. Empirical analysis was performed using a novel methodology combining a quadratic polynomial function and the ARDL bounds approach to cointegration by using time series data spanning the period from 1981-82 to 2021-22. The results indicate that public debt exerts a nonlinear impact on economic growth in both the long and short run in Kerala. This impact may be described by an inverted U-shaped relationship. This finding is expected, particularly in the context of Kerala where most of the government borrowings are utilised to meet revenue expenditure and a small portion of it is used for forming productive capital. Moreover, the results indicate the presence of a turning point or threshold above which the effect of public debt on economic growth shifts from positive to negative. The estimated turning point of the ratio of debt to GDP equals to 31.5 per cent. This implies that below the threshold, public debt is growth enhancing in Kerala. However, beyond this turning point, additional public indebtedness would negatively affect long-term growth.

Considering the fiscal position of Kerala state, we suggest the following corrective measures. (1) In the medium term, the state government should make efforts to control fiscal deficits and stabilise debt levels to achieve the targets set in the Kerala Fiscal Responsibility Act. (2) To finance meaningful programmes that contribute to capital formation, the government should create a fiscal space by cutting revenue expenditure on nonmerit goods and increasing revenue. (3) Kerala state should strengthen

its own tax revenue mobilisation. The decline in the growth of major own tax revenues must be examined thoroughly, and corrective actions must be implemented accordingly. Finally, although this study uses the widely accepted econometric methodology, the obtained results remain open to questions and debate as it did not include control variables in the ARDL framework due to the limited availability of adequate state-level data.

Disclaimer: The views expressed in this paper are those of the authors and do not the institution to which the authors belong.

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