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Assessing The Optimal Public Debt Threshold For Economic Growth In India: A Post FRBM Act Analysis

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Abstract

The study examines the non-linear relationship between Public Debt and Real Economic Growth in India during the Post-FRBM period using annual data from 2004-05 to 2023-24. Employing a Quadratic Regression Model, the analysis explores the impact of Public Debt-GDP ratio and its square on real GDP Growth rate. The result revealed a statistically significant inverted U-shaped relationship, indicating that moderate levels of debt are associated with higher economic growth but excessive debt beyond a threshold of approximately 74.5 percent of GDP negatively affects GDP Growth. These findings indicate that India's fiscal policy guided by Fiscal Responsibility and Budget Management (FRBM) Act must balance debt sustainability with growth objectives. The study highlights the need for maintaining public debt within a sustainable range to foster long-term economic growth without surpassing the optimal debt threshold.

Keywords: Public Debt, Economic Growth, FRBM Act, India, Quadratic Regression, Debt Threshold, Fiscal Sustainability

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Introduction

The relationship between public debt and economic growth has been a subject of debate among economists and policymakers. Moderate levels of debt can stimulate economic activity by stimulating productive investments, but excessive debt may lead to macroeconomic instability, crowding out of private investment and reduced growth potential. In the Indian context, the Fiscal Responsibility and Budget Management (FRBM) Act, enacted in 2003 played a pivotal role towards institutionalizing fiscal discipline. It set statutory limits on deficits and debt to ensure long-term sustainability. Despite the FRBM framework and its subsequent amendments, India's public debt has fluctuated significantly, particularly in response to global financial crises and COVID-19 pandemic. Understanding the impact of these debt levels on real economic growth especially in the context of post-FRBM Era is critical for evaluating the effectiveness of fiscal policy. There are many studies that have explored the debt-growth nexus in India mostly focused on linear relationships or short-term impacts. But there is limited empirical research examining the non-linear effects of public debt on economic growth and identifying a threshold beyond which debt becomes detrimental in the context of India. Furthermore, empirical evaluations remain scarce on the extent to which India's public debt under the FRBM Regime confirms to the optimal level conductive to the economic growth.

Fiscal Responsibility and Budget Management (FRBM) Act

The Fiscal Responsibility and Budget Management Act enacted by Indian Parliament in 2003 represents a landmark reform in the realm of fiscal policy. It was designed to institutionalize fiscal discipline and reduce fiscal deficits by establishing statutory limits on the government's fiscal deficit and public debt. The objectives of this act include promoting intergenerational equity, ensuring long-term macroeconomic stability and ensuring the credibility of fiscal policy.

Key Goals of the FRBM Act include

- Reducing Fiscal Deficit to sustainable levels
- Eliminating the Revenue Deficit
- Enhancing transparency in Fiscal operations
- Improving coordination between Fiscal and Monetary policy
- Ensuring Prudent Debt Management

The Act set specific targets for fiscal indicators. For instance, it mandated the central government to reduce its fiscal deficit to 3 percent of GDP and eliminate revenue deficit by March 2008. However, over time, the strict rules of the original framework had to be made more flexible to deal with economic shocks and the need for development. Consequently, the act has undergone several amendments one of the significant revisions came after N.K. Singh Committee on FRBM Review (2017). The FRBM Amendment Act of 2018 introduced a medium-term ceiling of 40 percent of GDP for central government and emphasized the need for more flexible, counter-cyclical fiscal framework. Despite these efforts, achieving fiscal consolidation targets has

proven challenging. The global financial crisis of 2008 and COVID-19 pandemic severely impacted revenue collection and necessitated increased public spending. In this context, the performance of FRBM framework becomes crucial as it raises important questions has it effectively controlled rising debt levels, supported long-term economic growth, or, conversely has its strict focus on fiscal rules limited the governments capacity to invest in critical development areas. This study seeks to explore these issues by examining how public debt has affected economic growth in India during the post-FRBM period.

Literature Review

The relationship between public debt and economic growth has gained significant attention globally with particular emphasis on whether there exists a non-linear threshold beyond which debt turns detrimental to growth.

Global Evidence on Debt Thresholds and Non-Linearity

(Reinhart & Rogoff, 2010) conducted a pivotal study involving 44 countries and found that public debt levels above 90% of GDP were associated with a significant slowdown in economic growth, suggesting an Inverted U-shaped (non-linear) relationship. Similarly, (Checherita, Westphal, C. , & Rother, P, 2012) investigated the average impact of government debt on per-captia GDP growth in 12 Euro countries over a period of 40 years starting in 1970 using Two-Stage Least Square (2SLS) and Generalised Method of Moments (GMM) estimators. They identified a non-linear impact of public debt on per-captia GDP growth with channels such as private saving, public investment, total factor productivity and long-term interest rates. (Kumar, 2015) extended this discussion using panel data from 38 advanced and emerging economies. The study confirms a non-linear, inverse U-shaped relationship suggesting that public debt negatively impacts growth beyond a threshold. (Panizza & Presbitero, 2014) using instrumental variable approach with Bayesian method and Three Stage Least Square Method (3SLS) challenged the deterministic view of direct causal link between public debt and economic growth. Their study across OECD countries concluded that no causal relationship could be established between public debt and economic growth. (Abubakar & Mamman, 2021) research investigates the impact of public debt on economic growth distinguishing between its permanent and transitory effects using (Mundlak, 1978) approach in 37 OECD countries. Their findings revealed a negative permanent and positive transitory effect of debt on growth, suggesting the impact of debt is not uniform over time.

Indian Context and Post FRBM Considerations

In the Indian context, (Bal & Rath, 2018) used Two-Stage Least Square and a non-linear ARDL approach for the period 1970-2013 and found a positive short- run and negative long-run effect of public debt on economic growth. They also suggested that government should prioritize public investment and productivity channels for utilizing public debt in India. (Agarwal & Ansari, 2022) focused on Uttar Pradesh and used Vector Error

Correction Mechanism (VECM) and Cointegration analysis. They found that higher debt to GSDP ratios and interest burden adversely affects long-run economic growth, though the impact on short-run growth was significant. Their state-level study underscored the importance of debt management at sub-national levels. (Thakur, 2023) investigated state-liabilities and regional inequality in India using Descriptive Statistics (Dispersion, Gini Coefficient, Moving average and Theil Entropy) and Time Series Regression over the period from 1980-81 to 2019-20. The study showed that Lending Rate, GDP growth and Trade balance are negatively related to liability at centre and state levels while Net FDI flows and Forex Reserves contribute positively to liability at centre and state levels.

Despite an extensive body of international literature on the non-linear relationship between public debt and economic growth, empirical evidence from India remains limited particularly in the context of Post-FRBM Act Era (2004-05) onwards. Moreover, few studies employed quadratic regression models to empirically determine the optimal debt-to-GDP ratio for India. Therefore, this study addresses these gaps by employing quadratic regression model to assess the relationship between public debt (as a percentage of GDP) and real GDP growth rate by using annual data from 2004-05 to 2023-24. The analysis aims to identify a growth-maximising debt threshold and evaluate whether India's fiscal path as guided by FRBM Act aligns with this threshold.

Objectives

The primary objective of this study is to investigate the non-linear relationship between public debt and real economic growth in India during the Post-FRBM Period (2004-05 to 2023-24). Specifically, the study aims to estimate the threshold level of public debt to GDP ratio that maximizes economic growth using a quadratic regression model. By doing so, the study intends to provide empirical insights into the effectiveness of FRBM framework in maintaining debt sustainability and supporting long-term economic growth.

Methodology and Data Source

The study employs a Quadratic Regression Model to examine the non-linear relationship between public debt and real GDP growth in India during the post-FRBM period from 2004–05 to 2023–24. Annual data on public debt-to-GDP ratio and real GDP growth rate were sourced from the (Union Budget documents, RBI Handbook of Statistics on Indian Economy and Ministry of Statistics and Programme Implementation (MoSPI).

Quadratic Regression Model

Quadratic regression model is a type of polynomial regression when the relationship between independent variable (X) and dependent variable is curvilinear and data follows a parabolic trend rather than a straight line. The purpose of these models is to capture relationships where changes in response variable is not constant

but changes at a rate proportional to its own value, creating non-linear association. Quadratic regression model is used in economics for identifying optimal points.

The general form of the quadratic function is :

$$Y = \beta 0 + \beta 1X + \beta 2X^2 + \mathcal{E}$$

Where

Y – Dependent variable

X- Independent variable

β0- Intercept

β1- coefficient for the linear term

β2- coefficient for the quadratic term

Ɛ- error term

Turning point of a quadratic function

The turning point of a quadratic function (Wooldridge, 2016) (Gujarati, 2002) is the value of X at which function reaches its maximum or minimum value (i.e. vertex of the parabola) depending upon the sign of β2

Formula to find the turning point

$$X^* = \frac{-\beta 1}{2\beta 2}$$

Model specification

To examine the hypothesized inverted U-shaped relationship between public debt and economic growth, a quadratic regression model was employed. This approach allows for the identification of a threshold level which additional debt becomes detrimental to economic growth. The functional form of the model is specified as:

$$Y_t = \beta 0 + \beta 1(Debt_t) + \beta 2(Debt)_t^2 + \mathcal{E}_t$$

Where

Y_t - real GDP growth at time t

β0- intercept

$Debt_t$ - public debt to GDP ratio at time t

$Debt^2_t$ – Square of public debt at time t

β1- coefficient of linear term Debt

β2- coefficient of squared term $Debt^2$

$\mathcal{E}_t$ – Error term

Note:

- If β2 is negative, it suggests an inverted U-shaped which indicates that when public debt increases, it increases economic growth, but beyond a threshold level when public debt increases, it is creating negative impact on economic growth.
- If β2 is positive, it suggests a U-shaped relationship implying that debt initially has a negative effect on growth but may become positive after a certain threshold.
- If β2 is not statistically significant, it suggests a linear relationship.

Variable description

1. Real GDP Growth (annual percentage change)	Real GDP Growth refers to the percentage increase in the total value of goods and services produced within the country, adjusted for inflation over the previous years. It essentially measures the real economic growth by comparing the output of the current year to the output of previous year using constant prices to eliminate the impact of price changes.
2. Public Debt to GDP ratio $= \frac{Total\ Public\ Debt}{Total\ GDP} * 100$	The total liabilities of centre and state governments in India expressed as a percentage of GDP constitutes the public debt to GDP ratio. This ratio is a key indicator of a country's economic health and fiscal sustainability reflecting the extent to which the government is borrowing to finance its expenditures.
3. Square of Public Debt	The square of public debt allows for the estimation of potential non-linear effects. The square of public debt refers to the relationship between public debt and economic growth, where the impact of public debt on economic growth isn't linear but rather exhibits an inverted U-shape. Research suggests that initially, public debt can positively impact economic growth but beyond a threshold it starts to negatively impact economic growth.

Empirical Analysis and Interpretation

Table 1 : Results of Multiple Regression Analysis

Variable	Coefficient	Std.Error	t-Statistic	P value
Constant	-208.71	84.40	-2.47	0.02
p−gdp	5.84	2.22	2.62	0.01
p−gdp^2	-0.03	0.01	-2.69	0.01

Note: F-statistic= 5.266 R^2= 0.382 p-gdp (public debt-gdp ratio) p-gdp^2 (square of public debt)

To investigate the relationship between public debt and economic growth a quadratic regression model was employed. This specification captures the non-linear effect of public debt on economic growth and helps to identify a potential threshold beyond which additional debt adversely impacts economic growth. The coefficient of p-gdp and p-gdp^2 is statistically significant as p-value is less than 0.05. The F-statistic (5.21) with low p value confirms that the model is reliable. The value of R^2 with 0.38 indicates a moderate fit model and explains that 38.26 percent of the variation in Real GDP growth is explained by the model.

The equation for the model is:

$$Y = -208.71 + 5.84(Debt) - 0.03(Debt)^2$$

The coefficient of Debt(β1=5.84) is positive and statistically significant (p=0.01) which indicates that an increase in Debt-to -GDP ratio is associated with higher GDP growth. Since the coefficient is positive it suggests that moderate levels of debt may stimulate economic growth by financing productive public investment. The coefficient of $Debt^2$ (β2 = -0.03) is negative and statistically significant(p=0.01) which indicates a non-linear (inverted U-shaped) relationship. This means that after a certain threshold, further increase in public debt starts to reduce economic growth.

Threshold Level of Public Debt

The turning point (threshold) of the debt level can be calculated by using the formula

$$Debt^* = \frac{\beta 1}{2\beta 2}$$

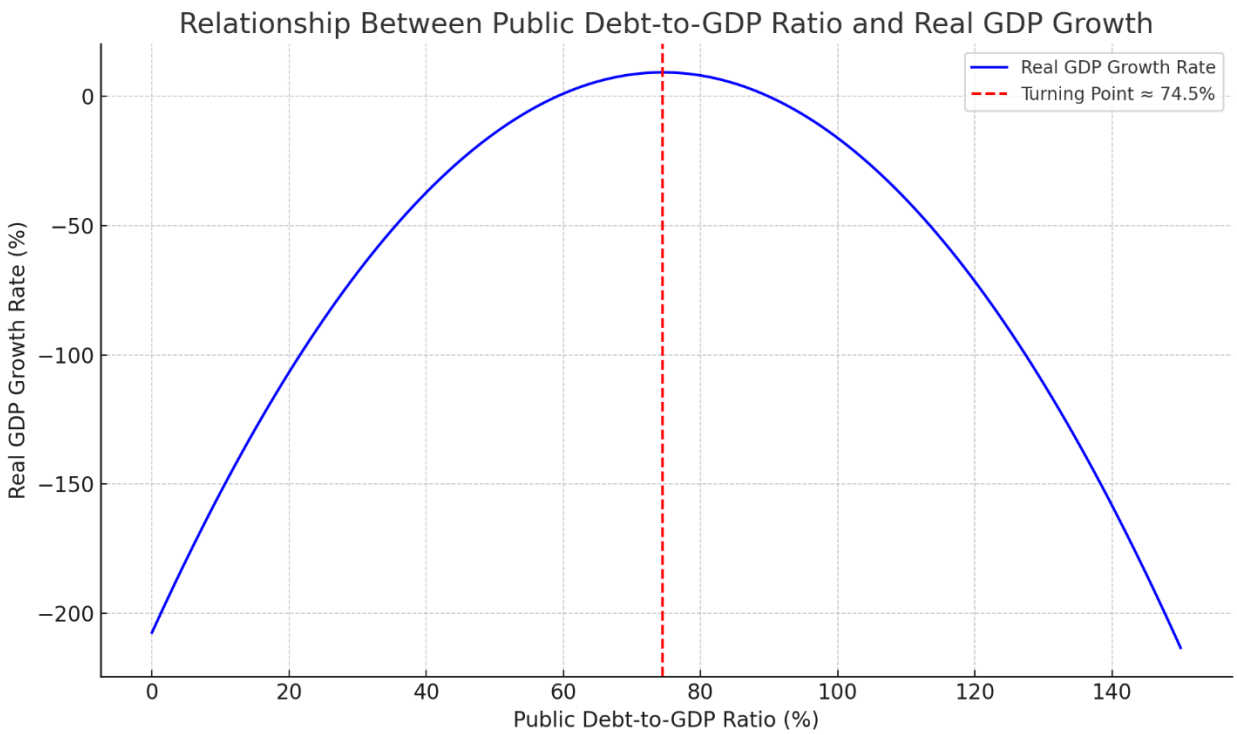
The value of β1=5.84 and β2 = -0.03

$$Debt^* = \frac{-5.84}{2\times -0.039}$$

$$Debt * = 74.2$$

This means that GDP growth is maximized when public debt is around 74.25 percent of GDP. Beyond this threshold, additional debt negatively impacts growth confirming inverted U-shaped hypothesis.

Threshold Effects of Public Debt on Real GDP Growth



Source : Author's own calculation

The graph illustrates an inverted U-shaped relationship between Public Debt- to- GDP ratio and Real GDP growth rate highlighting how the impact of debt on economic growth varies with its level. Initially, as the Debt-to-GDP ratio increases, real GDP growth also increases, suggesting that moderate public debt can stimulate growth through productive investment and fiscal expansion. However, beyond the turning point at approximately 74.5 percent further increase in debt begin to reduce growth , indicating diminishing returns and potential negative effects such as higher interest rate burden and crowding out of private investments. This visual representation confirms the existence of a threshold beyond which public debt becomes detrimental to economic performance, emphasizing the need for prudent fiscal management.

Key Findings

- The study confirms the hypothesized inverted U-shaped relationship between public debt and economic growth in India during the Post-FRBM period. Moderate public debt levels appear growth enhancing, but excessive debt becomes detrimental to economic growth.
- There is optimal range of public debt that supports economic growth. Policymakers should avoid excessive public borrowing as beyond a certain threshold it creates a detrimental effect on economic growth.

Conclusion

This study confirms a significant non-linear, inverted U-shaped relationship between public debt and real economic growth in India during the Post- FRBM period (2004-05 to 2023-24). Moderate levels of public debt positively contribute to growth by financing productive investments. However, beyond an estimated threshold of approximately 74.5% of GDP, further debt accumulation tends to hamper economic performance due to rising debt service cost and potential crowding out of private investments. Therefore, policymakers should aim to maintain public debt within the optimal range to balance fiscal sustainability and growth objectives. Instead of merely focusing on debt, emphasis should be placed on the efficient use of borrowed funds to support growth objectives such as infrastructure development, human capital formation and technological advancement. This approach will strengthen the effectiveness of the FRBM framework in promoting sustainable long-term economic growth.

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