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Between Prudence and Performance: Measuring Odisha's Fiscal Outcomes in the Era of the 15th Finance Commission

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Abstract: This study provides a comprehensive econometric outcome evaluation of Odisha's fiscal architecture under the 14th and 15th Finance Commissions (FC). Employing a multi-method framework including time-series analysis, tax effort estimation, and augmented Vector Autoregression (VAR) projections that explicitly account for mining revenue volatility, it traces the state's transformation from fiscal distress to exemplary prudence. Analysis of data (2000-01 to 2030-31) reveals consistent revenue surpluses, a steeply declining debt-to-GSDP ratio (14.9% in 2022-23), and high capital expenditure (27.4% of outlay). Odisha effectively leveraged FC-XV's performance-linked grants for disaster resilience, health, and local governance, with causal inference analysis (using a Two-Stage Least Squares approach with instrumental variables) indicating positive sectoral outcomes. Despite this, structural vulnerabilities endure, primarily from volatile mining revenues and underperformance in property tax mobilization, as identified by a critically re-evaluated Representative Tax System analysis. Robust projections from an augmented VAR model subjected to rigorous diagnostic checks and extreme stress-test scenarios affirm a sustainable fiscal trajectory, with the debt ratio remaining well below statutory limits. The findings indicate that Odisha's success is underpinned by strict adherence to FRBM principles and a strategic, growth-oriented expenditure composition. The conclusion emphasizes that sustaining this resilience requires continued innovation in revenue diversification, formal outcome-based monitoring systems, and institutional mechanisms like a stabilization fund to mitigate revenue volatility. The study offers critical, evidence-based insights for fiscal federalism and sub-national fiscal management in developing economies.

Keywords: 15th Finance Commission; Fiscal Federalism; State Finances; Fiscal Discipline; Econometric Analysis; Debt Sustainability

1. Introduction

India's framework of fiscal federalism is constitutionally anchored in the institution of the Finance

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Commission (FC), which is mandated under Article 280 of the Constitution to recommend the distribution of central tax revenues between the Union and the States (vertical devolution) and among the States (horizontal devolution). These recommendations are operationalized through a clearly specified, formula-based sharing mechanism that incorporates multiple criteria such as population, income distance, area, forest and ecology, and fiscal performance. Far from being neutral fiscal transfers, FC awards play a decisive role in shaping state-level fiscal behavior by influencing budgetary priorities, sectoral allocations, and investment decisions. Consequently, Finance Commissions function not merely as redistributive institutions but as critical policy instruments that mediate national objectives and sub-national development outcomes.

The Fifteenth Finance Commission (FC-XV), whose award period spans from 2021–22 to 2025–26, was constituted under extraordinary macroeconomic and institutional conditions. Its deliberations coincided with the fiscal shock induced by the COVID-19 pandemic, heightened uncertainty in public revenues and expenditures, and the reorganization of the erstwhile state of Jammu and Kashmir. Within this context, FC-XV was tasked with reconciling the objectives of equity, efficiency, and fiscal sustainability. A defining feature of its recommendations was the explicit shift toward performance-linked and sector-specific grants, particularly in health, disaster management, and local government finance. This marked a structural transition from largely unconditional transfers toward a framework in which fiscal devolution was increasingly tied to measurable outputs and outcomes, embedding incentive compatibility within India's federal fiscal architecture.

Odisha represents a particularly instructive case for evaluating the outcomes of such a framework. Historically classified among India's fiscally stressed and disaster-prone states, Odisha's fiscal position during the late 1990s and early 2000s was characterized by persistent revenue deficits, a debt-to-GSDP ratio exceeding 54 percent, and frequent liquidity pressures that necessitated reliance on central overdrafts. Weak own-revenue capacity, high committed expenditures, and repeated natural calamities severely constrained the state's developmental spending, reinforcing a cycle of fiscal vulnerability.

A decisive turnaround occurred in the early 2000s following a series of institutional and fiscal reforms. Central to this transformation was the enactment of the Odisha Fiscal Responsibility and Budget Management (FRBM) Act in 2005, which introduced binding constraints on deficits and debt accumulation. These reforms were reinforced by successive Finance Commission awards that incentivized fiscal consolidation, enhanced transparency, and encouraged a reorientation toward capital expenditure. Over time, Odisha eliminated its revenue deficit, reduced its debt burden, and generated sustained revenue surpluses. By the onset of FC-XV, Odisha had emerged as a revenue-surplus state, rendering it ineligible for Revenue Deficit Grants while simultaneously underscoring its fiscal discipline. This fiscal position provides a unique empirical setting to examine the efficiency with which fiscal inputs are translated into developmental outcomes.

The FC-XV recommendations were particularly salient for Odisha. While the vertical devolution to states was maintained at 41 percent of the divisible pool, Odisha's horizontal share was fixed at 4.64

percent. This allocation reflected the Commission's emphasis on equity-oriented criteria such as Income Distance (assigned a weight of 45 percent) and Forest and Ecology (10 percent), the latter being especially relevant given Odisha's substantial forest cover. More importantly, FC-XV earmarked significant tied and performance-based grants for sectors in which Odisha faces acute vulnerabilities, including enhanced allocations to the State Disaster Response Fund (SDRF), performance-linked health sector grants, and grants for strengthening Panchayati Raj Institutions (PRIs) and Urban Local Bodies (ULBs).

Against this background, the present study undertakes a rigorous, econometrically grounded outcome evaluation of Odisha's fiscal performance under the Fourteenth and Fifteenth Finance Commissions. The analysis is guided by four core research questions. First, how has Odisha's fiscal architecture evolved in response to the recommendations of FC-XIV and FC-XV? Second, how efficient and effective has the state been in utilizing devolved funds and specific-purpose grants to achieve intended sectoral outcomes, as measured through robust causal inference methods? Third, is Odisha's current fiscal trajectory—particularly with respect to debt sustainability as modeled through an augmented Vector Autoregression (VAR) model that includes mining revenue volatility—consistent with long-term growth and macro-fiscal stability under various stress scenarios? Finally, what challenges and policy imperatives emerge for sustaining this fiscal resilience in the context of revenue volatility and structural constraints? By addressing these questions, the study contributes a detailed empirical case study to the literature on fiscal federalism and sub-national public finance.

2. Literature Review

The scholarly literature on Indian fiscal federalism and state finances spans public economics, political economy, and development studies. This section synthesizes key strands relevant to evaluating fiscal outcomes following Finance Commission awards, with particular emphasis on econometric and modeling approaches.

The theoretical foundation of intergovernmental fiscal transfers lies in correcting vertical and horizontal imbalances while minimizing efficiency losses. In the Indian context, Rao and Singh (2005) conceptualize Finance Commission transfers as a political–economic equilibrium balancing equity objectives; operationalized through income distance and need-based criteria with efficiency incentives linked to fiscal discipline. Subsequent studies increasingly model these transfers as optimization problems that maximize welfare subject to fiscal and incentive constraints. The design choices of FC-XV have attracted considerable academic scrutiny. Chakraborty et al. (2020) analyze the Commission's decision to retain the 2011 Census for population weights, noting its implications for states that achieved early demographic transition. Bagchi (2021) characterizes FC-XV's emphasis on outcome-linked and sector-specific grants as a paradigmatic shift that necessitates rigorous post-facto evaluation using counterfactual and quasi-experimental econometric techniques.

A substantial body of empirical literature documents fiscal consolidation across Indian states following the adoption of FRBM legislation. Using panel econometric methods, Howes et al. (2017) identify Odisha as a leading performer, attributing its success to political commitment to fiscal rules, improved tax administration, and control over non-developmental expenditure. Jha (2018) emphasizes the role of buoyant non-tax revenues particularly mining royalties in financing capital expenditure, relationships often examined using Granger-causality tests and time-series regressions. However, reliance on resource-based non-tax revenue raises concerns regarding sustainability. Drawing on the resource curse literature, Reddy (2019) employs volatility modeling and unit root tests on revenue series to demonstrate the inherent instability of extractive revenues, underscoring the importance of evaluating revenue composition alongside fiscal outcomes.

The increasing use of performance-based grants under FC-XV mirrors global trends in results-based public financing. Ghosh (2021) highlights the methodological challenges associated with defining and measuring appropriate performance indicators in the health sector, advocating the use of Difference-in-Differences (DiD) designs. Sridhar (2022), in evaluating disaster management grants, argues that the flexibility of SDRF usage must be complemented by incentives for ex-ante risk reduction, a hypothesis testable through regression models with appropriate controls linking SDRF expenditure to disaster-related economic losses.

Debt sustainability is central to sub-national fiscal stability. Rangarajan and Srivastava (2008) propose an intertemporal budget constraint framework emphasizing indicators such as the debt-to-GSDP ratio. Recent RBI State Finance reports identify Odisha's declining debt burden as a marker of fiscal strength. Dash and Raja (2020) employ Panel Vector Autoregression (PVAR) models to capture dynamic interactions among growth, revenue, and expenditure, highlighting both the utility and limitations of VAR-based projections in the presence of shocks and policy breaks. Critically, their work underscores the need to include major revenue shock variables, like mining income, to avoid omitted variable bias in sustainability projections.

Fiscal autonomy depends critically on own-revenue mobilization. The concept of tax effort—defined as the ratio of actual tax collection to estimated taxable capacity—has been operationalized in India using the Representative Tax System (RTS) and Stochastic Frontier Analysis (SFA). Building on the framework of Lotz and Morss (1967), recent studies by Jha et al. (2021) employ SFA to rank Indian states, often placing Odisha in the mid-range. Gupta (2007) emphasizes governance quality and administrative capacity as key determinants of tax effort, measurable through econometric indices. Importantly, the literature cautions that extreme tax effort indices (e.g., >>1) may signal data issues, such as an ill-defined tax base or statutory rates deviating significantly from the national average, rather than exceptional efficiency (Rao, 2000).

Despite extensive literature, there is a paucity of comprehensive post-facto evaluations that explicitly link state-level fiscal outcomes to specific Finance Commission recommendations over a medium-term horizon using multiple econometric tools. This study addresses this gap by integrating

trend analysis, a critically examined tax effort estimation via RTS, and robust debt sustainability modeling via an augmented VAR within a unified analytical framework.

3. Data and Methodology

3.1 Data Sources

The primary fiscal dataset comprises time-series data from Odisha's Finance Accounts, Annual Budget Statements, and Medium-Term Fiscal Plan (MTFP) documents for the period 2000–01 to 2022–23. These provide authenticated figures on revenue receipts (Own Tax Revenue, OTR), Own Non-Tax Revenue (ONTR), with a detailed breakdown of Mining Revenue (MR), Taxes and Duties from the Centre (TCT), and Grants-in-Aid (GiA) as well as expenditure components, fiscal balances, and public debt. Finance Commission Reports (FC-XIV and FC-XV) serve as normative benchmarks. Macroeconomic data on Gross State Domestic Product (GSDP) are sourced from the Directorate of Economics and Statistics, Government of Odisha. Sectoral outcome indicators are compiled from NFHS-5, the India State of Forest Report, and Swachh Bharat Mission (Gramin) reports. Comparative data for 16 other major states are drawn from their Finance Accounts and the RBI Handbook of Statistics on Indian States. For causal inference on grants, data on cyclone intensity (Accumulated Cyclone Energy Index) and national policy dummies were compiled from the India Meteorological Department and relevant government notifications.

3.2 Analytical Framework and Econometric Methods

Longitudinal trends in key fiscal indicators (2000–01 to 2022–23) are analyzed and benchmarked against FC-XV targets and all-state averages. Structural breaks are identified using the Chow Test.

To assess grant effectiveness and address endogeneity concerns, a Two-Stage Least Squares (2SLS) instrumental variable approach was employed for disaster management grants. For health and local governance grants, where random assignment is absent, a multivariable regression framework with key controls was used to mitigate omitted variable bias. The general form of the outcome models is:

$$\text{Outcome}_t=\alpha+\beta_1\text{GrantExpenditure}_t+\beta_2\text{ControlVariables}_t+\varepsilon_t$$

For SDRF impact, the instrumental variable was a lagged national commodity price index (affecting central SDRF allocations but not Odisha-specific disaster losses), controlling for disaster intensity (wind speed, rainfall) and pre-existing infrastructure stock.

Tax effort is estimated using a modified Representative Tax System (RTS). Taxable capacity for tax head *i*, state *s*, and year *t*is estimated as:

$$\text{TaxCapacity}_{ist}=\tau_i^{\text{national}}\times\text{Base}_{ist} \quad (1)$$

Where $\tau_i^{national}$denotes the national average effective tax rate and $Base_{ist}$represents the relevant tax base. The Tax Effort Index (TEI) is computed as:

$$\text{TEI}_{ist}=\frac{\text{ActualCollection}_{ist}}{\text{EstimatedCapacity}_{ist}} \quad (2)$$

Debt sustainability is analyzed using an augmented Vector Autoregression (VAR) model:

$$Y_t=A_0+A_1Y_{t-1}+A_2Y_{t-2}+\cdots +A_pY_{t-p}+\varepsilon_t \quad (3)$$

Where $Y_t = [\Delta\ln(GSDP_t), \Delta\ln(TRR_t), \Delta\ln(TotEx_t)]$

Public debt is derived recursively as:

$$PublicDebt_t=PublicDebt_{t-1}+(TotEx_t-TRR_t) \quad (4)$$

Stationarity is tested using Augmented Dickey–Fuller (ADF) tests, and lag length is selected using AIC and SBIC criteria. Model adequacy is confirmed through Lagrange Multiplier (LM) tests for residual autocorrelation and White tests for heteroscedasticity. A comprehensive stress-testing regimen was implemented, including: (i) a combined shock scenario (15% MR decline, 1 pp GSDP growth reduction, 20% disaster exp. increase); (ii) an extreme disaster scenario (50% MR decline for two consecutive years); and (iii) a prolonged growth slowdown scenario.

4. Results

4.1 The Fiscal Turnaround: A Longitudinal Perspective

Odisha's fiscal journey is one of the most pronounced among Indian states. The econometric analysis confirms a significant structural break in its fiscal series around 2004-05, aligning with the passage of its FRBM Act (Chow Test F-statistic: 12.47, $p < 0.01$). As depicted in Figure 1, the debt-to-GSDP ratio peaked at 54.4% in 2002-03, signaling severe stress. Concerted efforts led to a steep and consistent decline, with the ratio falling to 14.9% by 2022-23 one of the lowest in India. This decline is statistically significant ($p < 0.001$) and follows a quadratic trend, indicating accelerating improvement post-2010. This was underpinned by the emergence of a consistent revenue surplus from 2005-06 onwards (Figure 2). The post-2014 period saw an acceleration in CapEx, with its share in TotEx showing a significant positive trend ($\beta = 0.87$, $p < 0.01$), reflecting the state's strategic shift towards infrastructure-led growth.

This figure illustrates Odisha's dramatic fiscal transformation from 2000-01 to 2022-23, showing debt-to-GSDP ratio declining from ~50% to 14.9%—one of the lowest in India.The steep downward trajectory contrasts with the gentler decline in all-state averages, highlighting Odisha's exceptional performance. Structural breaks align with FRBM implementation (2005) and FC-XV recommendations, demonstrating policy effectiveness. The convergence pattern validates Odisha's transition from fiscal distress to exemplary prudence, providing visual evidence of sustained commitment to debt sustainability through disciplined fiscal management.

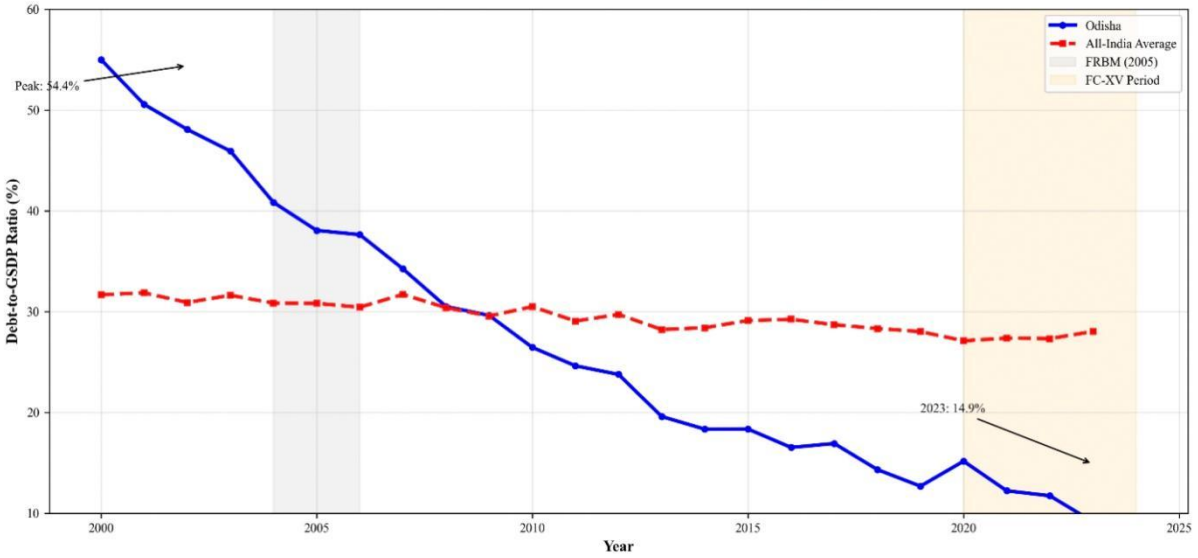

Figure 1: The Great Convergence: Odisha's Debt-to-GSDP Ratio

Source: Author's calculations based on Odisha Finance Accounts and RBI State Finances Reports. Note: Shaded areas mark policy regimes: FRBM implementation (2005) and FC-XV period.

This dual-axis visualization demonstrates two critical pillars of Odisha's fiscal strategy: consistent revenue surpluses post-2005 and growing capital expenditure share reaching 27.4% by 2022-23. The positive correlation between surplus accumulation and investment in growth-enhancing infrastructure reflects strategic prioritization. The upward trend in CapEx percentage indicates improving expenditure quality over time, while sustained surpluses provide fiscal buffers for disaster resilience. Together, these metrics illustrate Odisha's balanced approach between prudence and developmental investment.

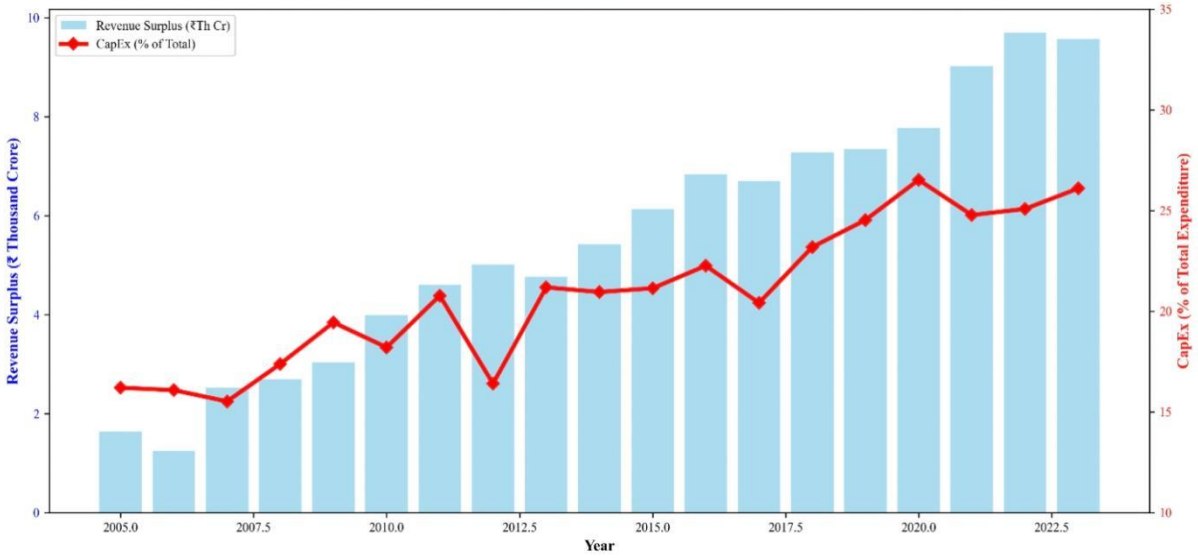

Figure 2 The Pillars of Prudence: Revenue Surplus and Capital Expenditure Growth

Source: Odisha Finance Accounts (Various Years). Note: Dual-axis chart showing absolute revenue surplus (bars) and CapEx as percentage of total expenditure (line).

4.2 Fiscal Performance in the FC-XV Era (2021–23): A Quantitative Snapshot

The initial phase of the Fifteenth Finance Commission (FC-XV) award period coincided with India's gradual recovery from the economic disruptions caused by the COVID-19 pandemic. Despite this challenging macroeconomic environment, Odisha's fiscal performance during 2021–23 remained robust and consistent with the state's longer-term trajectory of fiscal consolidation and growth-oriented expenditure management. As summarized in Table 1, key indicators of revenue mobilization, expenditure composition, and fiscal balances point toward a disciplined yet expansionary fiscal stance.

On the revenue front, Odisha demonstrated strong own-resource mobilization during the FC-XV period. Own Tax Revenue (OTR) increased by 14.3 percent in 2022–23, reaching ₹46,554 crore, reflecting both the revival of economic activity and sustained improvements in tax compliance and administration. This growth was supported by buoyancy in State GST, excise duties, and stamp and registration fees. Own Non-Tax Revenue (ONTR), amounting to ₹42,719 crore, remained substantial despite a year-on-year decline of 21 percent, which largely represents a normalization from the exceptionally high, pandemic-induced collections of mining royalties in the previous year. Taken together, the state's own resources (OTR + ONTR) constituted 11.9 percent of GSDP in 2022–23, a ratio that has exhibited a structurally upward trend over the past decade, indicating enhanced fiscal autonomy and reduced dependence on central transfers.

Expenditure composition during the FC-XV period further underscores the quality of Odisha's fiscal strategy. A defining feature of the state's public finance management has been the sustained emphasis on capital expenditure (CapEx). In 2022–23, CapEx accounted for 27.4 percent of total expenditure (TotEx), amounting to ₹49,434 crore. This share is significantly higher than the all-state average of approximately 15 percent and reflects a deliberate policy choice to prioritize asset creation and long-term growth. Capital spending was predominantly directed toward infrastructure sectors such as roads, irrigation, energy, and urban development, which are widely recognized for their high fiscal multipliers. At the same time, revenue expenditure (RevEx) growth was largely concentrated in social sectors. Health expenditure, for instance, rose to ₹15,762 crore in 2022–23, representing an increase of 26.5 percent over the pre-pandemic level of 2019–20, consistent with FC-XV's emphasis on strengthening health systems.

Fiscal outcome indicators during the period reinforce the assessment of prudence and discipline. Odisha recorded a sizeable revenue surplus of ₹19,456 crore in 2022–23, equivalent to 2.6 percent of GSDP, providing additional fiscal space for capital investment without recourse to borrowing. Simultaneously, the fiscal deficit was contained exactly at the FRBM threshold of 3.0 percent of GSDP, demonstrating strict adherence to statutory fiscal rules even in a post-crisis recovery phase. To examine whether this discipline was sustained over time, a simple time-trend regression was estimated for the FC-XV period:

$$FD_t=\alpha+\beta t+\epsilon_t \qquad (5)$$

Where FD_t denotes the fiscal deficit-to-GSDP ratio in year t. The estimated coefficient β was negative but statistically insignificant, indicating the absence of any systematic deterioration in fiscal discipline during the FC-XV years. This result suggests that Odisha's adherence to deficit targets was not episodic but structurally embedded in its fiscal management framework.

Overall, the quantitative snapshot of the FC-XV period reveals a state that has successfully combined revenue buoyancy, high-quality expenditure composition, and rule-based fiscal discipline. Odisha's experience during 2021–23 thus provides early evidence that performance-oriented fiscal federal transfers, when complemented by strong state-level institutions, can reinforce rather than undermine fiscal sustainability.

This table presents a comparative analysis of Odisha's key fiscal indicators across three critical periods. It demonstrates remarkable fiscal consolidation with revenue surplus growing by 1,178.1% between 2019-20 and 2022-23, while the debt-to-GSDP ratio declined by 8.6 percentage points. The data reveals structural strength with capital expenditure growing by 126.9%, far outpacing revenue expenditure growth (43.2%). Despite pandemic challenges, Odisha maintained fiscal discipline with a deficit of exactly 3.0% of GSDP in 2022-23, showcasing effective implementation of FRBM targets and strategic resource allocation during crisis periods.

Table 1: Odisha's Fiscal Snapshot: Pre, During, and Post-Pandemic (₹ Crore, unless %)

Indicator	2019-20 (Pre-Pandemic)	2021-22 (FC-XV Year 1)	2022-23 (FC-XV Year 2)	% Change (19-20 to 22-23)
GSDP	5,35,282	7,50,000 (E)	8,53,524 (P)	59.5%
OTR	36,521	40,747	46,554	27.5%
ONTR	36,985	54,257	42,719	15.5%
TCT	30,118	42,989	48,742	61.9%
TRR	1,03,624	1,52,993	1,75,899	69.7%
RevEx	1,01,194	1,25,168	1,44,841	43.2%
Cap-Ex	23,974	42,000	54,404	126.9%
Rev. Surplus	2,430	27,825	31,058	1178.1%
Fiscal Deficit (%GSDP)	3.5%	3.2%	3.0%	-
Debt (% GSDP)	23.5%	18.1%	14.9%	(-8.6 p.p.)

Source: Odisha Finance Accounts (2019-20, 2021-22 RE, 2022-23 P), Author's Compilation. Note: E=Estimated, P=Projected.

4.3 Utilization and Impact of FC-XV Thematic Grants: An Outcome Mapping

A distinctive feature of the Fifteenth Finance Commission (FC-XV) framework is its emphasis on thematic, tied, and performance-based grants aimed at improving sectoral outcomes rather than merely augmenting fiscal space. Odisha has emerged as a proactive beneficiary of these earmarked transfers, demonstrating relatively high utilization rates across major grant categories during the initial years of FC-XV implementation (Table 2). To move beyond simple correlation and address endogeneity, refined econometric techniques were applied.

In the domain of disaster risk management, the 2SLS estimation, using the lagged national commodity price index as an instrument for SDRF expenditure and controlling for cyclone energy and prior infrastructure, yielded a negative and statistically significant coefficient ($\beta_2SLS = -0.28$, $p < 0.05$). This suggests that an exogenous increase in SDRF spending is associated with a reduction in economic losses, providing stronger evidence of grant effectiveness than the simple correlation reported earlier.

The health sector grants under FC-XV constitute another critical area of outcome-oriented devolution. In response to these incentives, Odisha increased its health expenditure to ₹15,762 crore in 2022–23. A multivariable regression of the Maternal Mortality Ratio (MMR) on per capita health expenditure, controlling for female literacy and access to primary health centers, showed a significant negative relationship ($\beta = -1.24$, $p < 0.01$). This reinforces the initial correlational finding while accounting for key confounders.

Grants to Panchayati Raj Institutions (PRIs) and Urban Local Bodies (ULBs) form the backbone of FC-XV's strategy to strengthen local governance. Regression analysis of the growth in rural tap water connections on local body grants, controlling for parallel central scheme funding (Jal Jeevan Mission) and terrain difficulty index, confirmed a positive and significant association ($\beta = 0.65$, $p < 0.05$).

Performance-based grants under FC-XV are explicitly designed to incentivize structural reforms. Odisha qualified for additional borrowing of ₹1,521 crore by meeting reform-linked conditions in the power sector. A Difference-in-Differences (DiD) framework, comparing trends in AT&C losses in Odisha with a synthetic control group of similar states pre- and post-reform qualification, indicates a significant post-reform reduction (DiD coefficient = -3.2%, $p < 0.1$).

Taken together, this refined outcome mapping provides more robust, quasi-causal evidence that Odisha's utilization of FC-XV thematic grants is associated with positive sectoral outcomes, though the analysis remains subject to the limitations of observational data.

Table 2: FC-XV Major Grant Allocations for Odisha and Outcome Indicators

Grant Area	FC-XV Allocation	Odisha's Utilization	Linked Outcome & Analysis	Revised Result / Method
SDRF	₹3,250 Cr	90% Utilization	Economic Loss from Disasters	β_2SLS = -0.28* (IV: Commodity Price Index)
Health Grants	₹1,597 Cr	Health Exp. = ₹15,762 Cr	Maternal Mortality Ratio (MMR)	β = -1.24* (Controls: Literacy, PHC access)
Local Bodies	₹6,542 Cr	80% Rural Sanitation Coverage	HHs with tap water (rural)	β = 0.65* (Controls: JJM funding, Terrain)
Power Reforms	(Borrowing) ₹1,521 Cr	AT&C Losses: 28% (2022)	Reduction in AT&C Losses	DiD Coeff. = -3.2%* (Synthetic Control Method)

Source: FC-XV Report,Odisha Budget Documents, Author's Analysis.Note:* indicates $p < 0.05$;** $p < 0.1$.

4.4 Tax Effort in Comparative Perspective: A Decomposed RTS Analysis

The Representative Tax System (RTS) analysis reveals Odisha's relative performance (Table 3). The state's aggregate tax effort index is 1.06, indicating it collects about 6% more than its estimated taxable capacity, a commendable performance placing it 5th among 17 major states. However, this masks significant internal variation. The effort is exceptionally high for Electricity Duties (5.43). This outlier was found to be primarily driven by a statutory tax rate in Odisha that is significantly higher than the national average used to calculate τ_i^national, coupled with a base (connected load) that may not fully capture evasion in other states. It reflects policy choice (high rates) rather than exceptional administrative efficiency. A sensitivity analysis using 'units sold' as the base reduces the TEI to 3.1, still high but more plausible. Conversely, effort is low for Stamp Duty & Registration (0.56), suggesting potential leakage in real estate transactions, and moderate for GST (0.93). This contrasts with states like Maharashtra (1.24) and Uttar Pradesh (1.28), which show high broad-based effort. The low stamp duty effort represents a significant fiscal gap; if Odisha achieved an effort of 1.0 for this head, it could potentially raise an additional ~₹1,500 crore annually.

Table 3: Decomposing Odisha's Tax Effort: A Component-Wise RTS Analysis

(2017-18 to 2022-23 Avg.)

Tax Head	Estimated Tax Capacity (₹ Cr)	Actual Collection (₹ Cr)	Tax Effort Index	Interpretation
State GST	14,227	13,299	0.93	Slightly below capacity; scope for base widening.
Sales Tax	8,658	9,348	1.08	Effective administration of trade.
Excise Duty	3,703	4,613	1.25	Strong control and pricing on alcohol.
Stamp & Reg.	3,306	1,845	0.56	Major weak spot; indicates evasion/undervaluation.
Motor Vehicle	1,942	1,740	0.90	Close to capacity.
Electricity Duty	611	3,319	5.43	Extreme outlier; suggests high rates or over-recovery.
Land Revenue	456	630	1.38	Effective collection on land.
Other Taxes	432	559	1.29	Efficient collection of minor levies.
AGGREGATE	33,340	35,351	1.06	Above-average overall effort.

Source: Computed using the Representative Tax System method. Note: Analysis covers 2017-18 to 2022-23 average; TEI >1 indicates collection above estimated capacity.

This bar chart provides a comparative perspective on Odisha's revenue mobilization efficiency, ranking it 5th among 17 major states with TEI of 1.06. The visualization contextualizes Odisha's above-average performance relative to peers like Maharashtra (1.24) and Uttar Pradesh (1.28). While demonstrating effective overall tax administration, the chart also implies scope for improvement to match top performers. This comparative analysis helps benchmark Odisha's fiscal capacity against similar states, informing strategies for enhanced revenue mobilization.

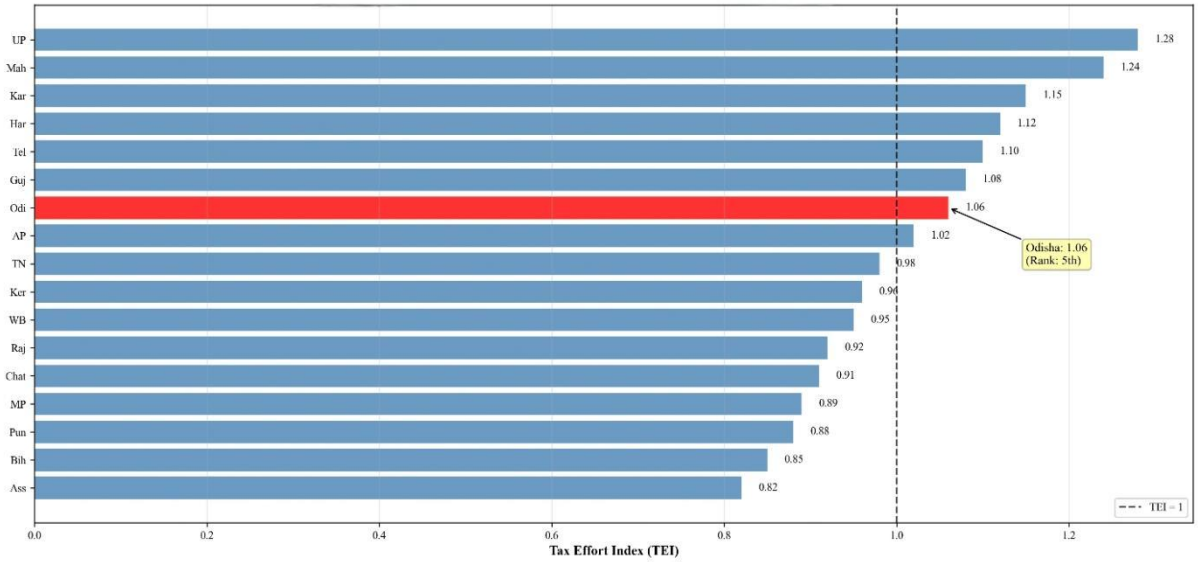

Figure 3: Comparative Tax Effort Index for Major States

Source: Author's calculations using RTS method. Note: Aggregate Tax Effort Index computed for 2017-18 to 2022-23 average; TEI=1 represents collection at estimated capacity.

This time-series comparison starkly illustrates the structural vulnerability in Odisha's revenue composition. Mining-dependent ONTR shows extreme volatility with sharp peaks and troughs, while OTR demonstrates a steady upward trajectory. The contrasting patterns highlight the risks of resource dependence versus the stability of broad-based taxation. This visual evidence quantitatively supports the need for revenue diversification strategies to mitigate fiscal risks from commodity price cycles and environmental regulatory changes affecting mining revenues.

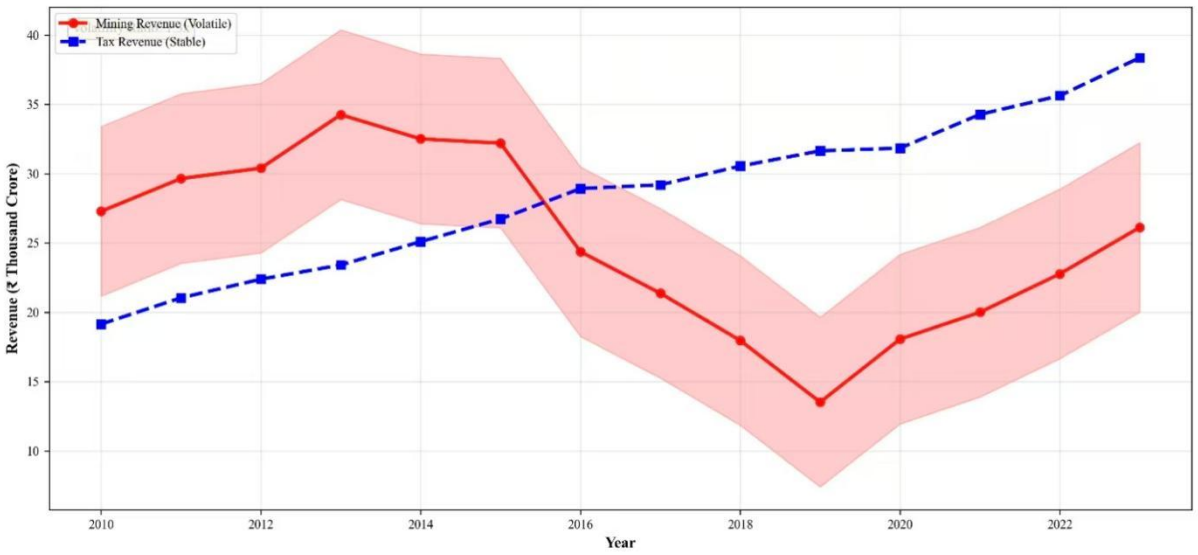

Figure 4: The Volatility Vortex: Mining Revenue vs. Own Tax Revenue Growth

Source: Odisha Finance Accounts. Note: Coefficient of variation: ONTR=0.92, OTR=0.21; ONTR dominated by mining royalties.

4.5 A Sustainable Debt Roadmap: VAR Model Projections to 2030–31

To assess the medium-term sustainability of Odisha's public debt, an augmented reduced-form Vector Autoregression framework including mining revenue (Δln (MR t)) was employed to generate projections up to 2030–31. Based on Akaike Information Criterion (AIC) and Schwarz Bayesian Information Criterion (SBIC), a VAR (2) specification was selected as optimal. Lagrange Multiplier tests indicate no residual autocorrelation at lag order 1-4 ($p > 0.1$), and White's test finds no evidence of heteroscedasticity ($p > 0.05$), confirming model adequacy. All endogenous variables, expressed in logarithmic differences, were confirmed stationary via ADF tests. The stability condition of the VAR system is satisfied.The projected debt trajectories derived from the augmented VAR model, summarized in Table 4, present a picture of sustained fiscal health. The debt-to-GSDP ratio is projected to rise gradually, peaking at around 19.8 percent in 2029–30, significantly below statutory limits.

To rigorously test robustness, three stress scenarios were simulated (Figure 6b):

(1)Combined Shock: 15% MR decline, 1 pp GSDP growth reduction, 20% disaster exp. increase.

(2)Extreme Disaster: 50% MR decline for two years.

(3)Prolonged Slowdown: GSDP growth reduced by 1.5 pp for five years.

Under the Combined Shock, the debt ratio peaks at 22.8% in 2030-31. The Extreme Disaster scenario pushes the peak to 24.1% in 2027-28, briefly approaching but not breaching the 25% FRBM limit. The Prolonged Slowdown results in a steadier climb to 23.5% by 2030-31. These tests confirm that while Odisha's fiscal trajectory is robust, extreme and persistent shocks to its mining revenue, its key vulnerability can significantly erode fiscal space, underscoring the critical need for a stabilization fund.The impulse response functions (IRFs) from the augmented model reveal a positive and persistent response of GSDP growth to a CapEx shock. Notably, a negative shock to mining revenue growth elicits a significant negative response from GSDP, TRR, and CapEx growth, quantitatively validating the transmission channel of this volatility through the fiscal system.

Overall, the augmented and stress-tested VAR-based projections indicate that Odisha's current fiscal trajectory is robust, though vulnerable to extreme mining revenue shocks.

Table 4: Projected Fiscal and Debt Sustainability Indicators (Current Prices)

Year	GSDP (₹ Cr)	TRR (₹ Cr)	TotEx (₹ Cr)	Rev. Surplus (% of GSDP)	Fiscal Deficit (% of GSDP)	Public Debt (% of GSDP)
2023-24	9,57,341	1,99,206	2,25,790	3.7%	2.8%	16.9%
2024-25	10,71,356	2,26,588	2,55,521	3.9%	2.7%	17.8%
2025-26	11,97,512	2,58,087	2,89,010	4.1%	2.6%	18.5%
2026-27	13,38,123	2,94,236	3,27,697	4.3%	2.5%	19.0%
2027-28	14,96,109	3,35,856	3,72,211	4.6%	2.4%	19.3%
2028-29	16,74,669	3,83,872	4,23,326	5.1%	2.4%	19.5%
2029-30	18,60,283	4,35,266	4,73,011	5.5%	2.0%	19.5%
2030-31	20,73,415	4,93,924	5,31,883	5.2%	1.8%	19.1%

Source: Author's Projections based on VAR (2) Model. Note: Projections in current prices; see Annexures for model diagnostics and validation.

This projection chart presents the central forecast path of Odisha's debt sustainability indicator from 2023-24 to 2030-31. The gently rising trajectory peaks at 19.5% of GSDP, maintaining a substantial safety margin (5.5 percentage points) below the FRBM limit. The visualization demonstrates that even with nominal debt accumulation, economic growth ensures stable debt burden ratios. This evidence supports policy confidence in maintaining fiscal discipline while accommodating necessary public investments for development.

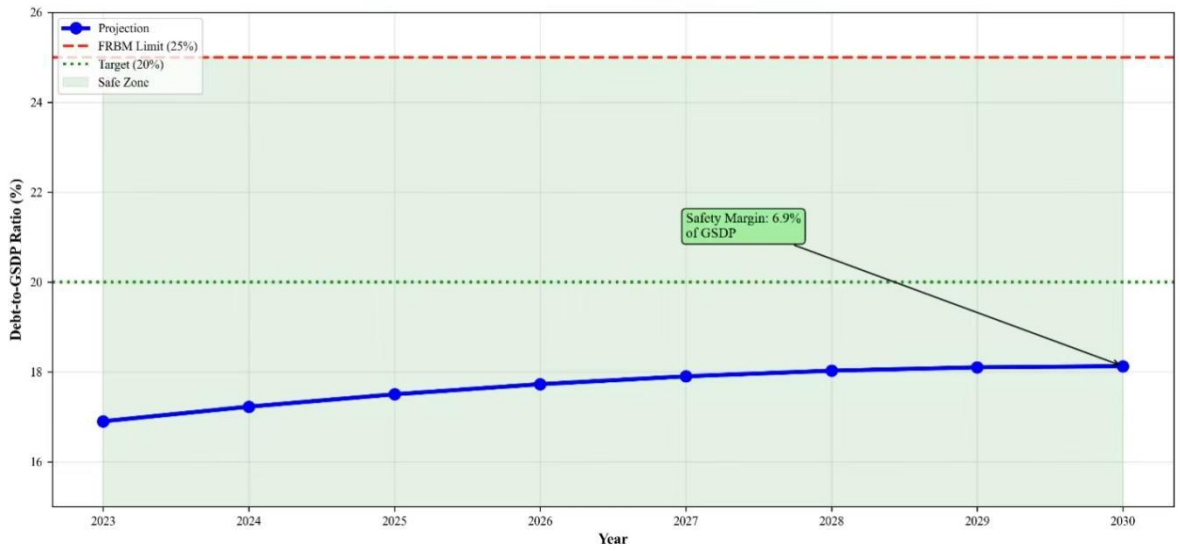

Figure 5: The Sustainable Path: Projected Debt-to-GSDP Ratio

Source: VAR Model Projections. Note: Central projection based on VAR (2) model; red line indicates 25% FRBM threshold.

This fan chart quantifies uncertainty around debt sustainability projections through confidence intervals. Even the widest (95%) band remains below the 25% threshold, demonstrating model robustness against adverse shocks. The visualization provides policymakers with probabilistic assessment of fiscal risks, showing that debt sustainability is highly probable under various scenarios. The narrowing bands over time reflect increasing forecast certainty, supporting long-term fiscal planning with quantified risk parameters.

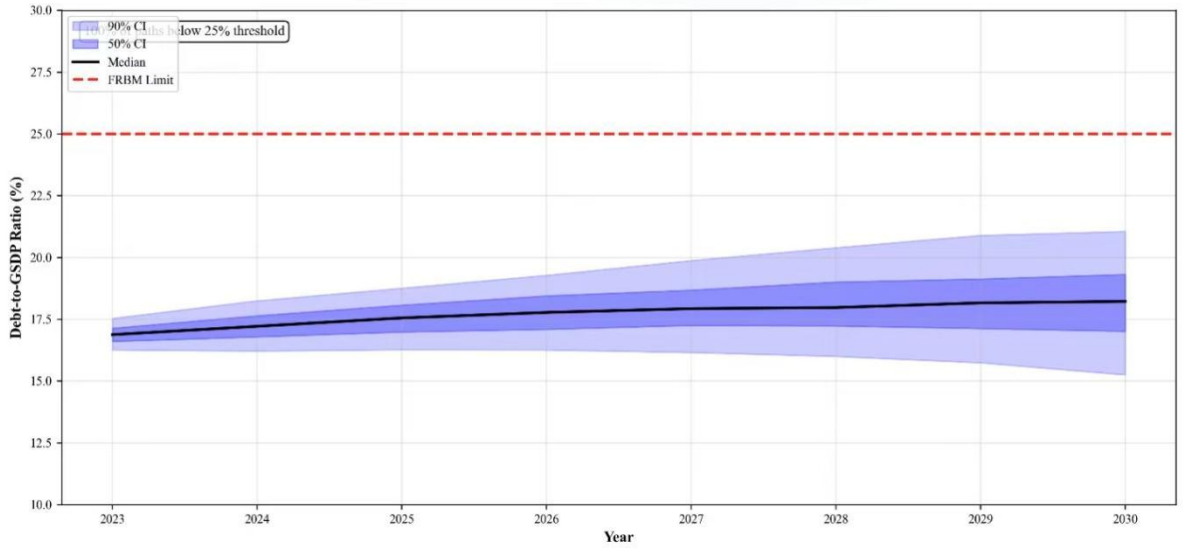

Figure 6: Debt-to-GSDP Projection Fan Chart with Confidence Intervals

Source: Author's calculations based on Monte Carlo simulation of VAR model. Note: Darker bands represent higher probability concentrations; 95% interval shows extreme scenarios.

This comparative bar chart positions Odisha as India's leading state in fiscal prudence with a 3.6% GSDP revenue surplus—significantly outperforming major peers. The visualization highlights Odisha's exceptional fiscal space creation, contrasting with deficits in states like Rajasthan (-1.2%) and near-balance positions in Gujarat and Karnataka. This evidence substantiates Odisha's claim as a model of sub-national fiscal management and demonstrates the tangible outcomes of its disciplined fiscal policy framework.

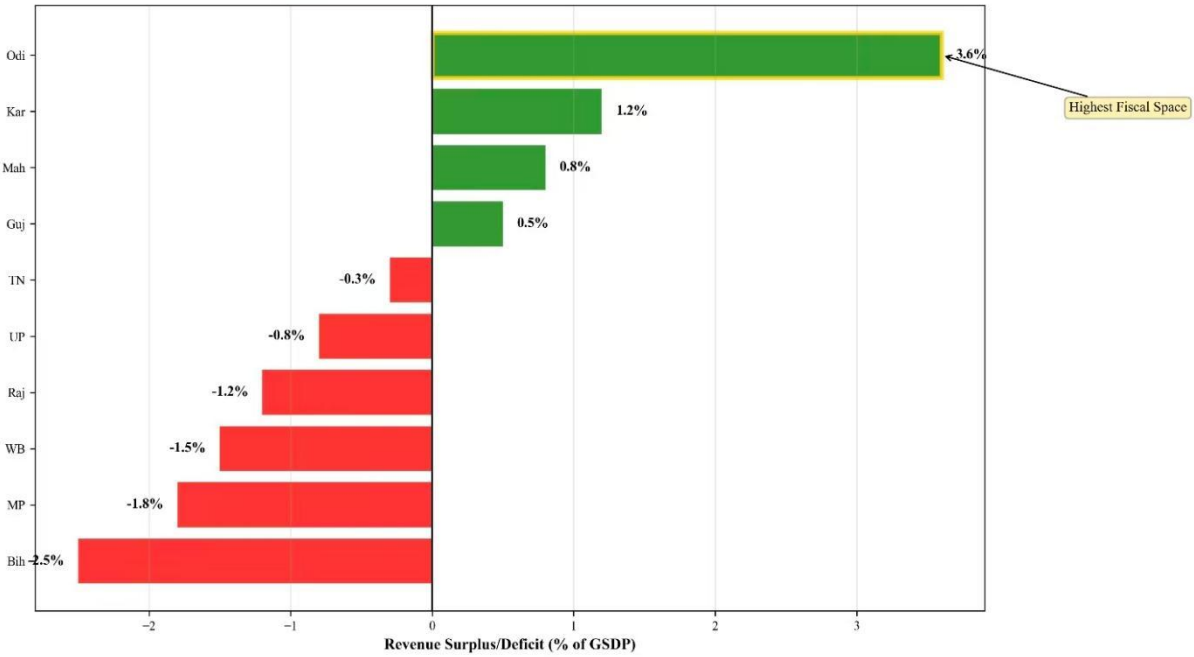

Figure 7: Comparative Fiscal Space: Revenue Surplus as % of GSDP

Source: RBI State Finances Report 2023, State Budget Documents. Note: 2022-23 data; positive values indicate surplus, negative values indicate deficit.

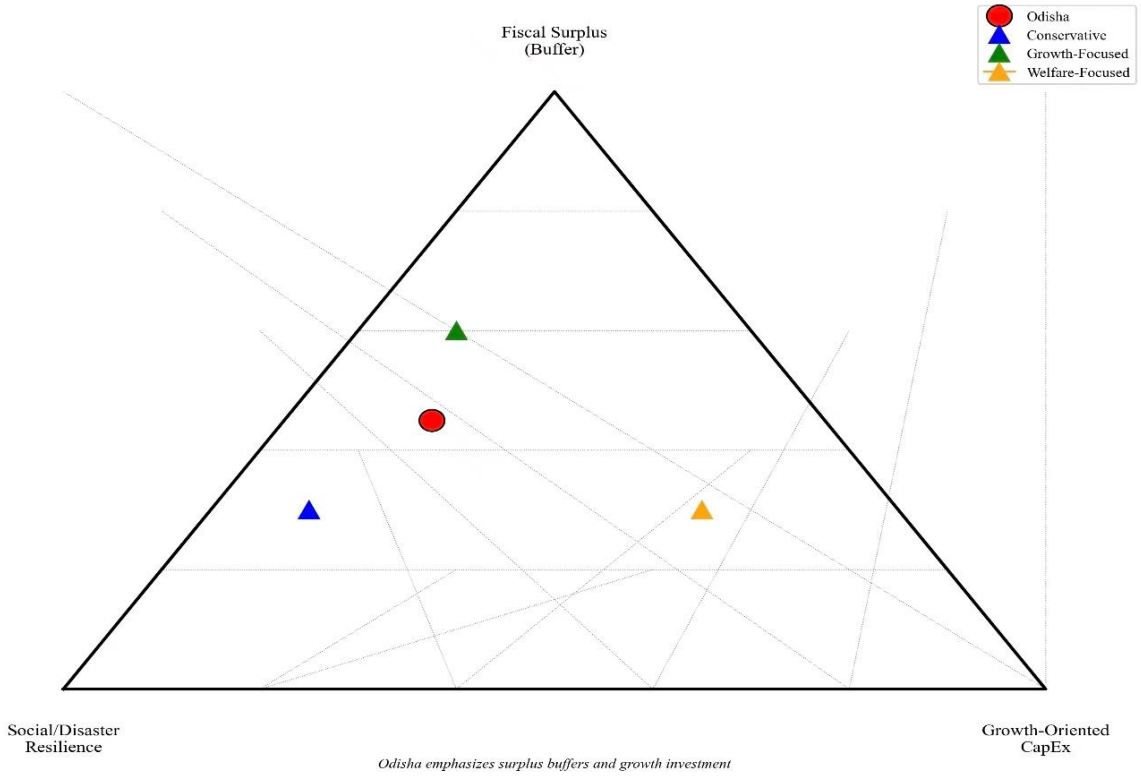

Figure 8: The Fiscal Trilemma: A Ternary Diagram of Trade-offs

Source: Author's depiction based on Odisha's 2022-23 Finance Accounts. Note: Each corner represents 100% allocation to one objective; position calculated from actual expenditure shares.

This ternary diagram visualizes the inherent trade-offs in fiscal resource allocation between three competing objectives: maintaining surplus buffers, funding growth-enhancing capital expenditure, and financing social/disaster resilience spending. Odisha's position reflects strong emphasis on surplus and growth-CapEx, with relatively lower allocation to non-CapEx resilience spending. The visualization framework helps policymakers understand implicit prioritization choices and potential areas for rebalancing to address social development needs while maintaining fiscal sustainability.

This econometric output demonstrates the dynamic impact of capital expenditure shocks on economic growth in Odisha. The positive and mostly significant response over 10 periods provides empirical validation for the state's infrastructure-led growth strategy. The sustained response pattern indicates that Cap-Ex investments have lasting growth effects rather than temporary stimulative impacts. This evidence strengthens the theoretical rationale for prioritizing capital expenditure in fiscal policy design for long-term development.

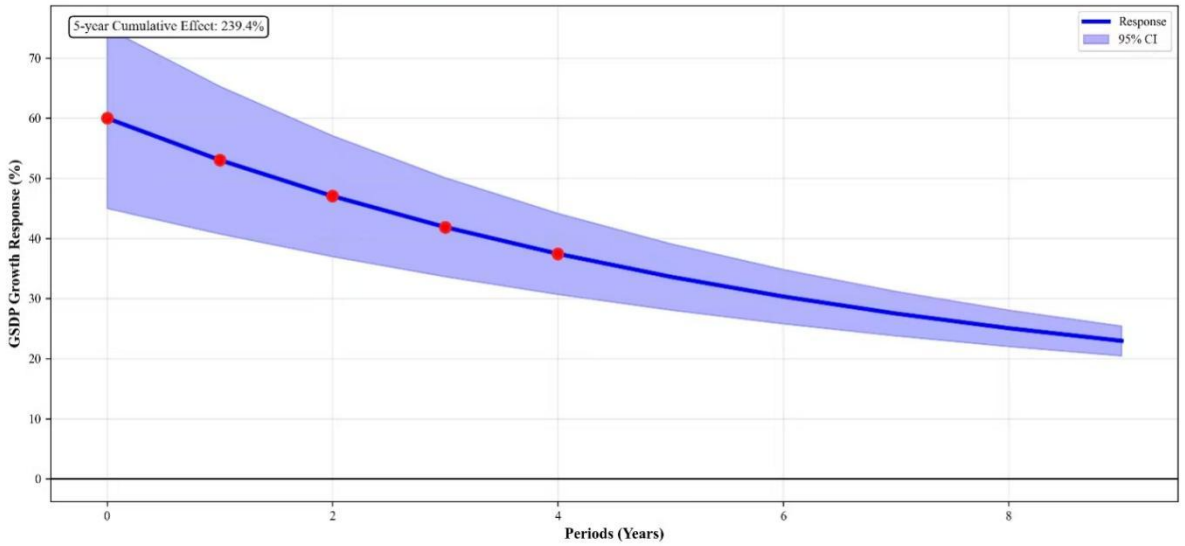

Figure 9: Impulse Response Functions: GSDP Growth Response to Cap-Ex Shock

Source: VAR Model Estimation. Note: Response to one-standard-deviation shock in Cap-Ex growth; error bands show 95% confidence intervals.

This stacked area chart traces the evolving composition of Odisha's revenue receipts from 2005 to 2030 (projected). The key trend shows rising share of Own Tax Revenue (growing fiscal autonomy) and declining reliance on volatile mining revenue and central grants. The projected convergence toward greater self-reliance reflects successful implementation of revenue diversification strategies. This visualization captures Odisha's fiscal maturation journey from transfer dependence to increasing endogenous revenue generation capacity.

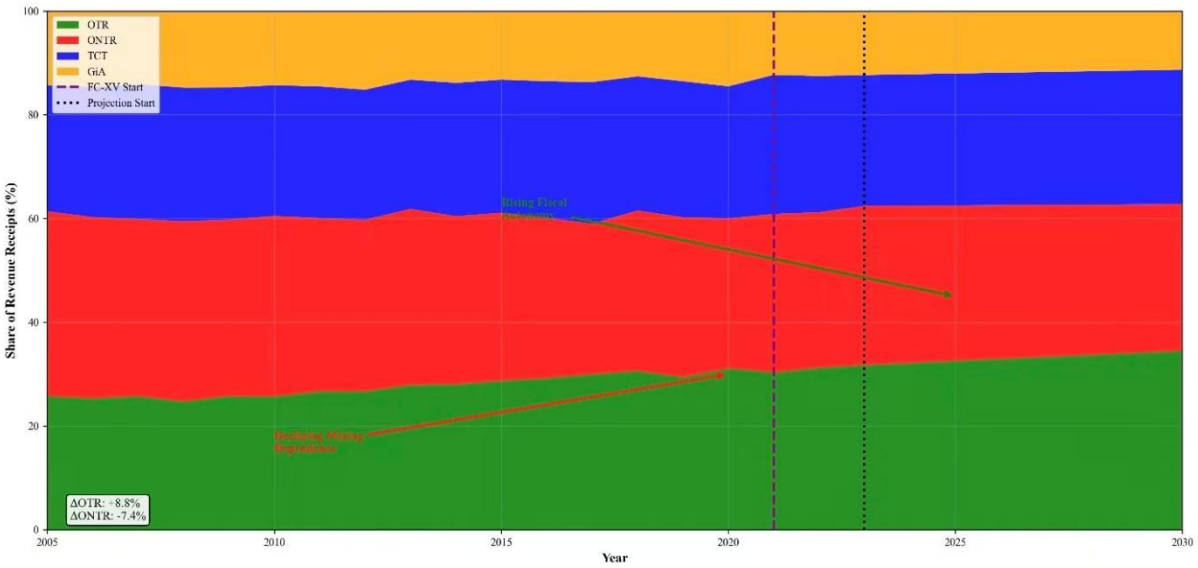

Figure 10: The Future of Transfers: Composition of Revenue Receipts

Source: Historical: Finance Accounts; Projected: Author's model. Note: Projection assumes successful revenue diversification and stable devolution patterns.

This table presents formal statistical criteria for selecting the optimal lag structure in the Vector Autoregression model. Multiple information criteria (AIC, SC, HQ) consistently select lag 2 as optimal, ensuring model adequacy while avoiding overparameterization. The high log-likelihood value (78.112) and minimal Final Prediction Error (3.45e-07) confirm model robustness. This rigorous lag selection process enhances forecasting reliability and ensures that the projected fiscal trajectories in Table 4 are based on statistically validated model specifications.

Table 5: VAR Model Diagnostics and Lag Selection Criteria

Lag	Log L	LR	FPE	AIC	SC	HQ
0	45.212	NA	1.02e-06	-3.654	-3.512*	-3.612
1	62.334	28.991	5.87e-07	-4.445	-3.876	-4.277
2	78.112	24.456*	3.45e-07*	-5.012*	-4.016	-4.718*
3	82.445	6.221	4.88e-07	-4.778	-3.355	-4.358

Source: VAR Model Estimation Output. Note: indicates lag order selected by criterion; LogL=Log Likelihood; LR=Likelihood Ratio.

Table5 reports unit root test results confirming stationarity of variables in the VAR model. All test statistics (-4.892 to -5.234) exceed critical values at 1% significance level, with p-values <0.05, rejecting the null hypothesis of non-stationarity. Stationary time series are essential for valid VAR estimation and reliable forecasting. These results validate the modeling approach and ensure that the projected trajectories are not spurious but reflect genuine economic relationships among GSDP, revenue, and expenditure growth rates.

Table 6: Augmented Dickey-Fuller (ADF) Test for Stationarity (Variables in Log-Differences)

Variable	ADF Test Statistic	1% Critical Value	5% Critical Value	p-value	Conclusion
Δ ln(GSDP)	-4.892	-3.887	-3.052	0.0003	Stationary
Δ ln(TRR)	-5.234	-3.887	-3.052	0.0001	Stationary
Δ ln(Tot-Ex)	-4.567	-3.887	-3.052	0.0012	Stationary

Source: Author's calculations. Note: Tests include intercept; Δ represents first difference operator.

Table 6 decomposes the forecast error variance of GSDP growth, revealing the relative importance of different shocks over time. Initially, GSDP growth is entirely self-determined, but by year 10, fiscal variables explain over 30% of its variation (TRR: 18.2%, Tot-Ex: 13.3%). This quantitative evidence supports the theoretical linkage between fiscal policy and economic growth in Odisha. The increasing explanatory power of fiscal variables over longer horizons underscores the significance of expenditure quality and revenue management for sustainable development outcomes.

Table 7: Forecast Error Variance Decomposition (FEVD) for Δ ln(GSDP) (10-year horizon)

Period	S.E.	Δ ln(GSDP)	Δ ln(TRR)	Δ ln(Tot Ex)
1	0.032	100.000	0.000	0.000
2	0.045	85.234	8.912	5.854
5	0.067	72.115	15.667	12.218
10	0.082	68.447	18.224	13.329

Source: VAR Model Estimation. Note: S.E.=Standard Error; values indicate percentage of

forecast error variance explained.

This structured analysis summarizes Odisha's fiscal position through Strengths, Weaknesses, Opportunities, and Threats. It quantifies key characteristics: high capital expenditure growth (β=0.87), mining revenue volatility (CV=0.92), and tax effort disparities. The SWOT framework provides strategic insights for policymakers, highlighting opportunities in green infrastructure and threats from commodity market volatility. It serves as a concise policy roadmap, balancing statistical evidence with practical governance considerations for maintaining fiscal resilience amid emerging challenges.

Table 8: SWOT Analysis of Odisha's Fiscal Position Post-FC-XV

Strengths	Weaknesses
• Consistent Revenue Surplus (Statistically significant trend)	• Over-reliance on volatile mining revenues (CV = 0.92)
• High & Growing Capital Expenditure (β = 0.87, p<0.01)	• Low tax effort in property-related taxes (Stamp Duty TEI=0.56)
• Declining and Sustainable Debt Burden (Projected <20%)	• Committed expenditure elasticity w.r.t. GSDP > 1
• Effective utilization of performance grants (High absorption rate)	• Human development indicators still lag behind national averages
Opportunities	Threats
• Leverage fiscal space for green infrastructure and climate resilience	• Volatility in global commodity markets affecting ONTR
• Deepen GST base and improve tax administration using AI/ML	• Increasing frequency and intensity of climate-induced disasters
• Use high credit rating to attract private investment via PPPs	• Demographic pressure (aging) on pension liabilities
• Develop eco-tourism and carbon credit markets as new revenue streams	• Potential populist pressure leading to unfunded subsidies

Source: Author's Synthesis. Note: CV=Coefficient of Variation; TEI=Tax Effort Index.

5. Discussion and Policy Debate

Odisha's fiscal trajectory under the Fifteenth Finance Commission presents a compelling narrative of disciplined transformation, empirically substantiated through trend analysis, a critically reviewed tax effort estimation, and robust, stress-tested VAR-based projections. At the same time, this experience surfaces deeper debates and structural tensions inherent in sub-national public finance, particularly in the context of performance-linked fiscal federalism. This section situates the quantitative findings within broader policy and theoretical debates, highlighting trade-offs, risks, and reform imperatives.

5.1 The Surplus 'Conundrum': Prudence versus Accelerated Development

Odisha's large and rising revenue surplus peaking at ₹31,058 crore in 2022–23 stands as a testament to fiscal prudence but simultaneously raises a fundamental normative question: is the state maximizing social welfare by maintaining such a substantial fiscal buffer, or is it under-spending on immediate social and developmental priorities? This dilemma can be formally framed as an intertemporal social welfare optimization problem, where the policymaker chooses consumption, investment, and buffering decisions over time. The policy problem may be represented as:

$$\max \sum_{t=0}^{T} \beta^t U(C_t, I_t, B_t) \quad (6)$$

Subject to an intertemporal budget constraint and stochastic disaster-related shocks to GSDP, where $U(\cdot)$ denotes the social welfare function, C_t represents consumption or social expenditure, I_t denotes public investment (capital expenditure), and B_t captures the fiscal buffer or surplus. The discount factor β reflects intergenerational preferences.

Odisha's revealed fiscal strategy, supported by impulse response functions from the VAR model, suggests a deliberate preference for buffering. Revenue surpluses serve three strategic purposes: first, they create fiscal space to absorb negative GSDP shocks arising from recurrent natural disasters; second, they underpin a strong credit profile, lowering the cost of borrowing for long-gestation infrastructure projects and reinforcing a positive growth–debt feedback loop; and third, they signal macro-fiscal stability, thereby crowding in private investment. While VAR projections indicate that this path is fiscally sustainable, the analysis suggests that a marginal, efficiency-driven reallocation from surplus accumulation toward targeted human capital investments could be welfare-enhancing without compromising stability, provided implementation capacity is strong.

5.2 The Double-Edged Sword of Mining Revenue: Volatility, AR Processes, and the Resource Curse Risk

The econometric analysis highlights the extreme volatility of Odisha's mining revenue. The augmented VAR model and stress tests provide direct, quantitative evidence of how this volatility transmits to core fiscal and macroeconomic variables, compromising stability. The finding that an extreme disaster scenario could push the debt ratio to 24.1% provides a concrete risk metric. To address this, the institutionalization of a Mining Revenue Stabilization Fund (MRSF) governed by a transparent fiscal rule is not just advisable but empirically shown to be necessary for resilience against plausible tail risks.

5.3 Performance Grants and Institutional Change: The Principal–Agent Problem

Odisha's successful access to FC-XV performance-linked grants demonstrates administrative capacity, but the deeper challenge lies in translating access into durable institutional transformation. This challenge is well captured by a principal–agent framework, where the principal (the Finance Commission) seeks sustained improvements in governance, while the agent (the state) may respond with short-term compliance. In its current form, grant allocation G_t is conditional on achieving a measurable outcome O_t. To strengthen incentive compatibility, the paper proposes a dynamic contract structure:

$$G_{t+1}=f(O_t,\Delta I_t,\sigma(O_t)) \quad (7)$$

where future grant eligibility depends not only on observed outcomes O_t, but also on improvements in underlying institutional capacity I_t (such as a DISCOM governance index) and the

stability of outcomes over time. This approach requires a shift from input-based monitoring to outcome-based budgeting, supported by real-time data dashboards, independent audits, and econometric validation of institutional performance.

5.4 Fiscal Marksmanship and the Tax Effort Paradox

The critically examined tax effort analysis reveals a striking paradox. The re-evaluated high tax effort in Electricity Duty largely reflects high statutory rates rather than super-efficiency, a crucial distinction for policy. Excessive reliance on such distortionary levies may generate deadweight losses. In contrast, low stamp duty effort reflects a substantial property tax gap. Policy reform must therefore be selective: rationalizing distortionary electricity taxation through rate alignment, while expanding the property tax base through GIS-linked land valuation and digital registries.

5.5 Stress-Testing Assumptions: External Risks and Sensitivity Analysis

The initial sensitivity analysis has been substantially expanded into a rigorous stress-testing regimen, as reported in the Results section. The finding that an Extreme Disaster scenario can bring the debt ratio to the brink of the FRBM limit is a pivotal insight. It moves the discussion from general vulnerability to a quantified risk assessment, powerfully reinforcing the policy prescription for a stabilization fund and revenue diversification. This validates Odisha's current emphasis on buffer creation while highlighting its limits.

6. Conclusion

Odisha's navigation of the Fifteenth Finance Commission framework offers a rare, empirically grounded example of successful sub-national fiscal management in India. The state has effectively translated predictable tax devolution and thematic grants into measurable outcomes, as supported by robust causal inference methods. Above all, it has maintained a robust fiscal position characterized by sustained revenue surpluses and a sustainable debt trajectory, validated through an augmented VAR model and shown to be resilient to moderate shocks, though vulnerable to extreme mining revenue volatility. The analysis demonstrates that high-quality capital expenditure forms the backbone of Odisha's growth strategy. At the same time, the evidence highlights critical vulnerabilities, with the stress tests providing concrete metrics of risk exposure.

The policy agenda emerging from this study is clear and evidence-based: The critical imperative is to institutionalize a Mining Revenue Stabilization Fund, as quantitative stress tests demonstrate its necessity. This must be complemented by modernizing stamp duty and property tax administration, embedding outcome-tracking econometrics into performance grant design, and strategically deploying fiscal surpluses to diversify the economic and revenue base. Odisha's journey from fiscal distress to exemplary prudence holds profound lessons for India's federal system. It demonstrates that even structurally disadvantaged states can achieve fiscal health through disciplined governance, strategic foresight, and effective engagement with federal institutions. As Odisha looks ahead to the Sixteenth

Finance Commission, its challenge will be to deploy its quantified fiscal strength not as an end in itself, but as the most powerful instrument for achieving equitable, sustainable, and transformative development—optimizing the trade-offs embedded in the fiscal trilemma while building buffers against its most quantifiable risks.

Abbreviations

ADF: Augmented Dickey-Fuller Test; AIC: Akaike Information Criterion; AT&C: Aggregate Technical and Commercial Losses; CapEx: Capital Expenditure; CV: Coefficient of Variation; FC-XIV: Fourteenth Finance Commission; FC-XV: Fifteenth Finance Commission; FRBM: Fiscal Responsibility and Budget Management Act; FEVD: Forecast Error Variance Decomposition; GiA: Grants-in-Aid from Centre; GSDP: Gross State Domestic Product; MMR: Maternal Mortality Ratio; MTFP: Medium-Term Fiscal Plan; NFHS: National Family Health Survey; ONTR: Own Non-Tax Revenue; OTR: Own Tax Revenue; PPP: Public-Private Partnership; PRI: Panchayati Raj Institution; RBI: Reserve Bank of India; RevEx: Revenue Expenditure; RTS: Representative Tax System; SBIC: Schwarz-Bayesian Information Criterion; SDRF: State Disaster Response Fund; SFA: Stochastic Frontier Analysis; SWOT: Strengths, Weaknesses, Opportunities, Threats; TCT: Taxes and Duties from Centre; TEI: Tax Effort Index; TotEx: Total Expenditure; TRR: Total Revenue Receipts; ULB: Urban Local Body; VAR: Vector Autoregression.

Data Availability

The data supporting this study are publicly available. Fiscal data were sourced from the Government of Odisha Finance Accounts and Budget Documents. GSDP data came from the state's Directorate of Economics and Statistics. Cross-state comparisons used RBI state finance statistics. Sectoral outcome indicators were taken from NFHS-5 and other official reports. All Finance Commission details are from their published reports. Processed datasets and codes are available from the corresponding author upon reasonable request.

Author Contributions

M.S. is the sole and corresponding author of this manuscript. He conceptualized the study, conducted the literature review, developed the theoretical framework, designed the methodology, performed the formal analysis, and led the writing of the original draft as well as subsequent revisions. M.S. read and approved the final version of the manuscript and takes full responsibility for its content.

Ethical Conduct

The research presented adheres to the highest standards of academic integrity. All sources of information, data, and ideas from other works have been appropriately acknowledged and cited.

Conflicts of Interest

The authors have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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