

Disentangling Fiscal Dependencies: Evidence from Uttar Pradesh and Bihar

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Abstract

This study examines the structural aspects of fiscal dependency of two states namely Uttar Pradesh and Bihar by analyzing the relationship between gross State Domestic Product and tax revenues which includes own tax revenue and share from center in tax devolution. The issue of subnational fiscal autonomy is crucial in the context of fiscal federalism, especially for governments with higher population and socio-economically challenged economies that mainly rely on intergovernmental transfers. In order to empirically examine the relationship among variables, the study uses Autoregressive Distributed lag Model (ARDL), which is well suited for time series analysis of mixed order of integration. The findings exhibit that both state's GSDP is largely impacted by the share in the central tax than the own tax revenues. The impact of own tax revenue is negative while the share in the central tax is positive on the GSDP for both in long and short-term for both the states. The coefficient of co-integration equation highlights the disparity in the speed of convergence towards the long-run equilibrium. Bihar trails with 31% (speed of adjustment), perhaps as a result of smaller revenue bases and administrative difficulties, but Uttar Pradesh respond to economic shocks rather rapidly with 42% (speed of adjustment), indicating a more effective fiscal mechanism.

Key words: Uttar Pradesh, Bihar, GSDP, Tax Revenue, Share in Central Taxes, ARDL, Bound-testing, Fiscal Dependency

1. Introduction

India has a quasi-federal fiscal system, with distinct roles for the Union and State governments in terms of collecting taxes and spending them. There is a major fiscal dependency between the federal government and states. Although states are entrusted with providing essential public services like health care, and rural development, they nevertheless have a limited capacity to provide enough on their own. Due to this structural mismatch, there is a significant amount of fiscal reliance on the Central government, especially through share from center in tax revenues and grants in aid. Other than this states also have its own tax and non-tax revenue sources (RBI, 2024). Uttar Pradesh (UP) and Bihar are the most populous and socio-economically challenged states in India, receives the highest inter se share from the center.

The poor and highly populous states, UP (18%) and Bihar (10%) together receive 28% of the devolved tax amount meant for all states (The Indian Express, 2024). In 2024-25 UP received Rs. 2.18 lakh crore as its share of central taxes, highest among all states (PRS UP, 2024). While Bihar received Rs. 1.13 lakh

crore in 2024-25 (PRS Bihar, 2024). Despite these substantial transfers, both states continue to exhibit low own tax-to-GSDP ratio, 10.3% in UP and only 5.6% in Bihar (PRS, 2024). These numbers demonstrate persistence dependence of both states on central support to meet their fiscal and developmental commitments. Bihar categorized as low-income state with the greatest reliance on federal transfers, followed by Orissa, Jharkhand, UP., Madhya Pradesh, and Rajasthan. The dependency ratio increased from 59% to 78% during the 9th to 12th Finance Commission (FC), and was about 76% in the first year of 13th FC. Concurrently, dependency of UP rose from 49% to 52% in 10th FC (Rao and Srivastava, 2014).

Table 1: Inter se share of State's (in %)					
State	FC XI	FC XII	FC XIII	FC XIV	FC XV
Bihar	14.788	11.173	11.089	9.787	10.058
Uttar Pradesh	20.057	19.517	19.987	18.205	17.939

Source: Various reports of Finance Commission

This paper disentangles the fiscal dependency of UP and Bihar by empirically investigating the relationship among their own tax revenue (OTR) collection, share in central taxes (SCT) and Gross State Domestic Product (GSDP). We employed Autoregressive Distributed Lag (ARDL) technique originally developed by Pesaran, M. H., & Shin, Y. (1995), Pesaran (1997) and Pesaran, et al. (2001). It provides insights on how inter-governmental fiscal transfers are structured and how they affect the fiscal health of subnational entities. The comparative method offers a nuanced understanding of divergent yet parallel fiscal trajectories of both the states. Analysis of short-term contribution and long-term impact of different attributes of state finances also becomes important to track if any variable contributing significantly in state finances for one or few years is meaningfully strengthening it in long-term or not. It will help states to choose their feasible way of revenue optimization which can enhance their fiscal autarky.

2. Review of Literature

India is a unitary-biased federation with more central government authority than the states, while being referred to as a quasi-federal. A quasi-federal structure is more precisely described a 'Co-operative Federalism', in which the relationships between the several tiers of government are dynamic and governance is multilayered (Kelkar, 2019). Rao and Singh (2001), critically analyzed how the attributes of Indian federalism impact the level and composition of fiscal transfers from the federal to state governments. Concurrently, they addressed both the distributive problems that resulted from the potential for secession and those which are an outcome of ongoing governance politics at the same time.

This multilayered federal structure and high degree of centralization of resources causes the feeling of increasing financial dependency of states on the center (Kumari, 1968). Another study to review the financial dependency of states on center is conducted by Rao and Srivastava (2014), in which they categorized the states according to their income in low, medium and high-income states and found that the low-income states are highly dependent on central transfers as compared to middle and high-income groups. Bihar has the greatest dependency followed by Orissa, Jharkhand, UP., Madhya Pradesh, and Rajasthan. BIMARU (Bihar, Madhya Pradesh, Rajasthan, UP) states have high degree of conditional transfers as compared to non-plan grants. And as far as the total grants concerned Bihar was the major

beneficiary (Darshini and Gayathri, 2021). The fiscal reliance of states on transfers from the central government intensified from 1990-91 to 2007-08. Both the overall high buoyancy of central taxes and the gradual rise in their percentage suggested by succeeding FCs were attributed for this trend (Srivastava and Rao, 2011).

In this study we will be delineating the relationship between the state's own tax revenue, state's share in central taxes, and the GSDP of the states with the help of the ARDL model. The model has been previously used to analyze the tax revenue and growth of states (Neog and Gaur 2020, Nayak et al 2022, Prasad et al 2022). The model seems to be fit for the small data sample for the time series analysis.

3. Data Source and Methodology

The study is based on secondary data collected from the Handbook of Statistics on Indian States and State Finance: A Study of Budget of various years published by RBI for the period 2000-01 to 2020-21. It analyses the short-run and long-run dynamic relationship among GSDP, own tax revenue and share from center for UP and Bihar. The natural logarithm form of data is used for the estimation of the model.

We applied the ARDL Model, introduced by Pesaran, M. H., & Shin, Y. (1995), Pesaran (1997) and Pesaran, et al. (2001), for the long-run and short-run investigation. Firstly, we checked the stationarity of the data by applying the Augmented Dickey-Fuller test (Dickey, D. A., & Fuller, W. A., 1979). Most of the data series in our study are non-stationary at level I(0), and stationary at first difference I(1). Regressing non-stationary series on other similar series using OLS technique cause 'spurious regression problems' (Murthy VN and Okunade A. A, 2016). whereas ARDL model can be used irrespective of whether the regressors are purely I(0), purely I(1) or mutually cointegrated, (Pesaran, et al. 2001). But it can't be applied on I(2) (Saha and Iqbal, 2024).

This model has various advantages such as it is suitable for small as well as large sample size, which is not possible in the Johansen cointegration technique because it requires large data samples for authenticity (Johansen, S., & Juselius, K., 1990). Furthermore, the ARDL procedure employs a single reduced-form equation, while conventional techniques use a system of equations to estimate long-run relationships (Ozturk and Acaravci, A. 2010).

ARDL form of equation:

$$\Delta \ln (\text{GSDP})_t = \alpha + \sum_{i=1}^n \beta_{1i} \Delta \ln (\text{GSDP})_{t-i} + \sum_{i=0}^n \beta_{2i} \Delta \ln (\text{OTR})_{t-i} + \sum_{i=0}^n \beta_{3i} \Delta \ln (\text{SCT})_{t-i} + \delta_1 \ln (\text{GSDP})_{t-1} + \delta_2 \ln (\text{OTR})_{t-1} + \delta_3 \ln (\text{SCT})_{t-1} + v_t \quad (1)$$

Where, GSDP= gross state domestic product

OTR= own tax revenue

SCT= share in central taxes

v_t = white noise term

Δ = first difference operator

i = number of lags

n = optimal lags, selection of optimal lags is based on Akaike Information Criterion (AIC) and Schwarz Bayesian Criterion (SBC).

The co-integration or long-run relationship among the variables are determined by the bound test procedure, based on the joint F-statistic also called as Wald statistic. Further, the coefficients of the long-run model can be calculated with the help of the following equation.

$$\ln(\text{GSDP})_t = \alpha + \sum_{i=1}^n \beta_{1i} \ln(\text{GSDP})_{t-i} + \sum_{i=0}^n \beta_{2i} \ln(\text{OTR})_{t-i} + \sum_{i=0}^n \beta_{3i} \ln(\text{SCT})_{t-i} + \mu_t \quad (2)$$

The short-run Dynamics of the model can be calculated the with help of the following equation:

$$\Delta \ln(\text{GSDP})_t = \alpha + \sum_{i=1}^n \beta_{1i} \ln(\text{GSDP})_{t-i} + \sum_{i=0}^n \beta_{2i} \ln(\text{OTR})_{t-i} + \sum_{i=0}^n \beta_{3i} \ln(\text{SCT})_{t-i} + \psi(\text{EC})_{t-1} + \xi_t \quad (3)$$

$(\text{EC})_{t-1}$ is the error correction term, which illustrates the speed at which the variables can converge toward the long-run equilibrium and the ECT should have a statistically significant negative coefficient (Ozturk and Acaravci, A 2010).

Subsequently, the Ramsey Regression Equation Specification Error Test (RESET) has been applied to check about the specification error and afterwards Jarque-Bera for normality, Breusch-Godfrey serial correlation LM test for autocorrelation, Bruesch-Pagan-Godfrey test for heteroscedasticity, Cumulative Sum (CUSUM) and Cumulative sum of square (CUSUM-SQ) tests for the stability of the model has been tested.

Economy of Bihar

Bihar is among the nation's most productive agricultural states. Bihar's agricultural production employs almost 80% of the population, which is significantly more than national average. The state's GSDP expanded at a CAGR (in Rs.) of 11.31% between 2015-16 to 2024-25 (IBEF). The GSDP of Bihar is expected to be Rs. 10.97 lakh crore for 2025-26 at current prices, amounting to growth of 22% over 2024-25. Total revenue receipts are estimated to be Rs. 2.60 lakh crore. Out of which Rs. 67,741 crore is collected from own resources and Rs. 1.93 lakh crore received from the center. Own tax revenue as percentage of GSDP is estimated to be 5.4% in 2025-26 (PRS, 2025-26).

Table: 1, Bihar 2025-26	
GSDP at current prices	Rs. 10.97 lakh crore
Total Revenue Receipt	Rs. 2.60 lakh crore
Own tax revenue	Rs. 59,520 crore

Share in central taxes	Rs. 1.38 lakh crore
Grants	Rs. 54,575 crore

Source: PRS Bihar Budget Analysis 2025-26

Economy of Uttar Pradesh

With population of over 200 million, UP is the most populated state in India. (IBEF). As per the budget analysis of PRS 2024, the GSDP of UP for 2025-26 at current prices is expected to be Rs. 30.8 lakh crore, amounting to growth of 12% over 2024-25. Rs. 6.62 lakh crore is expected as the total revenue receipt for 2025-26, a 21% increase over the 2024-25 revised estimates. In which the state will raise Rs. 3.19 lakh crore by its own resources, while the center would contribute Rs. 3.43 lakh crore. The own tax revenue as percentage of GSDP is estimated as 9.6% in 2025-26.

Table: 2, UP 2025-26	
GSDP at current prices	Rs. 30.8 lakh crore
Total Revenue Receipt	Rs. 6.62 lakh crore
Own tax revenue	2.95 lakh crore
Share in central taxes	2.55 lakh crore
Grants	Rs. 87,915 crore

Source: PRS UP Budget Analysis 2025-26

Empirical Analysis

Firstly, we applied the Augmented Dickey Fuller test developed by Dickey, D. A., & Fuller, W. A. 1979 to check the stationarity of the variables. Although it is not the pre-condition for the application of the model (Saha and Iqbal, 2024). The results of the test are presented in the table 3 shows that all the variables are stationary at first difference for both the states. Since none of the variable is stationary at I(2), it implies that we can use the ARDL model (Saha and Iqbal, 2024).

Table: 3 (Unit Root Test Results)				
	Variables	GSDP	OTR	SCT
Bihar	t-statistic	-6.8465*	-3.637*	-3.7856*
	p-values	0	0.0149	0.011

	t-statistic	-3.375376*	-5.481197*	-4.379045*
UP	p-values	0.0272	0.0004	0.0035
	Order of Integration	I(1)	I(1)	I(1)

Note: *Significant at 1 percent level.

Source: Author's own estimation.

Upon determining that all the variables are stationary at I(1), we proceed to examine the ARDL bound testing approach (Pesaran, et al., 2001) and the results presented in the table 4.

Table 4: ARDL Long Run Form and Bound Test				
	Computed F- statistic values	Level of Significance	Critical Values	
			I(0)	I(1)
Bihar	6.2733 (k=2)	10 percent	2.63	3.35
		5 percent	3.1	3.87
		1 percent	4.13	5
UP	5.6227 (k=2)	10 percent	2.63	3.35
		5 percent	3.1	3.87
		1 percent	4.13	5

Source: Author's own estimation

Critical values obtained from Pesaran et. al. (2001)

From the result we can observe that the value of computed F-statistics is 6.27 and 5.62, greater than the upper bound critical values at 1% level of significance for Bihar and UP respectively. This suggests the co-integration among the variables and we can construct the long -run relation among the variables.

Thereafter, we estimated the coefficients of long-run model with the help of equation 2 and results presented in the table 5. Which presents that the impact of OTR and SCT both have insignificant impact on the GSDP for Bihar in long-run, while OTR has the negative but insignificant effect and SCT has positive significant impact on the GSDP at 5% level of significance in case of UP. Meaning thereby, 1% increase in SCT of UP will result in 45% increase in the GSDP of UP.

Table 5: Long Run ARDL Model				
	Variables	ln OTR	ln SCT	c
Bihar	Coefficients	-0.79	1.4944	4.7006
	p-values	0.4163	0.2243	0.1329
UP	Coefficients	-0.0122	0.4500**	8.9092
	p-values	0.9451	0.0297	0

** presents the 5 percent level of significance.

Source: Author's own estimation.

Besides the estimations of long-run form bound testing and long-run coefficients, the short-run coefficients also calculated with the help of the equation 3 and the results presented in the table 6. From the results we can say that the lag period of OTR has positive and significant impact on GSDP of Bihar, and the current SCT has the significant positive effect on the GSDP while lag period's SCT has negatively but sometimes significantly impacting the GSDP of the Bihar. On the other hand, in case of UP lagged OTR has negative significant and current SCT has positive significant effect on the GSDP of state. While current period's OTR and lagged SCT insignificantly impacting the GSDP. These results are consistent with (Kulkarni and Dhume, 2018), they discovered that whereas the ratios of states' share of central taxes have a favourable effect on per capita GSDP, increase in states' own per capita tax revenue have a negative effect. The value of co-integration equation or error correction terms are -0.3126 and -0.4293 for the states Bihar and UP respectively, stands for the saying that the short-run dynamics will converge toward the long-term equilibrium with 31% and 42% speed of adjustment.

Table 6: Short Run Dynamics (Error Correction Model)			
	Variables	Coefficients	p-values
Bihar	$\Delta (\ln \text{OTR})$	-0.1043	0.3041
	$\Delta (\ln \text{OTR}(-1))$	0.2112**	0.0441
	$\Delta (\ln \text{OTR}(-2))$	0.2101**	0.0133
	$\Delta (\ln \text{SCT})$	0.2642*	0.0022
	$\Delta (\ln \text{SCT}(-1))$	-0.0455	0.5689
	$\Delta (\ln \text{SCT}(-2))$	-0.2121**	0.0311
	Coint Eq (-1)	-0.3126*	0.0005
	R-squared	0.9103	
	Adjusted R-squared	0.8475	
UP	$\Delta (\ln \text{OTR})$	0.0766	0.1311
	$\Delta (\ln \text{OTR}(-1))$	-0.1441**	0.0174
	$\Delta (\ln \text{OTR}(-2))$	-0.1361**	0.0138
	$\Delta (\ln \text{SCT})$	0.1482*	0.0008
	$\Delta (\ln \text{SCT}(-1))$	0.0568	0.1516
	Coint Eq(-1)	-0.4293*	0.0005
	R-squared	0.8143	
	Adjusted R-squared	0.73	

*, ** presents the 1 percent, 5 percent level of significance respectively.

Source: Author's estimation.

After computing all the results of the model, we are heading towards the diagnostic and stability checking in order to boost the authenticity of the model.

Table 7: ARDL Diagnostic Tests			
	Test	F-statistic	p-values
Bihar	Jarque-Bera (Normality)	0.8762	0.6452
	Bruesch-Godfrey Serial Correlation LM Test	0.0853	0.9195
	Bruesch-Pagan-Godfrey (Heteroscedasticity)	0.4058	0.9049
	Ramsey RESETT Test	1.4488	0.274
UP	Jarque-Bera (Normality)	0.8965	0.6387
	Bruesch-Godfrey Serial Correlation LM Test	4.7674	0.0628
	Bruesch-Pagan-Godfrey (Heteroscedasticity)	0.3948	0.8948
	Ramsey RESET	0.4094	0.5426

Source: Author's own estimation.

Bruesch-Godfrey serial correlation LM test for autocorrelation, Bruesch-Pagan-Godfrey test for heteroskedasticity, Jarque-Bera test for normality and Ramsey Regression Equation Specification Error Test (RESET) for specification error/omitted variables are conducted and results presented in the table 7 represents that for both states the null hypothesis of normality, no serial correlation, homoskedasticity, and no specification error cannot be rejected because p-values for all tests are greater than 0.05 (5% level of significance). It exhibits that our model is free from the problems of autocorrelation, heteroskedasticity, non-normality and specification error.

At last, the CUSUM and CUSUMSQ test developed by Brown, et al.,1975 has been performed to test the stability of the model. Presented in the fig 1 and 2, found that CUSUM and CUSUMSQ plots stays within the critical bound limits and model is stable.

Figure: 1

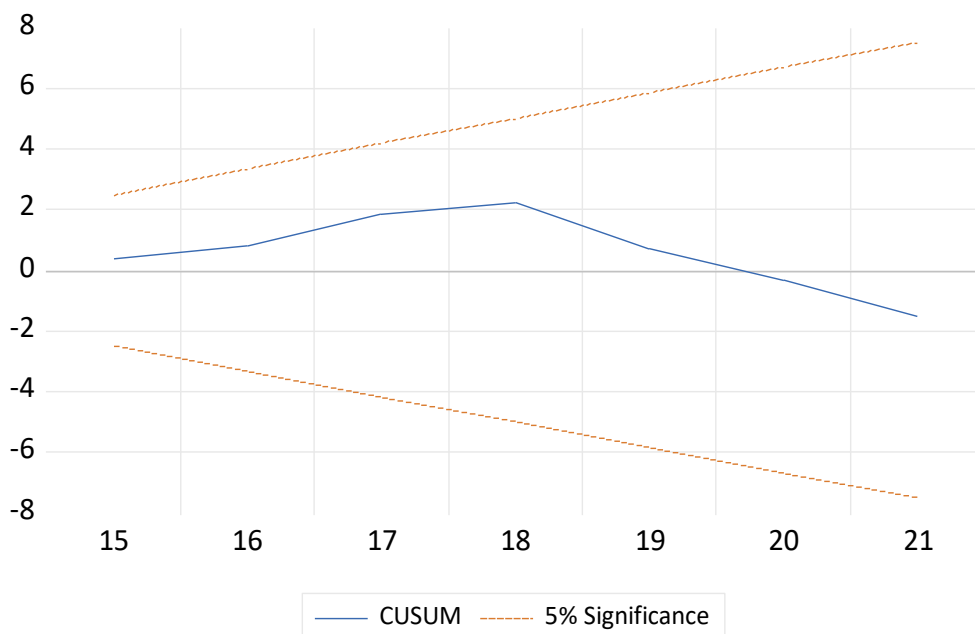
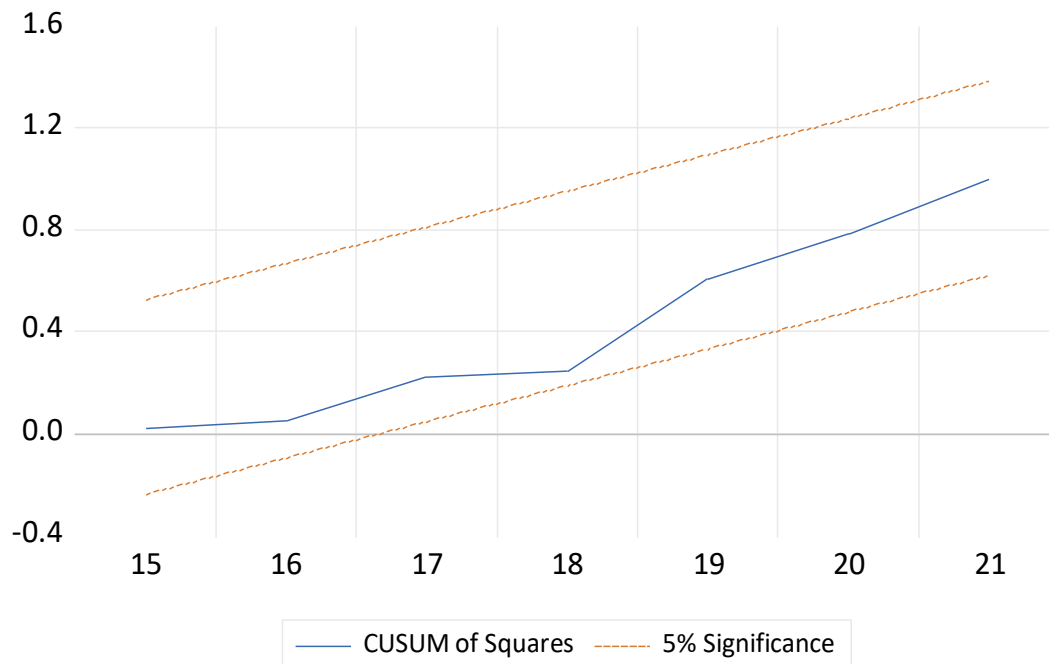


Figure: 2



4. Conclusion

This study is aimed to examine the characteristics and dynamics of fiscal dependency in Bihar and UP, India's two biggest and economically diversified states. Both are the top most populous states and receives highest percentage in horizontal devolution of funds from the center. Through the analysis of the short-run and long-run dynamics among GSDP, OTR and SCT, we sought to identify the structural connections that characterize fiscal autonomy and dependency of states on center in federal system.

The long-run calculations indicate that OTR has negative impact on the GSDP, whereas SCT has positive impact on both states. This outcome implies that excessive reliance on state-level taxes may exert a contractionary impact of long-run economic growth. This could be because of inefficiencies in tax administration, narrow revenue base, and the distortionary effects of indirect taxation on investment and consumption. On the contrary, positive long-term relation between SCT and GSDP reinforces the stabilizing function of fiscal transfers in India's federal structure, especially in structurally underdeveloped areas where Union Government's financed development expenditures continuous to be a vital source of growth.

However, the short-run coefficients show a reversal of effects in comparison to long-run coefficients in Bihar. While the UP's short-run coefficients showing similar to long-run relation. These variations can be interpreted through the state-specific fiscal behavior and absorption capacity. Bihar's negative response to SCT in short-term may stem from short-term inefficiencies or delays in fund utilization, while, positive response to OTR might reflect temporary efficiency gains from improved tax management and enhanced revenue mobilization. On the other hand, UP's short-term positive coefficient of SCT suggests that external fiscal injections have an immediate stimulative effect, and negative coefficients of OTR might reflect the crowding-out effect of distortionary taxation on private sector. These findings are in line with

endogenous growth theories and framework of fiscal federalism, which posit that composition and efficiency of fiscal tools play a crucial role in determining the growth outcomes. The divergent impact across time horizon highlights the vital importance of a balanced fiscal plan that promotes both intergovernmental equity and revenue autonomy.

In order to reduce negative growth consequences of taxes, both state governments should first work toward tax system rationalization, which includes the broadening the base, improving compliance, and reducing distortionary factors. And in order to ensure that intergovernmental transfers are used for productive capital formation rather than recurrent expenditure, central transfers must be directly tied to developmental performance. And the last is that to improve state's own fiscal capacity and reducing structural reliance on the center, fiscal governance reforms must be prioritize on efficiency, transparency, and accountability. Thus, India's federal structure, sustainable regional development eventually necessitates a balanced strategy that fosters inclusive and long-term economic growth by strategic central support with prudent fiscal devolution.

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