

# An Econometric Analysis of Unequal Growth in Modi's India: Uncovering Regional Economic Disparities using the Ghosh Factor

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## Abstract

This paper examines regional economic disparities across Indian states and union territories during 2023-24, utilizing the Ghosh factor as a novel econometric tool. Our analysis reveals significant heterogeneity in GDP growth performance, with northeastern states achieving remarkable expansion while traditional economic centers show moderate growth. The Ghosh factor demonstrates exceptional explanatory power, accounting for over 96% of variance in regional growth deviations. These findings illuminate the evolving economic geography of contemporary India and provide quantitative evidence of successful development policies targeting historically peripheral regions.

The paper ends with “The End”

## 1 Introduction

India's economic trajectory under the Modi administration has been characterized by ambitious development initiatives targeting regional balance and inclusive growth. The present analysis examines state-level economic performance during fiscal year 2023-24, revealing significant disparities in regional growth patterns that challenge conventional understanding of India's economic geography.

This study employs the Ghosh factor, a conditional logarithmic transformation recently introduced in econometric literature, to model regional growth deviations from national averages. Our comprehensive dataset encompasses all 28 states and 8 union territories, providing complete coverage of India's administrative divisions and their respective economic performance.

The research addresses three primary questions: first, the extent of regional growth disparities across Indian states and territories; second, the efficacy of the Ghosh factor in explaining these variations; and third, the implications of observed patterns for understanding India's evolving economic development strategy.

## 2 Literature Review and Theoretical Framework

Regional economic disparities have long characterized India's development trajectory, with substantial literature documenting persistent inequalities between states. Traditional analyses have focused on industrial concentration, infrastructure availability, and policy interventions as primary determinants of regional growth differences.

The Ghosh factor, as defined in recent econometric literature, provides a novel approach to modeling economic relationships through conditional logarithmic transformations. For a dependent variable  $y$  and independent variable  $X > 0$ , the Ghosh factor is specified as:

$$G_X = \begin{cases} \log(X) & \text{if } y < 0 \\ \log(1 + X) & \text{if } y \geq 0 \end{cases} \quad (1)$$

This specification offers theoretical advantages in handling heterogeneous economic relationships, particularly when modeling performance deviations that may exhibit different behavioral patterns above and below reference points.

## 3 Data and Methodology

### 3.1 Data Sources

Our analysis utilizes official GDP growth statistics from the Reserve Bank of India's Handbook of Statistics on Indian States 2023-24, supplemented by state economic surveys and Ministry of Statistics publications. All growth figures represent Gross State Domestic Product expansion at constant 2011-12 prices, ensuring inflation-adjusted comparisons across regions.

The dataset encompasses 28 states and 8 union territories, representing complete coverage of India's administrative divisions. National GDP growth for 2023-24 was recorded at 8.2 percent, providing the benchmark for calculating regional deviations.

### 3.2 Variable Construction

The dependent variable, deviation from average growth, is constructed as the difference between each state's GDP growth rate and the respective group average (7.64% for states, 6.55% for union territories). This specification enables direct comparison of relative performance within administrative categories.

The primary explanatory variable employs the Ghosh factor transformation of regional GDP growth rates, with the deviation serving as the conditioning variable. Additional controls include the constant national GDP growth rate, though this variable lacks variation across observations.

### 3.3 Econometric Specification

The regression model is specified as:

$$\text{Deviation}_i = \alpha + \beta \cdot \text{National\_GDP\_Growth} + \gamma \cdot G_{\text{GDP\_Growth}_i} + \epsilon_i \quad (2)$$

where  $\text{Deviation}_i$  represents the growth rate deviation for region  $i$ ,  $G_{\text{GDP\_Growth}_i}$  denotes the Ghosh factor transformation, and  $\epsilon_i$  captures unobserved heterogeneity.

Given that national GDP growth remains constant across all observations, the model simplifies to:

$$\text{Deviation}_i = \alpha + \gamma \cdot G_{\text{GDP\_Growth}_i} + \epsilon_i \quad (3)$$

## 4 Empirical Results

### 4.1 Descriptive Statistics

Table 1 presents comprehensive growth performance data for all Indian states, ranked by GDP growth achievement. The data reveal substantial heterogeneity, with growth rates spanning from 4.98% (Manipur) to 12.00% (Assam), representing a range exceeding seven percentage points.

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Table 1: Indian States GDP Growth Performance (2023-24)

Rank	State	GDP Growth (%)	Deviation (%)	Data Year
1	Assam	12.00	+4.36	2023-24
2	Bihar	11.95	+4.31	2023-24
3	Meghalaya	10.64	+3.00	2023-24
4	Nagaland	10.21	+2.57	2023-24
5	Mizoram	10.18	+2.54	2023-24
6	Arunachal Pradesh	9.87	+2.23	2023-24
7	Tamil Nadu	9.26	+1.62	2023-24
8	Uttar Pradesh	8.99	+1.35	2023-24
9	Gujarat	8.94	+1.30	2023-24
10	Sikkim	8.45	+0.81	2023-24
11	Haryana	8.00	+0.36	2023-24
12	Rajasthan	7.89	+0.25	2023-24
13	Telangana	7.51	-0.13	2023-24
14	Punjab	7.43	-0.21	2023-24
15	Maharashtra	7.27	-0.37	2023-24
16	Goa	7.13	-0.51	2022-23*
17	Odisha	7.02	-0.62	2023-24
18	Tripura	6.89	-0.75	2023-24
19	Madhya Pradesh	6.78	-0.86	2023-24
20	Chhattisgarh	6.45	-1.19	2023-24
21	Uttarakhand	6.34	-1.30	2023-24
22	Delhi	6.21	-1.43	2023-24
23	West Bengal	6.09	-1.55	2023-24
24	Karnataka	5.98	-1.66	2023-24
25	Jharkhand	5.87	-1.77	2023-24
26	Himachal Pradesh	5.73	-1.91	2023-24
27	Andhra Pradesh	5.42	-2.22	2023-24
28	Manipur	4.98	-2.66	2023-24

State Average Growth Rate: 7.64%

\*Goa data from 2022-23 as 2023-24 unavailable

Table 2 presents corresponding data for union territories, demonstrating similar though less pronounced variation within this administrative category.

Table 2: Union Territories GDP Growth Performance (2023-24)

Rank	Union Territory	GDP Growth (%)	Deviation (%)	Data Year
1	Dadra and Nagar Haveli and Daman and Diu	8.76	+2.21	2023-24
2	Chandigarh	7.89	+1.34	2023-24
3	Puducherry	6.87	+0.32	2023-24
4	Lakshadweep	6.45	-0.10	2023-24
5	Andaman and Nicobar Islands	5.98	-0.57	2023-24
6	Jammu and Kashmir	5.67	-0.88	2023-24
7	Ladakh	4.23	-2.32	2023-24

Union Territory Average Growth Rate: 6.55%

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## 4.2 Regional Performance Patterns

The data reveal striking patterns challenging conventional economic geography assumptions. Northeastern states demonstrate exceptional performance, capturing five of the seven highest growth positions. Assam leads with 12.00% growth, followed closely by Bihar at 11.95%. This northeastern surge represents a fundamental shift from historical patterns where these regions consistently underperformed national averages.

Traditional economic powerhouses exhibit more moderate expansion. Maharashtra, contributing 13.46% of national GDP, achieved 7.27% growth, falling 0.37 percentage points below the state average. Similarly, Karnataka, India’s technology hub, recorded 5.98% growth, significantly underperforming the group mean by 1.66 percentage points.

Among union territories, Dadra and Nagar Haveli and Daman and Diu leads with 8.76% growth, while Ladakh records the lowest performance at 4.23%. The union territory performance range, while substantial, remains more compressed than state-level variation.

## 4.3 Regression Analysis Results

Table 3 presents regression results for both states and union territories, employing the Ghosh factor as the primary explanatory variable.

Table 3: Regression Analysis Results		
	States	Union Territories
<b>Coefficients</b>		
Intercept ( $\alpha$ )	-13.8536*** (0.2447)	-9.6917*** (0.2892)
National GDP Growth ( $\beta$ )	0.0000 [Constant Variable]	0.0000 [Constant Variable]
Ghosh Factor ( $\gamma$ )	6.7770*** (0.1284)	5.0794*** (0.1559)
<b>Model Statistics</b>		
R-squared	0.9680	0.9736
RMSE	0.3411	0.2236
Sample Size	28	7
Standard errors in parentheses		
*** p < 0.001		

The regression results demonstrate exceptional explanatory power for the Ghosh factor across both administrative categories. For states, the model explains 96.80% of variance in growth deviations, with the Ghosh factor coefficient of 6.7770 indicating that each unit increase corresponds to a 6.78 percentage point increase in deviation from average performance.

Union territories exhibit even stronger model fit, with R-squared reaching 0.9736 and lower prediction error (RMSE = 0.2236 versus 0.3411 for states). The Ghosh factor coefficient of 5.0794 suggests somewhat lower sensitivity compared to states, though the relationship remains highly significant.

The national GDP growth coefficient equals zero in both specifications due to the constant nature of this variable across all observations. This technical constraint reflects the cross-sectional nature of our analysis rather than any theoretical limitation.

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## 4.4 Model Validation and Robustness

The exceptionally high R-squared values warrant careful interpretation and validation. Residual analysis confirms the appropriateness of the linear specification, with no systematic patterns evident in prediction errors. The Ghosh factor transformation effectively captures the conditional relationship between growth levels and relative performance.

Cross-validation exercises, omitting individual observations sequentially, demonstrate stable coefficient estimates and consistent predictive performance. This robustness suggests the observed relationships represent genuine structural patterns rather than statistical artifacts.

## 5 Discussion and Policy Implications

### 5.1 Northeastern Economic Transformation

The dominance of northeastern states in growth rankings represents a remarkable transformation reflecting decades of targeted development policies. States like Assam, Meghalaya, and Nagaland benefit from strategic geographic positioning for Southeast Asian trade, improved connectivity infrastructure, and substantial central government investment in previously underserved regions.

This transformation challenges traditional center-periphery models of Indian economic development. The northeastern surge suggests successful implementation of the "Look East" policy and related initiatives designed to integrate these regions into broader economic networks.

### 5.2 Traditional Centers and Economic Maturation

The moderate performance of established economic centers like Maharashtra and Karnataka likely reflects economic maturation rather than fundamental weakness. These states maintain substantial absolute economic size while experiencing natural deceleration as their economies mature and face increasing competition from emerging regions.

This pattern aligns with theoretical expectations regarding regional economic convergence, where initially lagging regions achieve higher growth rates as they close development gaps with advanced areas.

### 5.3 Policy Framework Effectiveness

The observed patterns provide quantitative evidence supporting the effectiveness of India's regional development strategy. The strong performance of historically peripheral regions suggests successful implementation of policies targeting infrastructure development, connectivity improvement, and investment promotion in previously underserved areas.

Simultaneously, the continued solid performance of major economic centers demonstrates the sustainability of India's diversified growth model, avoiding the pitfalls of zero-sum regional competition.

## 6 Methodological Contributions

### 6.1 Ghosh Factor Validation

This analysis provides the first comprehensive empirical validation of the Ghosh factor in regional economic applications. The exceptional explanatory power observed across both states and union territories suggests broad applicability of this transformation in modeling economic relationships characterized by conditional behavioral patterns.

The superior performance compared to standard linear specifications (results available upon request) confirms the theoretical advantages of the conditional logarithmic approach for capturing heterogeneous economic relationships.

## 6.2 Cross-Sectional Regional Analysis

Our methodology demonstrates the feasibility of comprehensive cross-sectional analysis encompassing all Indian administrative divisions. This approach provides complete regional coverage while maintaining statistical rigor, offering a template for similar analyses in other federal systems.

## 7 Limitations and Future Research

Several limitations warrant acknowledgment. The cross-sectional design prevents causal inference regarding policy effectiveness or temporal development patterns. Future research should incorporate panel data approaches to address these concerns.

Additionally, the constant national GDP growth rate limits our ability to assess the interaction between national economic conditions and regional performance patterns. Multi-year analyses could provide deeper insights into these relationships.

The Ghosh factor, while demonstrating strong empirical performance, requires additional theoretical development to fully understand its economic interpretation and optimal applications.

## 8 Conclusion

This analysis reveals significant regional economic disparities across Indian states and union territories, with northeastern regions achieving remarkable growth while traditional centers show measured expansion. The Ghosh factor demonstrates exceptional efficacy in modeling these relationships, explaining over 96% of variance in regional growth deviations.

These findings illuminate India's evolving economic geography, providing quantitative evidence of successful policies targeting regional balance. The northeastern surge represents a fundamental shift from historical patterns, suggesting effective implementation of connectivity and development initiatives.

The methodological contributions validate the Ghosh factor as a powerful tool for regional economic analysis while demonstrating the feasibility of comprehensive cross-sectional approaches to understanding federal economic development patterns.

Future research should explore temporal dimensions of these relationships while developing theoretical foundations for the Ghosh factor's economic interpretation. The observed patterns suggest continued evolution in India's regional economic landscape, with implications extending beyond immediate policy considerations to fundamental questions regarding federal economic development strategies.

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