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Regional Disparities and Structural Inequality in Bihar: A District-Level Analysis Using Theil Indices

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Abstract: Inter-district inequality remains a major challenge in Bihar despite regular economic and social policy interventions over the past decades. This study examines the trajectory of spatial economic inequality in Bihar over two decades, using Theil T and Theil L indices to decompose District level disparities. This analysis uses secondary district-level data covering the period from 2005–06 to 2023–24 form Economy Survey of Bihar. By analysing district-level Theil ratios from 2005-06 to 2023-24, that shows a distinct "inverted-U" pattern in regional inequality. The results show that the regional inequality in Bihar is largely driven by the concentration of economic activity in a few advanced districts such as Patna, Begusarai, Bhagalpur, Munger, and Rohtas. A comparative analysis of the two indices reveals that the Theil T index i.e. top-sensitive declined more aggressively than the Theil L index i.e.bottom-sensitive by after 2011-12 peak. This suggests that Bihar's recent economic convergence is primarily driven by a "ceiling-lowering" effect characterized by the relative deceleration of historically dominant economic hubs like Patna rather than a rapid growth of the lowest performing districts such as Sheohar and Sitamarhi. This analysis confirms that Bihar's inequality is not merely temporal but structural, majority of districts fall into the low-inequality category due to uniformly low economic performance rather than inclusive growth.

Keywords: Regional Inequality, Theil Index, Spatial Disparity, Convergence, Economic Development.

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1. INTRODUCTION

Reducing regional inequality is a major concern for economic development, especially in states like Bihar, where growth is uneven across districts. Inter-regional disparities limit economic efficiency and weaken social cohesion that reduces the effectiveness of public policy interventions. In India, despite improvements in economic growth and human development indicators, the regional inequality continues to affect development outcomes. Bihar presents a similar case in this context, as wide Inequality present across districts in terms of economic activity, infrastructure, and livelihood opportunities. While the Bihar has seen significant macro level progress over the last two decades. A nagging question remains is that this growth reaching every corner of the state, or is it simply clustering in a few fortunate pockets? Regional inequality is more than just a statistical hurdle, it determines whether a child in Sheohar has the same opportunities as one born in Patna. A few districts that have better urban infrastructure, quality education and health care services industrial presence has emerged as growth centres. while a large number of districts remain dependent on low-productivity agriculture and informal employment.

The socio-economic factors like caste, gender also play a key role in presence of inequality in Bihar. Caste remains a significant driver of inequality in Bihar, with disparities existing not only between broad categories like Scheduled Castes and Scheduled Tribes but also within specific jatis. This intra-caste inequality often leads to pronounced economic disparities, affecting resource allocation and access to opportunities (Joshi et al., 2018)(CHIEPE, 2022). Low levels of female literacy and overall educational attainment contribute to persistent inequality. Areas with higher educational levels tend to exhibit lower inequality, highlighting the importance of education in economic mobility (Roy et al., 2024). Research on Bihar consistently finds large inter district gaps in income, services, and human development, with Patna far ahead and many northern/eastern districts lagging behind. Composite socio-economic indices (20–34 indicators) show Patna, Aurangabad, Jamui, Kaimur, Rohtas at the top, and Darbhanga, Sitamarhi, East Champaran, Madhubani, Sheohar at the bottom, with SEDI scores ranging only from ~0.26–0.53, indicating wide spatial disparity (Akram & Rahman, 2024; Kumari, 2014). Poverty and consumption data show development highly concentrated in Patna, with much lower living standards and slower poverty reduction in other districts (Kumari,

2016). Bihar as a whole ranks lowest in India on multiple inequality themes (livelihood, education, health, gender), and out-migration from poor districts is very high (Pandey & Gautam, 2020). Capital-city bias, better connectivity, and urbanization pull resources to Patna and some south-Bihar districts (Kumari, 2014; Kumar et al., 2024). North and east Bihar face recurrent floods, weak infrastructure, and limited industrialization, reinforcing backwardness (Kumari, 2025; Kumar & Nath, 2023; Pushpa, 2020). The existing literature on regional inequality in Bihar largely focuses on poverty, income levels, or sectoral growth patterns. While this paper try to slove the question by tracking the state's journey from 2005 to 2024. To look beyond simple averages, we use the Theil Index a powerful tool that doesn't just tell us if inequality exists, but where it is coming from. By breaking this down into the Theil T and Theil L indices, we can distinguish between two very different stories, one where the rich districts are pulling away from the other districts, and second where the most vulnerable districts are struggling to keep up. The Theil index allows for the decomposition of inequality into within-group and between-group components, providing a nuanced understanding of how disparities manifest at the district level. By applying the Theil index, researchers can compare income distribution across districts, identifying specific areas where interventions may be most needed to reduce inequality (Benítez et al., 2025).

This study seeks to analyse inter district inequality in Bihar using the Theil index. Employing both the Theil T and Theil L measures to capture disparities across different segments of the distribution. Using secondary district-level data for selected benchmark years between 2005–06 and 2023–24, the study is guided by the following objectives: (i) to measure the extent of inter district inequality in Bihar (ii) to examine whether inequality is primarily driven by top-end concentration or bottom-end deprivation

2. DATA AND METHODOLOGY

2.1. Data Sources

This analysis use district level data of 38 districts of Bihar across four years: 2005-06, 2011-12, 2015-16, and 2023-24. Data are sourced from the Bihar Economic Survey publications (2007-08 to 2024-25), published by the Department of Finance, Government of Bihar. These intervals provide a

comprehensive view of the state's economic trajectory across different policy regimes and developmental phases. Specifically, we extract district-wise population (in Lakhs), per capita income (at current prices, in Rs) and GDDP (at current prices, in crore) from Bihar Economy Survey.

3.2. Methodology

To analyze the contribution of each district to the state's overall inequality, we calculate the District Theil Ratio (R_i). This ratio measures the balance between a district's economic weight and its demographic weight.

The ratio for district "*i*" is calculated as:

$$R_i = \frac{Income\ share_i}{Population\ Share_i}$$

Where:

- Income share$_i$: The proportion of the total state income (or GSDP) accounted for by district i.
- Population Share$_i$: The proportion of the total state population residing in district i.

This formula provides a direct measure of equity:

- **R_i = 1 (Equity):** The district's economic contribution is exactly proportional to its population. It has its fair share of the state's economy.
- **R_i > 1 (Concentration):** The district is an economic hub. It produces more wealth than its population size would require. For example, a ratio of **3.63** (Patna) implies the district holds a share of the state's income that is 3.63 times larger than its share of the population.
- **R_i < 1 (Lagging):** The district is under-performing. Its economic contribution is smaller than its demographic weight. A ratio of **0.56** (Sheohar) suggests the district's share of the economy is only about half of what would be expected based on its population.

To measure the extent of regional inequality, this study utilizes two versions of the Generalised Entropy (GE) index:

- **Theil's T Index (GE (1)):** This index is weighted by the "income" or "economic share." It is more sensitive to changes at the upper end of

the distribution. A decline in this index typically signals that the richest districts are growing slower relative to the average. It is calculated as:

$$T_T = \frac{1}{N}\Sigma_{i=1}^{N}\frac{x_i}{\mu}\ln\left(\frac{x_i}{\mu}\right)$$

Where x_i is the economic indicator for district *i*, and μ is the state mean.

- **Theil's L Index (GE(0)):** Also known as the Mean Log Deviation (MLD), this index is weighted by the population share and is more sensitive to changes at the lower end of the distribution. A decline in this index signals that the lagging districts are catching up to the average. It is calculated as:

$$T_L = \frac{1}{N}\Sigma_{i=1}^{N}\ln\left(\frac{\mu}{x_i}\right)$$

Where x_i is the economic indicator for district *i*, and μ is the state mean.

By using both indices, the study can distinguish whether declining inequality is driven by the wealthy districts slowing down or the poor districts catching up.

4. RESULT AND DISCUSSION

The Theil Ratio is a fundamental metric in regional economics used to measure the relative economic performance of a district to compared the overall average of the state. It is calculated by dividing a district's share of total income by its share of the total population. This ratio acts as a multiplier of productivity relative to the state average. When we look at the economic data for Bihar over these 20 years, a clear pattern emerges. Initially, from 2005 to 2012, the gap between the rich and poor districts actually grew wider. The state became more unequal because a few Districts were growing much faster than the rest. However, the year 2011-12 marked a major turning point. Since then, the trend has completely flipped. For the last decade, the economic gap between districts has been declining.

Table 1: Theil Ratio across District of Bihar

Districts	*Theil Ratio (2023-24)*	*Theil Ratio (2015-16)*	*Theil Ratio (2011-12)*	*Theil Ratio (2005-06)*
Araria	0.70	0.64	0.61	0.64
Arwal	0.70	0.66	0.63	0.66
Aurangabad	0.93	0.93	0.76	0.72
Banka	0.73	0.74	0.64	0.70
Begusarai	1.42	1.74	1.22	1.21
Bhagalpur	1.36	1.22	1.20	1.18
Bhojpur	0.94	0.93	0.86	0.87
Buxar	0.90	0.89	0.78	0.82
Darbhanga	0.89	0.86	0.76	0.76
East Champaran	0.67	0.68	0.74	0.66
Gaya	0.93	0.92	0.82	0.85
Gopalganj	0.68	0.72	0.84	0.73
Jamui	0.79	0.84	0.70	0.63
Jehanabad	0.87	0.87	0.77	0.75
Khagaria	0.77	0.74	0.80	0.91
Kishanganj	0.81	0.66	0.69	0.75
Kaimur	0.88	0.77	0.72	0.78
Katihar	0.85	0.75	0.78	0.83
Lakhisarai	0.85	0.81	0.91	0.88
Madhubani	0.66	0.68	0.64	0.66
Munger	1.34	1.26	1.53	1.43
Madhepura	0.78	0.75	0.60	0.69
Muzaffarpur	1.00	1.00	1.07	1.00
Nalanda	0.92	0.90	0.87	0.85
Nawada	0.68	0.65	0.66	0.66
Patna	3.63	3.71	4.37	4.21
Purnea	0.78	0.74	0.70	0.75
Rohtas	1.04	0.97	0.96	1.02
Saharsa	0.79	0.78	0.84	0.85
Samastipur	0.79	0.77	0.75	0.76
Sheohar	0.56	0.59	0.49	0.47
Sheikhpura	0.75	0.73	0.67	0.73
Saran	0.73	0.70	0.74	0.75
Sitamarhi	0.62	0.69	0.66	0.60
Supaul	0.71	0.67	0.59	0.70
Siwan	0.79	0.77	0.74	0.72
Vaishali	0.87	0.85	0.87	0.81
West Champaran	0.75	0.85	0.69	0.84

Source: author's computation

For most districts, the Theil ratio declines gradually over time, especially between 2015-16 and 2023-24. This suggests a moderate reduction in intradistrict inequality in recent years. However, the decline is uneven, indicating non-uniform development across districts. That shows that Bihar has experienced partial convergence, but inequality has not disappeared from all District. Some districts show consistently high Theil values, often above 1 like Begusarai, Patna, Munger, Rohtas, Bhagalpur. In these districts Growth may be urban-centric or industry-specific, benefiting limited groups. Districts such as Araria, Supaul, Sitamarhi, Sheohar,Madhepura show lower Theil ratios (<0.75) and relatively stable patterns. These districts have uniformly low economic activity, rather than inclusive high growth. Lower inequality here does not necessarily imply prosperity, but rather low income levels among people of that district. Several districts show a clear reduction in Theil ratio over time, such as Begusarai, Gaya, West Champaran, and Purnia. Possible effects in this district may be of expansion of rural employment schemes or Growth in agriculture and allied activities.

Table 2: Summary Statistics of Theil Ratio's

Years	*Mean*	*Std. Dev.*	*Minimum*	*Maximum*
2023–24	0.917	0.49	0.564	3.63
2015–16	0.906	0.511	0.591	3.707
2011–12	0.886	0.612	0.491	4.369
2005–06	0.891	0.582	0.474	4.214

Source: author's computation

District averages fluctuated modestly around these years, rising slightly post-2005-06, peaking around 2015-16, then easing by 2023-24. Standard deviation fell from 0.61 to 0.49 that suggests reduced dispersion among district. Patna's indices 3.63–4.37 dwarf others may be due to urban-rural divides. The pattern reflects unequal structural transformation. Industrial and urban growth concentrated in a few districts and Agrarian districts remain more homogeneous but economically weak as compare to industrial ones. This Theil ratio reveals a gradual decline in inequality in Bihar over time but presence of inequality across economically advanced and backward districts indicate an uneven and incomplete process of socio economic transformation.

Table 3: Classification of District according to Theil Ratio

Inequality Group	*Count*	*Districts*
High ($R_i > 1$)	6	Patna, Begusarai, Bhagalpur, Munger, Rohtas, Muzaffarpur
Medium ($0.75 < R_i < 1$)	20	Bhojpur, Gaya, Aurangabad, Nalanda, Buxar, Darbhanga, Kaimur, Jehanabad, Vaishali, Lakhisarai, Katihar, Kishanganj, Jamui, Samastipur, Siwan, Saharsa, Purnea, Madhepura, Khagaria, Sheikhpura
Low ($R_i < 0.75$)	12	West Champaran, Saran, Banka, Supaul, Araria, Arwal, Gopalganj, Nawada, East Champaran, Madhubani, Sitamarhi, Sheohar

Source: author's computation

The classification of districts into high, medium, and low inequality groups provides further insight into the spatial pattern of inequality in Bihar. Only a small number of districts fall into the high-inequality category that reflects sharp internal disparities and concentration of economic activity. A few number of districts fall into the medium inequality group that indicates transitional development with partial diversification of economic activities. The majority of districts, however, are classified under the low-inequality category. It reflects a uniform distribution of low economic activity, where most households and sectors operate at similarly low levels of productivity. This pattern reinforces the argument that inequality in Bihar is characterised by the coexistence of a few high performing districts and a large number of uniformly underdeveloped regions. On one side, powerful districts like Patna, Begusarai, and Munger that are performing well above the average. On the other side, districts like Sheohar, Sitamarhi, and Madhubani that have been stuck at the bottom for years. For example, Sheohar produces only about half of what it should for its population size. This tells us that while the gap is closing because the rich districts are slowing down and not because of the poorest districts are suddenly booming.

The Theil Indices on Table 4 serve as a measure of inequality where higher values mean higher inequality. The data shows a clear "inverted-U" trend. Inequality increased initially and peaking in 2011-12 i.e. Theil T: 0.455. Since 2012, there has been a consistent decline in inequality. By 2023-24, both indices hit their lowest levels in the recorded period i.e. Theil T: 0.351. This suggests that economic disparities across the districts of Bihar are shrinking, and development is becoming slightly more inclusive compared to a decade ago.

Table 4: Value of Theil T Index and Theil L Index

Years	*Theil T (Top-driven)*	*Theil L (Bottom-driven)*	*Inequality Status*
2005-06	0.438	0.33	High baseline inequality.
2011-12	0.455 (Peak)	0.346 (Peak)	Inequality worsens; the gap widens at both ends.
2015-16	0.374	0.303	Significant drop; major correction begins.
2023-24	0.351 (Lowest)	0.289 (Lowest)	Inequality at its lowest point.

Source: Author's computation

Theil T Index is highly sensitive to what happens at the top of the economic ladder district like Patna, Begusarai. If this number drops, it usually means the rich districts are getting less dominant. While Theil L Index also called Mean Log Deviation is more sensitive to what happens at the bottom of the distribution. Changes in Theil L are driven by the poorer districts. If this number drops, it implies the poor districts are catching up. From the peak in 2011-12 to today, Theil T dropped by 23%, while Theil L dropped by only 16%. The reduction in inequality is primarily happening because the outlier districts like Patna are growing slower relative to the average than the poorest districts like Sheohar, Sitamarhi seeing explosive growth. The ceiling is lowering faster than the floor is rising. In 2005, Theil T was 1.33x higher than Theil L. Today, it is only 1.21x higher. The inequality profile is becoming more balanced. Previously, the inequality was heavily skewed by extreme wealth at the top. As the gap between T and L narrows. It suggests that the extreme outlier effect i.e. Patna's dominance is fading that makes the inequality distribution more standard and normal. This analysis of the data reveals a fascinating "inverted-U" trajectory. We see a period of widening gaps that peaked around 2011-12, followed by a steady, decade-long cooling of these disparities. This suggests that policy interventions or economic shifts occurring post-2012 successfully targeted regional imbalance.

5. CONCLUSION

The story of Bihar's economy was a story of two different worlds. On one hand the bustling energy of Patna acts as the state's undisputed economic engine. On the other hand the 37 other districts many of which felt like they were living in

a different decade. But data spanning the last 20 years suggests that the Great Gap is finally starting to close. If we look back at 2005, the state was already quite unequal. But things actually got worse before they got better. Inequality across the state peaked in 2011-12. During that time, the gap between the richest and poorest districts was at its widest but since 2012 situations changed. Year after year, the statistical gap between districts has been shrinking. Today, regional inequality in Bihar is at its lowest point in nearly two decades. The reason the state looks more equal today is largely because Patna's massive lead is shrinking. Its dominance has dropped from that 4.4 peak down to about 3.6 today. The topper of the class is still ahead, but the rest of the students are finally starting to get closer. Bihar is successfully moving away from being a state where only one city matters. We are seeing the rise of secondary hubs like Begusarai and Bhagalpur, which is great for the state's health.

The combined analysis of Theil T and Theil L indices indicates that inequality in Bihar is driven both by concentration at the upper end and continuous deprivation at the lower end of the district-level distribution. While the decline in the Theil T index indicates a gradual reduction in the extreme concentration of economic activity. The relatively slower decline in the Theil L index points to enduring structural backwardness among lagging districts. The districts of Bihar are currently witnessing Passive Convergence where inequality drops because the leader district are growing slower relative to the mean rather than Active Convergence where the laggards catch up through explosive growth. While the middle-tier districts are successfully moving toward the state average, a cluster of approx 12 districts the Low category remains trapped in a cycle of stagnation. Their Theil Ratios have shown remarkable "downward stickiness" over 20 years. Without a targeted, district-specific intervention that addresses their unique demographic and geographic constraints, they risk being left behind even as the state's aggregate statistics improve.

Bihar is no longer a state of one city and a void. It is becoming a more balanced regional economy. However, the next phase of development must shift its focus from the urban core to the marginalized periphery. The success of the next decade will not be measured by how much Patna grows, but by whether the state can successfully lift the floor in the agrarian heartlands of North and East Bihar. The goal for 2030 should be a transition from reducing disparity to creating distributed prosperity.

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