



A Fixed Effects Analysis of Absolute Income Convergence Across Indian States from 1970 to 2020

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Article Info

Article History:

Published: 25 Feb 2026

Publication Issue:
Volume 3, Issue 2
February-2026

Page Number:
422-426

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Abstract:

This study investigates the evidence of absolute income convergence among fifteen central Indian states over a multi-decadal horizon spanning from 1970 to 2020. Using a Fixed Effects (FE) panel data model to control for time-invariant, state-specific heterogeneity, such as geographic location, historical institutional frameworks, and climate, the analysis tests the Neoclassical “catch-up” hypothesis against the realities of India’s evolving macroeconomic landscape. The methodology focuses on the relationship between initial per capita income levels and subsequent growth rates across several temporal benchmarks, including the pre-reform era of centralised planning and the post-1991 period of market liberalisation. The research explores whether the Indian sub-national economies are moving toward a unified steady state or if internal barriers continue to foster persistent inequality. By evaluating absolute beta-convergence through a longitudinal lens, this paper contributes to the sub-national growth literature by identifying structural breaks in the convergence path. The use of the Fixed Effects approach ensures a robust estimation by neutralising regional characteristics that could otherwise distort the findings, providing a cleaner assessment of the “absolute” path to parity in a diverse federal union.

Keywords: Economic Growth, Convergence, Income, India, Fixed Effect.

1. Introduction

The core of neoclassical growth theory rests on the “Catch-up Effect,” which posits that under conditions of diminishing returns to capital, poorer economies should exhibit higher growth rates than richer ones. In the Indian context, the period between 1970 and 2020 represents a critical era for testing this Absolute Convergence Hypothesis. Unlike conditional convergence, which assumes states reach different steady states based on structural variables, absolute convergence suggests that state-level incomes will eventually gravitate toward a common equilibrium.

To rigorously test this, this study employs a Fixed Effects (FE) panel data model. This approach is pivotal because it accounts for unobserved, state-specific characteristics, such as cultural factors, climate, or long-standing legal legacies, that remain constant over the fifty years but significantly influence a state’s growth trajectory. By “shouting out” these time-invariant factors, the FE model provides a cleaner estimation of the speed of convergence, isolating the impact of initial income levels on subsequent growth.

The 1970 to 2020 timeline encompasses vastly different macroeconomic environments, from the centralised planning of the pre-reform era to the market-driven dynamics of the post-1991 period. By analysing this data through a fixed-effects lens, we can determine if the inherent disparities between states like Maharashtra

and Bihar are narrowing over the long run, or if the “absolute” path to parity remains elusive despite decades of national integration and fiscal transfers.

This paper contributes to the sub-national growth literature by providing a longitudinal assessment of whether Indian states are moving toward a unified steady state or if internal barriers continue to prevent the laggard regions from closing the absolute income gap.

2. Literature Review

The discourse on regional economic disparities is primarily anchored in the competing frameworks of the Neoclassical and Endogenous growth models. The Neoclassical tradition, pioneered by Solow (1956), posits that economies characterised by diminishing returns to capital and stable technological preferences will inevitably witness a “catch-up” effect. In this framework, Absolute (Unconditional) Convergence occurs when poorer regions grow faster than wealthy ones, eventually gravitating toward a synchronised level of per capita income, a concept later refined by Mankiw et al. (1992) to include human capital. Conversely, Endogenous models by Romer (1986) and Lucas (1988) suggest that increasing returns to scale and knowledge spillovers can lead to persistent divergence. Empirical validation has yielded mixed results; while Barro (1991) and Barro & Sala-i-Martin (1991) laid the foundational groundwork for testing these theories, Rodrik (2013) identified unconditional convergence within modern manufacturing, a claim later challenged by Barro (2016) at the aggregate level. Further nuances were added by Sutirtha Roy et al. (2016), who distinguished between S-convergence (catching up) and W-convergence (surpassing the frontier).

In the Indian context, the evidence is similarly polarised. Early research by Cashin & Sahay (1996) identified a 1.5% annual convergence rate among 20 states from 1961 to 1991, suggesting a slow but steady narrowing of disparities. However, this Neoclassical optimism was challenged by Marjit & Mitra (1996) and Rao et al. (1999), who argued that geographical barriers and policy biases, such as the gravitation of private investment toward affluent states as noted by Ahluwalia (2002) and Adabar (2004), thwarted the “catch-up” process. This trend toward sigma-divergence was further documented by Chikte (2011), particularly in the post-reform era. Methodological shifts, such as those employed by Cherodian & Thirlwall (2015) and Roy et al. (2019) using panel data tests, have underscored the need for sophisticated analysis. By focusing on the 1970-2020 period through a Fixed Effects lens, this study seeks to isolate the absolute convergence force while controlling for state-specific, time-invariant heterogeneity, thereby determining if India’s sub-national economies are truly moving toward a unified equilibrium or remaining trapped in persistent inequality.

3. Data and Methodology

To evaluate absolute β -convergence, the study employs a fixed-effects model to regress average per capita Net State Domestic Product (NSDP) growth on initial income levels. The following equation represents this relationship;

$$g_{i,t,t-\tau} = \alpha + \beta \ln(y_{i,t-\tau}) + \varepsilon_{i,t}$$

Where $g_{i,t,t-\tau}$ is the average growth rate of per capita NSDP, and $\beta \ln(y_{i,t-\tau})$ represents the natural logarithm of income at the start of the period. A negative and statistically significant β -coefficient confirms the presence of a “catch-up” effect, where less affluent regions grow at a faster pace than wealthier ones. The inclusion of fixed effects is vital for neutralising time-invariant regional characteristics that could otherwise distort the findings. Data are primarily collected from secondary sources such as EPWRF and CMIE States of India.

1. Evidence of Absolute convergence through fixed effect estimation

To rigorously evaluate the evidence on absolute income convergence across the 15 major Indian states from 1970 to 2020, the choice of an appropriate panel-data estimator is paramount. Before interpreting the regression coefficients, a Hausman Specification Test was conducted to determine the consistency and efficiency of the estimators. The Hausman test essentially evaluates the null hypothesis that the state-specific effects are uncorrelated with the regressors. If the null hypothesis is rejected ($p < 0.05$), the Random Effects model is deemed inconsistent due to correlation between state-specific error terms and the explanatory variables, necessitating the use of a Fixed Effects (FE) model. In this study, the Fixed Effects approach was selected to control for time-invariant heterogeneity, such as geographic location, historical institutional frameworks, and climate, which uniquely influence the growth trajectory of each Indian state. By “shouting out” these unobserved state-level idiosyncrasies, the FE model provides a more robust and unbiased estimation of the absolute convergence parameter.

Table 1: Fixed effect estimation of absolute income convergence of Indian states from 1970 to 2020.

	1970-2020		1970-1990		1991-2020		2001-2020	
	Coeff	Prob	Coeff	Prob	Coeff	Prob	Coeff	Prob
	t-stat		t-stat		t-stat		t-stat	
c	-9.328	0.071	-94.354	0.007	25.772	0.004	67.083	0
	-1.817		-2.813		2.936		6.981	
lny	1.268	0.012	9.841	0.006	-1.959	0.02	-5.673	0
	2.556		2.878		-2.386		-6.444	
R-sq	0.143		0.245		0.245		0.654	
Adj R-sq	0.047		-0.012		0.092		0.536	
F-stat	1.492		0.953		1.603		5.541	
D-W stat	2.048		2.273		2.254		2.078	

Source: Author’s calculation by using the EPWRF database

The empirical results presented in the table reveal a fascinating, non-linear narrative of India’s subnational development over the last five decades. The primary indicator for absolute convergence is the coefficient of the initial income level (lny). According to Neoclassical growth theory, absolute convergence holds only when this coefficient is negative and statistically significant, implying that states starting from a lower per capita income base grow faster than wealthier states.

For the whole study period of 1970-2020, the results show a positive coefficient of 1.268 ($p = 0.012$). This statistically significant positive value indicates a long-term trend of absolute divergence across the fifty-year

horizon. It suggests that, on average, a state's initial wealth acted as a catalyst for further growth rather than a hindrance, allowing affluent states to maintain or expand their lead over poorer ones. However, a granular breakdown into sub-periods illustrates that the pre-liberalisation era heavily skews this aggregate result. In the 1970-1990 sub-period, the divergence was most acute, with a significant positive coefficient of 9.841 ($p = 0.006$). During these two decades of centralised planning and the "License Raj," the structural barriers to growth were so significant that laggard states were unable to leverage the "catch-up" effect, leading to a widening chasm between the leaders and the followers.

A significant structural break is observed following the 1991 economic reforms. For the 1991-2020 period, the lny coefficient finally turns negative (-1.959) and is statistically significant ($p = 0.02$). It marks a pivotal transition in the Indian economy, where the forces of market liberalisation, increased labour mobility, and technological spillovers began to facilitate absolute convergence. This trend has not only sustained but also accelerated in the modern era. In the 2001-2020 sub-period, the coefficient deepens to -5.673 with high statistical significance ($p = 0.000$). The Adjusted R² also rises dramatically to 0.536 in this final period, suggesting that initial income levels now explain a substantial portion of the variation in growth rates. The high Durbin-Watson (D-W) statistics across the models (averaging near 2.0) further confirm the absence of serial correlation, ensuring the reliability of these findings.

The data suggest a "tale of two Indias": an earlier era defined by persistent divergence, followed by a post-millennium era where the Neoclassical prediction of absolute convergence has finally taken root, allowing poorer states to narrow the absolute income gap at an accelerating pace.

4. Conclusion

The findings of this study illustrate a complex, non-linear trajectory of regional economic development in India, moving from a protracted era of divergence to a modern period of accelerating catch-up. While the aggregate data for the full fifty-year span (1970-2020) suggests a long-term trend of absolute divergence, with a significant positive coefficient of 1.268, this result is fundamentally anchored in the pre-liberalisation decades. During the 1970-1990 sub-period, the "License Raj" and centralised planning frameworks appeared to exacerbate regional disparities, resulting in an acute divergence coefficient of 9.841. This earlier era stood in direct opposition to the Neoclassical "catch-up" effect, as initial wealth acted as a catalyst for further growth in affluent states. At the same time, laggard regions remained trapped by structural barriers.

However, the post-1991 economic landscape reflects a significant structural break, with the absolute convergence hypothesis finally gaining empirical support. The transition to market liberalisation and increased labour mobility led to a shift in the coefficient to -1.959 between 1991 and 2020, signalling that poorer states began to grow faster than their wealthier counterparts. This trend reached its peak in the 2001-2020 period, where the convergence coefficient deepened significantly to -5.673. The robustness of these modern findings is underscored by a high Adjusted R² of 0.536 and stable Durbin-Watson statistics, confirming that initial income levels have become a powerful predictor of subsequent growth in the current millennium. This "tale of two Indias" suggests that while internal barriers once prevented parity, the contemporary economic environment has successfully fostered a path toward regional income synchronisation.

Funding Details

No funds were received from any agencies or institutions.

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