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Regional Disparities Across Indian States: Are the Trends Reversing?

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Abstract

India has experienced consecutive decadal accelerations in aggregate growth rates, beginning in the 1980s, furthered by deregulatory policies resultant from the 1991 financial crisis, and continuing through the 2000s. This surge in economic growth has brought about significant prosperity for some states, while leaving other states nearly unchanged. Our research endeavours to document the regional disparities of growth across a sample of the 16 most economically prominent states from 1980-2010. The results indicate a lack of both β and σ convergence, along with a pronounced increase in the Theil index. Given the consistent results obtained from our analysis, we conclude that the growth experience has indeed been imbalanced. A continuation of the documented unbalanced regional growth could compromise national progress. Specifically, lack of convergence and heightened regional inequality could sabotage the great strides towards development achieved by India through deregulatory reform and liberalization policies, begun in the 1980s, although most notably undertaken after the financial crisis of 1991.

Keywords: Convergence, Regional Convergence, Regional Economic Growth, Regional Inequality, and Theil Index

1.0 Introduction

Over the past 30 years, India's boom in economic growth has brought about tremendous improvements for a considerable percentage of its vast population. However, much of the extant coverage of this phenomenon leaves wholly or partially untouched the issue of regional imbalances in said development.

During the last three decades, some of the more prosperous states have more than quadrupled their state domestic product per capita (SDPPC), while other have not even doubled. The current study endeavours to document this unequal growth and consider the future repercussions of such lopsided development.

To understand the dynamics of regional growth, researchers commonly employ income convergence analysis. This branch of economic thought attempts to understand the relationship between initially rich and initially poor economies: how the growth rates of rich economies compare to those of poorer economies and whether or not convergence exists among them. These convergence issues could scarcely be more relevant for the case of India, where robust growth over the last several decades has left an increasingly wide gap between its richest and poorest states.

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India's poorest states are also its most populous, leading to suspicion that a continuation of these unbalanced growth trends may lead to exaggerated intra-country disparities, precipitating political, social and economic disasters. As a result of the rising state-wise divergence, and the perception that market liberalization reforms created these disparities, some fear that India's post-independence phobia of foreign exploitation may return and jeopardize continued strides towards future economic development.

As discussed by Barro & Sala-i-Martin (1992) and Sala-i-Martin (1995), the greater attention paid to convergence analysis was an outgrowth of the popularization of modern endogenous economic growth modelling, beginning towards the end of the 1980s. Through the principle of diminishing returns to reproducible capital, the neoclassical models predict income convergence across economic units; accordingly, cross-country convergence analysis was seen as an essential proof in testing the legitimacy of these growth models. Interest in the dissection of the results from convergence testing was presumed to yield valuable results potentially facilitating a clearer understanding of economic growth theory. Complementary to this intensification in convergence analysis interest was the wide-scale availability of expansive international GDP datasets provided by Summers & Heston (1991), potentiating applied quantitative analysis.

Regional and state-wise convergence analysis has been a popular field of study for developed nations; although data issues may discourage extensive research for developing countries, a moderate selection does exist.

Examples of applied studies finding absolute convergence across developed regions include the 47 Japanese prefectures (1955-1990), 48 U.S. states (1880-1990), OECD countries (1960-1990), 90 European regions (1950-1990), 11 German regions, 11 United Kingdom regions, 21 French regions, 20 Italian regions and 17 Spanish regions (1955-1987) (Sala-i-Martin (1995)). Related to the case of Spanish regions, De la Fuente (2002) finds convergence of incomes, with Leonida & Montolio (2004) confirming convergence across Spain. Canova & Marcet (1995) provide evidence showing fast convergence rates across Western Europe, while Islam (1995) documents convergence across a sample of 97 countries; Caselli, Esquivel & Lefort (1996) likewise find convergence across a sample of 97 countries. However, Sala-i-Martin (1995) does not find convergence for a sample of 110 countries from 1960-1990.

As is often the problem with cross-country economic growth studies, convergence studies' results likewise tend to suffer when applied to especially heterogeneous samples. Absolute convergence theoretically ought to be more readily observed when applied to areas with similar economic parameters, such as: political and institutional environments, savings rates, population growth rates, as well as tastes for technology (Nagaraj et al. (2000)). Further, the intra-country differences in social and economic conditions theoretically could be greater than when compared to countries characterized by higher levels of economic development, potentially handicapping the likelihood of obtaining absolute convergence results.

Nevertheless, Juan-Ramón & Rivera-Batiz (1996) provide results for absolute convergence across Mexico, while Jian, Sachs & Warner (1996) find light trends of convergence across China (before deregulation) although after 1978 and through 1993 they do find stronger evidence of convergence. Later, Weeks & Yao (2003) confirm regional convergence in China from 1978-1997. Although not currently a developing country, Koo, Kim & Kim (1998) find convergence across the 10 states of Korea from 1967-1992, despite a decade of divergence (1972-1982) resultant from price shocks related to the 1970s oil crisis. For the case of Brazil from 1939-1995, Ferreira (1999) only finds evidence of conditional convergence[3].

Cárdenas & Pontón (1995) document absolute convergence across Columbia's 22 regions between 1950 and 1990, while an even faster rate of convergence was discovered when controlling for regional differences.

[3] Although conditional convergence testing is not undertaken in this current study, it refers to the convergence of incomes across regions once initial heterogeneity in the steady state is attempted to be held constant by region specific macroeconomic variables.

Elias & Fuentes (1998) compare conditional convergence rates in Chile and Argentina, finding that from 1960-1985 Chilean regions converged faster than Argentinean regions. Taking into consideration the precedents taken from developing nations, we proceed with caution concerning the current study for the case of Indian states.

Both research and common knowledge alike would suggest that convergence across Indian regions might be more difficult to observe. Given the diverse historical, cultural and organic barriers that separate India's vast regions, spread over 28 states and 7 union territories, and with the world's second largest population at well over 1.2 billion, the regional heterogeneity is astounding. However, as will be discussed more exhaustively in section three, a common practice in the ambit of Indian cross-state research is to limit the sample to only the most populous and economically prominent states; in theory this should aid in controlling for overly pronounced differences across India's diverse regions. When considering the size and population of Indian states, one can begin to appreciate why there is such cultural and ethnic diversity across this enormous country; indeed, the individual states are comparable to medium and large sized countries. Census data from the 2012 India Data Book provided by the Planning Commission shows that the average population of the 16 major states considered in this study was approximately 68,316,00 (Planning Commission (2012)). That state average population figure would shockingly rank as the 20th largest country in the world (CIA (2012)); further, the average area of those states is 189,573 km^2, which alone would rank 88th worldwide (CIA (2012)). The scale of India's size is a factor for the study of convergence across regions; despite the uniqueness of the Indian case, its population and cultural diversity, we endeavour to evaluate the evolution of convergence across the 16 most economically relevant states from 1980-2010.

The organisation of this paper and the empirical research centres on the classically established methodology laid out by Barro & Sala-i-Martin (1992) and a further publication by Sala-i-Martin (1995). In section two of this paper the methodology and theoretical construct of convergence analysis is presented; the principal varieties of convergence are discussed, and quantitative analysis styles are introduced.

In section three we provide a brief preface for the case of Indian states and regions; following the introduction in section three we present our own quantitative results applied to a sample of 16 of the most economically prominent and populous states of India from 1980-2010. Given the potential for confusion on relating our findings of distinct varieties of convergence, we reserve section four entirely for the comparison of our results to other authors' similarly designed research, rather than a piecemeal evaluation scattered throughout. In section five we conclude and indicate policy suggestions.

2.0 Convergence Methodology

Under the general heading of convergence exist two principal metrics commonly discussed in the literature: β and σ, as termed by Barro & Sala-i-Martin (1992). Fundamentally, absolute β convergence refers to the phenomenon of poorer countries growing at a comparatively faster pace than richer countries, with that process eventually leading to some level of convergence of incomes. Classical growth models predict this outcome given the diminishing returns to capital; as such, the growth rate should vary inversely to the observed initial capital stocks. The following equation given by Barro & Sala-i-Martin (1992) summarises the quantitative underpinnings of absolute β convergence:

1) $$Y_{i,t,t+T} = \alpha - \beta \cdot \log(y_{i,t}) + \in_{i,t}$$

Where $Y_{i,t,t+T} = \ln\left(\frac{y_{i,t+T}}{y_{i,t}}\right)\cdot\left(\frac{1}{T}\right)$ is the average growth rate of GDP for economic unit *i* between period t and $t+T$ with $\in$ representing an independently distributed error term.

If $\ln(y_{i,t})$ is the logarithm of economic unit *i*'s GDP per capita at time *t* and the coefficient β is greater than 0, it can be deduced that absolute convergence is present in the dataset.

Having reviewed the measurement of absolute β convergence, we now take a closer look at the fundamentals of σ convergence.

The σ convergence hypothesis is in fact quite simple: economic units that show a decreased level of dispersion of income per capita levels over time are said to exhibit σ convergence. Barro & Sala-i-Martin (1992) provide the following equation to summarise the principle:

2) $\sigma_{t+T} < \sigma_t$

Where σ_t represents the standard deviation at time *t* of *ln* ($y_{i,t}$) for all *i*. If the dispersion of incomes across all *i* between period *t* and *t+T* diminishes, we can say that the dataset exhibits σ convergence.

The neoclassical models of economic growth have laid the groundwork for the augmented, or endogenous growth modelling techniques made popular in the late 1980s. The intensified discussion of economic growth issues essentially lead to the popularisation of convergence theory, and the equations presented in this section. Now that we have completed the discussion of the relevant quantitative measures for absolute β and σ convergence, it is useful to explore the more in-depth theoretical discussions underlying these empirical formulae.

With respect to the connection between the empirical discussion, theoretical constructs and the historical significance of convergence analysis, Galor (1996) presents an eloquent dialogue relating the abovementioned issues regarding the main arguments associated to this field. He documents authors such as Romer (1986), Lucas (1988) and Barro (1991) as providing evidence to discredit the hypothesis of cross-country absolute convergence. Arguably the first of the revolutionary papers on modern endogenous growth theory, Paul Romer's (1986) 'Increasing Returns and Long-Run Growth' constructs an argument for sustained long-run economic growth rates by refuting the notion of diminishing returns to reproducible capital. The fundamental construct of absolute convergence is then called into question on the grounds that one of its core premises (related to the neoclassical model's assumption of diminishing returns to capital stocks) that growth rate ought to vary inversely with respect to initial capital stocks. That is, if poorer countries no longer have the comparative advantage of higher growth rates due to their comparatively lesser capital stocks, their prospects for converging towards income levels of more capitally intensive countries are severely handicapped.

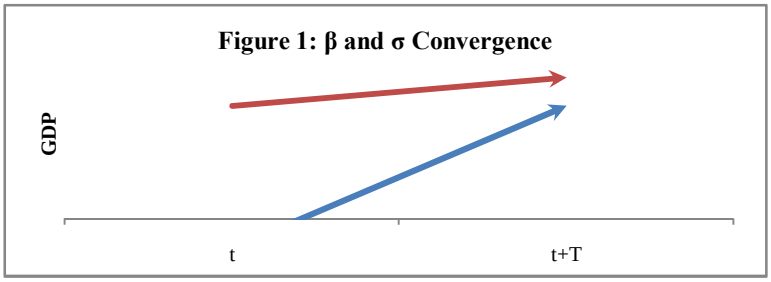
Lucas (1988), through the construct of several theoretical models[4], likewise finds little reason to support the claim that poorer economies, as a rule, should grow faster than their wealthier counterparts. Among other factors, he also mentions that high dispersion of growth rates among countries may persist indefinitely, given constant returns to reproducible capital (including human capital), given an accumulation or spillover effect. Importantly, he notes that said levels should not necessarily depend on initial stocks, further supporting the objection that growth rates do not necessarily vary inversely with initial capital reserves. Barro (1991) provides empirical results showing that the relationship between initial GDP levels and subsequent growth is close to zero; however, once initial human capital levels are controlled for across countries, the correlation becomes strongly negative.

[4] Speficially regarding this discussion on convergence, see the models and discussions introduced in sections 4 and 5 of his paper.

The implication is that only those poorer countries exhibiting relatively high levels of human capital stocks will grow faster than rich countries. What is the same, poor countries with low levels of human capital will not be able to grow faster, and will essentially be trapped in a low income low growth cycle.

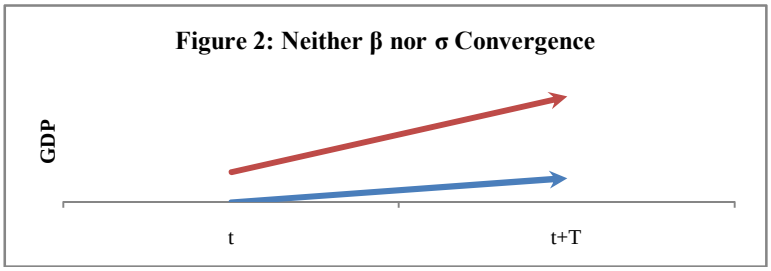
Much of the debate surrounding absolute β convergence centres on the comparability of economic units, based on both initial and structural conditions. The notion that starkly contrasting economies could ever reach the same level of income implies the assumption that the parameters defining their steady state characteristics also converge. That is, for their incomes to converge, they also should exhibit similar governmental institutions, savings rates, population growth rates, tastes, and technologies, along with many other characteristics. Indeed, such an assumption may be difficult to imagine; accordingly, it should come as no great surprise that many authors have found more compelling absolute convergence results by way of studying relatively homogeneous regions, given that their initial economic parameters are similar. In the case of analysis of a collection regions, countries or economic blocs that exhibit similar qualities, the literature supports the notion that realisation of absolute β convergence is more feasible. With the case of intra-country datasets, the theoretical advantage is that the steady state parameters are naturally far more comparable. In our current study applied to the states of India, we will enjoy the benefit of having reasonable justification to evaluate absolute β convergence.

Many researchers fall into the trap of believing that β and σ convergence are both measuring the same phenomenon. One would naturally assume that as a poor country catches-up to a richer country over time (β convergence), that correspondingly the dispersion among those economic units' incomes would fall over time (σ convergence). Although in a two economy model that statement would be true, as depicted by figure 1 below, there is more to the story.



Source: Sala-i-Martin (1995)

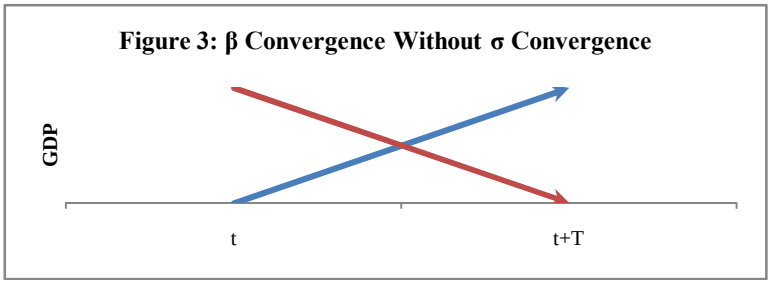
Above we can observe the simplified example of two economies' intertemporal development. The initially richer (red) and initially poorer (blue) economies exhibit both β and σ convergence across the two periods. Although both economies experience growth in GDP over time, the poorer economy (blue) grows at a faster rate than the initially richer economy (red); this indicates β convergence. Additionally, between period *t* and period *t+T*, we observe a decrease in the dispersion of the GDP across economies; this indicates σ convergence. Following this example, another easily imaginable scenario is the exact opposite of figure 1; the initially poorer economy (blue) fails to grow faster than the initially richer economy (red). In this case, we observe neither β nor σ convergence.



Source: Sala-i-Martin (1995)

Above in figure 2 we can see that β convergence has not occurred, given that the poorer economy has not grown faster than the richer economy. Correspondingly, the dispersion of incomes over time has, of course, also increased; that is to say that σ convergence has also gone unobserved.

Although the two previous examples would lead one to deduce that β and σ convergence always go hand in hand, let us provide an example first presented in Sala-i-Martin (1995). An abbreviated reiteration of β and σ convergence principles would say that β convergence only refers to the notion of initially poorer economies growing relatively faster than initially richer economies over time, while σ convergence serves only as a commentary on the intra-sample dispersion among economies over time. A demonstrative theoretical example presents a two-economy model, wherein an initially poorer economy grows so much faster than the initially richer economy, such that between periods *t* and *t+T*, the initially poorer country has switched positions with the initially richer country.



Source: Sala-i-Martin (1995)

In figure 3 we can observe that there was β convergence (the poorer economy did in fact grow faster than the initially richer economy) but no σ convergence occurred because at time *t* the dispersion of incomes is exactly equal to the dispersion at time *t +T* (the initially poorer economy overshot, or simply exchanged places with the initially richer economy). Although a rare and unlikely circumstance, the example is illustrative of the fact that β and σ convergence are mutually exclusive, and accordingly are not necessarily observed together.

Having reviewed the relevant theory and empirical principals of convergence analysis, the following section will move into coverage of the India specific experience. Since its independence from Great Britain in 1947, India has undergone extreme changes in development. Specifically, we will focus on the 1980s when a more pro-business paradigm was introduced across the economy, through the 1990s characterised by financial crisis in 1991 and subsequent progressive deregulation, and including the most recent decade, the 2000s.

3.0 State-Wise Indian Growth Experience

Since independence, India's government has maintained a clear agenda towards potent fiscal federalism aimed at balanced state-wise economic progress. Despite this effort, the issue of disparities in regional economic output has persisted over many years.

To a great extent, these persistent inequalities are due to the exceptionally wide variety of cultural and natural differences stretched across India's enormous land area, population and states; overall, realizing harmonised growth has been especially challenging.

For this reason, India's Constitution has been specifically designed to allow for strong central control of economic policies, including allocation of strategic monetary aid for poorer states. The planning commission of India should be seen as a great boon for the economy, in that it potentiates this strong central government, and in principle ought to fortify the likelihood of state-wise convergence. However, as will be discussed in later sections, recent results indicate that cross-state incomes in India are not experiencing convergence.

Interest in studying the economic evolution of India has experienced a significant uptick in recent years. Most notably, researchers have become interested in the explosive growth observed after the financial crisis of 1991 and the resultant deregulation. However, India had been enjoying elevated growth rates since the beginning of the 1980s, a clear departure from the popularly termed "Hindu" growth rate prevailing since independence (1947) through the 1970s. This wave of rapid development has brought great increases in wealth and development for some states, while leaving other states nearly unchanged. Some researchers point to the reforms realised after the 1991 crisis as being responsible for the divergent growth experiences, as well as large disparities in education, health and infrastructure across states (Das, Barua & Ghosh (1993), Das & Barua (1996), Bhattacharya & Sakthivel (2004), Kumar (2004) and Ghosh (2010)).

Others however, see that all states have benefitted to some extent from the reforms (Ahluwalia (2002), Ahluwalia (2000) and Ahluwalia et al. (1996)). Our current study will endeavour to analyse the convergence relationships across Indian states to uncover the evolution both before the 1991 crisis as well as after.

One inherent difficulty in the study of cross-state convergence in India lies with challenge of adequate data. Even India's economic planning committee continues to set national growth targets and establish other metrics to judge the success or failure of the implemented national economic plans, while the government continues to ignore the significant cross-state variations, and fails to work at improving them by not establishing targets for state level production nor facilitating analysis or justification for these wide cross-state differences (Ahluwalia (2000)). The puzzling lack of abundance concerning state-wise dissections of the nationally aggregated indicators has made research difficult. The scarcity of research on this topic is likely a product of the comparatively weaker selection, availability and reliability of data for individual states. A prominent author working in the field of Indian economics for over 40 years, highlights a quality issue which seems representative of the overall unsatisfactory circumstances regarding state-wise data reliability:

Ideally, the SDP (State Domestic Product) data series for individual states should be fully consistent with the national accounts estimates of GDP (Gross Domestic Product) but this…is not possible at present. Information on the SDP…is collected by the CSO…. In this process the CSO (Central Statistical Organisation) takes note of differences in methods of estimating the SDP in different states, but it does not refine the SDP series to make them consistent with each other and with the national accounts (Ahluwalia (2000) pg. 1)

Given this fundamental lack of institutional scrutiny and control for arguably the most important economic indicator, SDP, the expectations one can have for other macroeconomic variables and their quality is critically put into question.

Observations for all 28 states and the 7 union territories are difficult to come by; thusly, following the methodology of leading authors who use similarly abbreviated samples of Indian states (Nagaraj et al. (2000), Ahluwalia (2002), Trivedi (2002), Bandyopadhyay (2003, 2009, 2011), Purfield (2006), Amin & Matoo (2008), Nayyar (2008), Ghosh (2010), Chikte (2011), Aiyar & Mody (2012), Kumar & Subramanian (2012)), this study will consider 16 prominent states that are representative of both a large portion of India's total population and overall economic output.

The underlying reasons for including some states while rejecting others in the study samples relate to population size and economic might. Some states, for example Delhi, have exaggeratedly high SDPPC (State Domestic Product Per Capita) figures for a relatively small population. For example, Delhi's SDPPC is well over three times the average for the 16 selected states, while its population (at 16 million) would constitute less than 25% of the average calculated for our 16 state sample. Clearly Delhi is not representative of a typical Indian state and would be an outlier; and as such an observation would certainly bias results, we prefer to exclude Delhi and states characterized by similarly unrepresentative features. In some cases, the less populous states lack SDPPC observations, making it impossible to include them. However, from a statistical standpoint, their low populations and similar non-representative characteristics, make it more palatable to exclude them. It is worth highlighting the impressive disparity in population figures across regions; take the population of Uttar Pradesh at nearly 200 million, and Lakshadweep's mere 64,000 inhabitants (Planning Commission (2012)). Although it would be attractive to undertake analysis for all 28 states and the seven union territories; but given the data restraints and methodological concerns, it is preferable to harmonise the sample and eliminate the states that could compromise results.

For studies that undertake econometric analysis, rather than simply summarising data, the most common sample sizes vary between 14 and 16 states. Few authors expand their samples past 18, and it is indeed rare to see further extension. A restriction on potential variables to employ in our study is forced due to a lack of sufficiently longitudinal coverage necessary to accommodate the demanding goals of this lengthy study period. Accordingly, the following analysis has been adapted to, and in spite of, the data limitations; a modest grouping of figures and calculations has been compiled in order to examine various fundamental relationships regarding income convergence.

To begin with the introduction of our sample, table 1 below provides a snapshot view of macroeconomic conditions observed in the 16 states throughout our observation period from data taken from the Reserve Bank of India (RBI).

Table 1: Macroeconomic Summary Statistics

	1980s	1990s	2000s	Populaton	Literacy	Gini	Poverty
Punjab	3.3%	2.3%	3.3%	27,704	76.68	0.34	8.4
Haryana	3.2%	1.8%	6.0%	25,353	76.64	0.34	14.0
Maharashtra	3.4%	4.1%	6.6%	112,373	82.91	0.34	30.7
Himachal Pradesh	2.8%	3.7%	4.5%	6,857	83.78	0.31	10.0
Kerala	1.2%	4.1%	6.0%	33,388	93.91	0.37	15.0
Gujarat	3.1%	4.1%	7.2%	60,384	79.31	0.29	16.8
Assam	1.7%	0.4%	3.0%	31,169	73.18	0.26	19.7
Tamil Nadu	3.3%	4.4%	5.6%	72,139	80.33	0.34	22.5
Karnataka	3.0%	5.0%	5.0%	61,131	75.60	0.31	25.0
Orissa	2.6%	2.7%	5.8%	41,947	73.45	0.32	46.4
West Bengal	1.6%	4.4%	4.7%	91,348	77.08	0.33	24.7
Madhya Pradesh	1.1%	2.6%	3.9%	72,598	70.63	0.33	38.3
Andhra Pradesh	3.8%	3.2%	5.7%	84,666	67.66	0.33	15.8
Uttar Pradesh	2.2%	1.0%	3.0%	199,581	69.72	0.33	32.8
Rajasthan	3.4%	2.4%	4.1%	68,621	67.06	0.31	22.1
Bihar	2.0%	-0.8%	4.5%	103,805	63.82	0.27	41.4

Source: Author's Calculations from RBI (2013) Data & Planning Commission (2012)

The states are ordered from highest to lowest SDPPC in 1980. We can observe the decadal average annual growth rates for the states, their population and literacy rates from the 2011 census, along with the Gini[5] index and poverty headcounts taken from the most recent 2004-05 survey data.

Casual observation through correlation tests indicate that the wealthier states at the beginning of our study period tended to grow faster in each of the separate decadal groupings[6], have higher literacy rates[7], lower rates of poverty[8]; however, higher SDPPC was related to higher within state Gini[9] coefficients. A further troubling finding was that higher SDPPC was inversely related to population size[10], a worrisome result implying that the poorest states are also those encumbered with managing the largest populations with comparatively fewer resources.

Further, this result could imply an exacerbation of cross-state income inequality, leading to heightened socio-political instability. However, these informal tests serve only as a starting point for more rigorous quantitative analysis, although the results indicate some alarming tendencies.

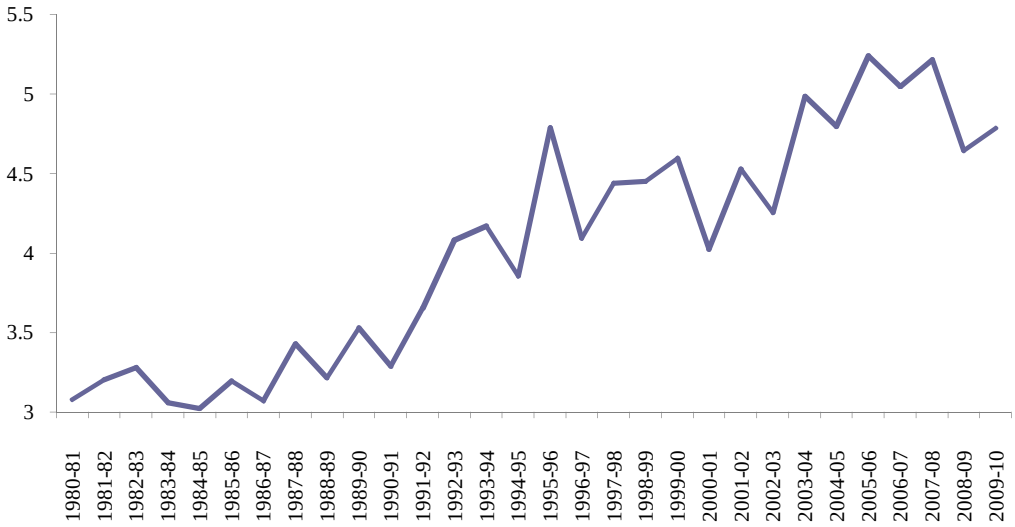
3.1.0 Inequalities in Growth and Income across Indian States

After the previous section's brief introduction, it is clear that the inequalities in economic conditions across Indian states demand further attention. In the study of convergence results, authors commonly first introduce the overall state of inequality (in growth rates and income) at the state or regional level. Bandyopadhyay (2011) highlights an interesting point: currently the richest states of India (Maharashtra, Haryana, Punjab) are similar in development levels to middle-income countries (Brazil and Poland); while the poorest states of India (Bihar, Uttar Pradesh, Madhya Pradesh) are inferior in human development and economic growth measures to Sub Saharan African countries[11]. Perhaps the most troubling issue raised by the above comparison is the stagnant growth levels in those poorest states. Indeed, Bihar experienced an overall negative annual growth rate for the 1990s, while Uttar Pradesh and Madhya Pradesh grew far too slowly in the 1990s to begin catching up to the richer states. Although encouraging improvement in growth rates for the poorest states has been observed for the most recent decade, persistently high levels of poverty, lower literacy rates all distributed across staggering populations may prove to be significant roadblocks for the potential to begin on the path towards convergence.

Figure 4 below introduces an illustrative example of the cross-state inequalities in SDPPC levels throughout our study window. The ratio captures the maximum level of SDPPC compared to the minimum for the 16 states considered in this study, for each given year throughout the 30-year period.

[5] The Gini values displayed are an average of rural and urban data obtained from the India Data Book 2012.
[6] 1980 SDPPC correlation with decade average growth rates: 1980s = 0.222, 1990s = 0.344, 2000s = 0.294
[7] 1980 SDPPC correlation with literacy rate: 0.735
[8] 1980 SDPPC correlation with poverty rate: -0.598
[9] 1980 SDPPC correlation with Gini coefficient: 0.319
[10] 1980 SDPPC correlation with population: -0.579
[11] Richest and poorest states are considered from updated SDPPC data (2010), not as observed in table 1 for the initial 1980 income.

Figure 4: Maximum to Minimum SDPPC Ratio



Source: Author's Calculation from RBI (2013) Data

The above result corroborates a clear and steady departure of the two extremes of the cross-state Indian income level spectrum. We can see that the ratio of maximum to minimum SDPPC started in 1980 at 3.08, rising to over 5.22, and then finishing at 4.78 in 2010. It is also noticeable that the ratio remained fairly stable throughout the 1980s, a result we will see repeated in later analysis, while a clear acceleration of the maximum to minimum ratio can be observed around 1990. The state of inequality in 1980 alone is alarming, but the increase over the 30-year study window is troublesome: the fact that the richest state had a SDPPC level over five times larger than the poorest! Indeed, high levels of cross-state inequality are nothing new for India, and updated results suggest that such trends are not disappearing.

Table 2: SDPPC Decadal Levels and Rank

	[1] 1980s	[2] 1990s	[3] 2000s	[4] 1980s	[5] 1990s	[6] 2000s	[7] 1980-2010
Maharashtra	16070	25589	40688	3	2	1	2
Haryana	18612	25534	40544	2	3	2	7
Punjab	20514	26983	35215	1	1	3	11
Himachal Pradesh	14870	21042	34934	4	5	4	8
Gujarat	14565	22031	34744	5	4	5	4
Kerala	13570	20183	34118	6	7	6	5
Tamil Nadu	12855	20622	32955	8	6	7	1
Karnataka	12295	18596	29639	9	8	8	6
Andhra Pradesh	11199	16408	27721	10	9	9	3
West Bengal	10588	14852	23841	12	10	10	9
Rajasthan	9837	14679	19655	14	11	11	10
Orissa	10961	12374	18234	11	14	12	12
Assam	13208	14601	17086	7	12	13	16
Madhya Pradesh	10195	13180	16509	13	13	14	14
Uttar Pradesh	9314	11338	13646	15	15	15	15
Bihar	6391	6571	8716	16	16	16	13

Source: Author's calculation from RBI (2013) Data

Table 2 below provides a more complete depiction of the evolution of SDPPC levels throughout our three-decade observation window. Averages were calculated for each state's decade specific SDPPC level to assist with a period ranking. We prefer decadal averages to point specific measurement as it captures a more stable, representative indication of a state's wealth. The states are ordered from highest to lowest SDPPC as observed by their 2000-2010 average SDPPC value.

We can see in columns 1, 2 and 3 the average levels of SDPPC for the 1980s, 1990s and 2000s, respectively; columns 4, 5 and 6 show the corresponding rankings. In column 7 we have calculated the absolute growth for each state from 1980 to 2010; these growth rates were then ranked to juxtapose this absolute change throughout the entire study period with the wealth ranking metrics.

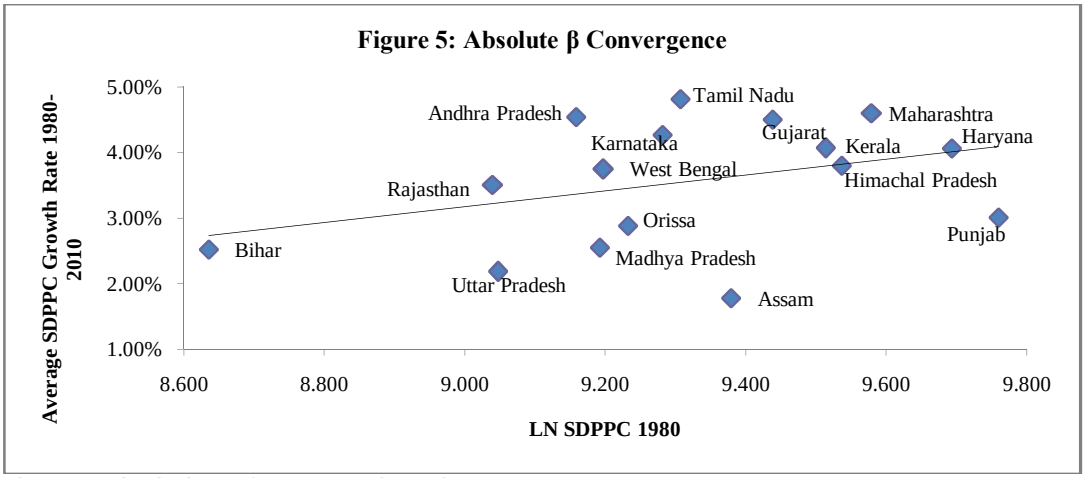
Without the aid of sophisticated econometric tools, we can clearly see a strong tendency for states that started at a high ranking in the 1980s to remain high throughout, while the reverse is also true; states that started with a low ranking SDPPC had a high propensity to remain at the lower end of the ranking spectrum.

Column 7 shows the same overall tendency for the richer states to enjoy the highest absolute growth from 1980 through 2010, albeit at a less pronounced rate and with a few exceptions. Punjab is an interesting exception, given that it was the richest in 1980, but has only the 11th highest growth rate throughout the period. Although not as marked, Himachal Pradesh and Haryana were likewise initially and persistently rich, but had growth rates well below their wealth rank. At the poorer end of spectrum in column 7 we see mostly stagnation, with little encouragement for signs of higher growth for the poorest states.

3.2.0 Absolute β Convergence across Indian States

Having discussed various casual metrics regarding income levels and subsequent growth rates, we transition to more familiar convergence tests. As discussed at length in section 2.0, absolute β convergence in the context of the current study would highlight the tendency of initially poorer states to grow faster than initially richer states, independent of initial conditions or steady state parameters. To explicitly test this relationship, a Barro & Sala-i-Martin (1992) absolute β convergence test has been undertaken, incorporating all 16 states over the entire observation period. The states' natural logarithms of initial SDPPC for the observation year 1980 have been graphed alongside their respective average growth rates for the full observation period, 1980-2010. If absolute β convergence were to be observed, an inverse relationship ought to be observed between initial income level and the subsequent average period growth rate. In figure 5 below we can see the results for our test for the 16 states of India.

Figure 5: Absolute β Convergence



Source: Author's Calculations from RBI (2013) Data

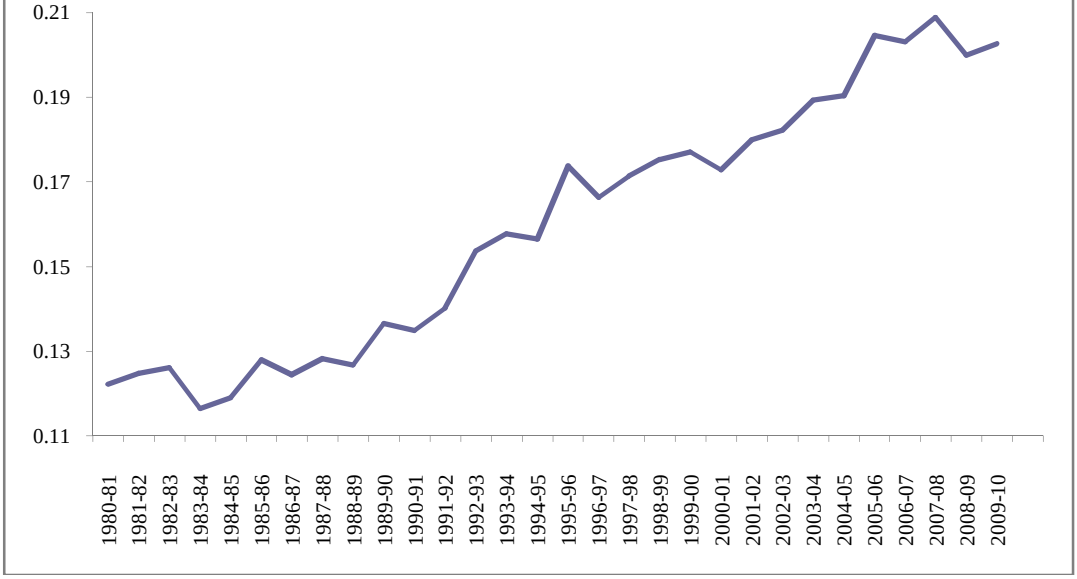
The positive trend line obtained by our absolute β convergence test confirms that throughout the observation period 1980-2010, initially poorer states did not tend to grow at a faster pace than the initially richer states. Indeed, the opposite is true: the initially richest states tended to grow comparatively faster than the initially poorest states.

The speed of convergence obtained from the β coefficient provides information on how long it would take any state to reach its steady state income level; Barro & Sala-i-Martin (1990) provide cross-country results indicating 2.0% annually is typical. That rate would imply an economy would need approximately 34 years to close 50% of the gap between its initial level of income and its steady state level, typically referred to as the half life[12]. Given that our results do not indicate convergence, our coefficient results indicate the speed at which the states grew apart. Specifically, for the 1980-2010 period, we obtain an annual rate of divergence of 1.2%. Each decadal period maintained the finding of divergence, although the rates varied: for the 1980s the speed of divergence was 0.8%, for the 1990s it was 2.3% and 1.4% for the 2000s. Combined with our informal discussion of growing cross-state inequalities, the lack of absolute β convergence should not be surprising.

3.2.2 σ Convergence Across Indian States

Finally, we evaluate the existence of σ convergence. In the context of our current study, to observe σ convergence across the 16 states of India between 1980 and 2010, we would expect the cross-state dispersion of SDPPC levels to have decreased over time. The metric employed is quite simple: we present the standard deviation of all 16 states' SDPPC in year *t* (1980), and compare it to year *t* + *T* (2010). In our case, we do not observe σ convergence, given that our results reveal that in fact SDPPC dispersion across states has increased substantially. To display these findings, we have realised the same calculation for all observation years.

Figure 6 : σ Convergence



Source: Author's Calculation from RBI (2013) Data

Figure 6 above shows quite clearly that cross-state income levels have diverged, and in a rather significant pattern. At the very beginning of the 1980s, σ convergence was taking place, albeit at a gradual pace. The calculation of the standard deviation of incomes across the 16 states was 0.124 in 1980, dropping to the lowest level for the entire observation period of 0.119 in 1984, but finally growing to 0.135 by 1989.

[12] The half life (HL) can be calculated as the solution to $e^{-\beta * HL} = 0.5$, which yields: $HL \cong 0.69 / \beta$

However, beginning in the 1990s, we observe strong acceleration in the rate at which states' income levels diverge.

In 1990, the standard deviation is 0.135 and over the decade it increases to 0.176 by 1999. The 2000s saw the same figure increase from 0.171 to 0.203 by 2010, although it did peak higher at 0.207 for the year 2007. The σ convergence exercise corroborates the popular finding that divergence in income levels remained relatively flat in the 1980s, while it began to accelerate strongly around 1990. Taken altogether, the results show clearly that the dispersion of cross-state SDPPC levels has increased significantly over the period 1980-2010; in particular, these increases have been notably more pronounced beginning around 1990, and maintaining high rates for the 2000s.

3.2.2 Theil Index of Cross-State Inequality

Having already executed a summary of cross-state heterogeneity in growth experience, in conjunction with the two classically oriented convergence tests, we present one final empirical measure to explicitly calculate a cross-state inequality indicator. Specifically related to the goal of our study of convergence, we utilize the well-known Theil index (Theil (1967)) as a means to test the intertemporal tendencies of inequality across states, shedding light on the pattern of convergence or divergence. An especially convenient feature of this inequality indicator, which other popular inequality figures do not satisfy (for example Gini coefficients), is the decomposability of the Theil index. Bourguignon (1979) underlines the feature of decomposability as being a measure that allows for aggregate inequality to be separated into a weighted average of the disparity between the sub-groupings of the population. Decomposability is useful when the complete sample population of income earners under study can be divided into a finite number of sub-groupings (in our case the 16 states of India); once the population is disaggregated, realizing a summation of the individual inequalities arising solely from differences across the individual groupings yields an inequality calculation. In our case, this quantification represents an easily understandable number at a given time, but when calculated across many years, yields valuable information pertinent to the study of convergence. Given that our goal is to study intertemporal cross-state convergence dynamics, an understanding of the evolution of the Theil index runs parallel to that objective.

The application of this index to our current study captures the cross-state disparity of individual states' State Domestic Product (SDP) with respect to their population in a given year, measuring the deviation from a perfectly proportionate distribution.

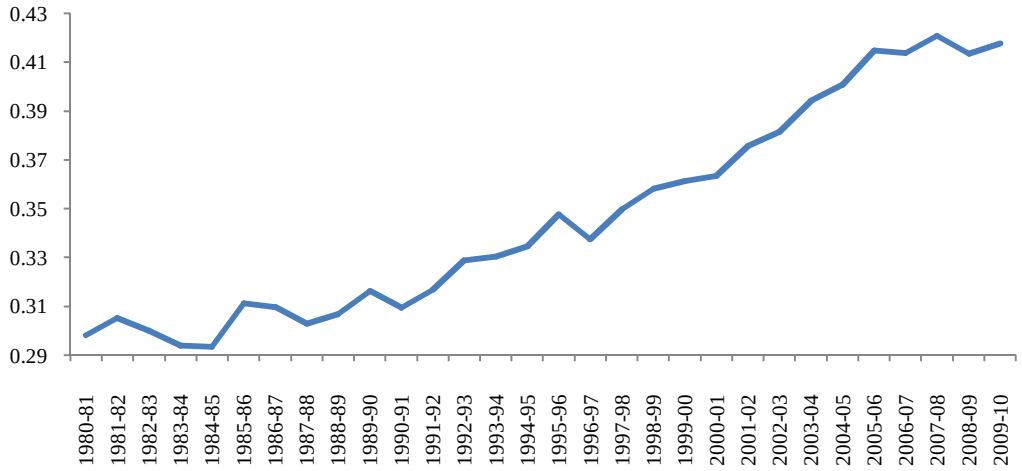
As a result, the formula has the shortcoming of not accounting for intra-state inequalities, as the nature in which the index is calculated treats each state as if all inhabitants were to be homogeneous with respect to income level; however, this shortcoming does not hinder our case, given that our study only refers to state level incomes. Below, the formula for the Theil index is given by:

$$J = \sum_{i=1}^{n} \left(\frac{P_i}{\sum P_{16\,States}} \right) \ln \left[\frac{\frac{P_i}{\sum P_{16\,States}}}{\frac{Y_i}{\sum Y_{16\,States}}} \right] = \sum_{i=1}^{n} P_i \ln(j_i)$$

Where *P* represents population, *Y* refers to income, and the *i* subscripts indicate individual states' characteristics.

As population data is only available at ten-year intervals, we utilized linear interpolation to create annual observations from the 1981, 1991, 2001 and 2011 data, while using the same linear method to extend the estimations one year back, achieving a final observation window from 1980-2010. SDPPC data is available for all years and states up until the 2009-10 year, the last year we were able to extend the analysis. Figure 7 below displays the values obtained:

Figure 7: Theil Index Across Indian States 1980-2010



Source: Planning Commission (2012) & RBI (2013)

As we can observe, the index closely resembles our σ convergence analysis, in that cross-state divergence remained relatively calm during the 1980s, while experiencing an obvious acceleration at the beginning of the 1990s, and further acceleration during the 2000s. Specifically, the decadal increases in the Theil index were 0.018, 0.052 and 0.054 for the 1980s, 1990s and 2000s, respectively. Given that this same pattern of growing inequality has been observed in our σ convergence and figure 4, the conclusion of accelerating state-wise inequality indeed appears robust.

4.0 Discussion

Having presented results from two of the most commonly employed convergence tests, along with the addition of cross-state inequality analysis by way of the Theil index, we now compare our results with those of authors' of similarly focused research. In a general sense, the absence of cross-state β and σ convergence from 1980-2010 is tremendously robust, as is the finding of state-wise divergence of incomes. Authors that claim to confirm convergence among states tend to have studied periods prior to those associated with the accelerated growth observed from the 1980s to the present. Another potentially confounding issue lies with the sample of states selected. Authors do not agree on the exact number of states to include, although the most common groupings range between 14 and 16 states. It is important to note this cross-sectional selection component given the likelihood for outlier states' inclusion to have a strong influence on convergence results. We discuss only those publications that maintain a methodology consistent with established studies in the field of empirical analysis applied to Indian states.

To facilitate a straightforward presentation of results and to avoid confusions with the three varieties of convergence discussed, we evaluate the different categories individually.

To begin, we compare our finding of no absolute β convergence with the same results from: Kumar & Subramanian (2012) for the 2000s; Stewart & Moslares (2012) for 1980-2009; Kumar (2011) for both pre (1982-1991) and post (1991-2005) deregulation periods; Kalra & Sodsriwiboon (2010) for 1970-2003; Ghosh (2010) from 1960-2007 with a most pronounced divergence after the implementation of deregulation; Nayyar (2008) from 1978-2003; Purfield (2006) 1970-2004; Rodrik & Subramanian (2004) for both the 1980s and 1990s at statistically significant levels, and for the 1960s and 1970s outside of traditional statistical significance parameters; Datt & Ravallion (2002) for the 1990s; Trivedi (2002) from 1960-1992; and Nagaraj et al. (2000) for 1970-1994.

Contrasting these findings, Cashin & Sahay (1996) do find absolute β convergence from 1961-1991. A noteworthy detail related to their study is their inclusion of 20 states, an unusually high number, potentially responsible for the abnormal output; further, some of their reported coefficients indicating convergence were statistically insignificant.

Next, we move to the evidence regarding σ convergence and the empirical findings in the literature. Our results indicate a lack of σ convergence, and in fact a very significant increase in the dispersion of cross-state SDPPC levels. This finding accords with: Kumar & Subramanian (2012) from 1971-2009; Stewart & Moslares (2012) for 1980-2009; Chikte (2011) for both (1970- 1990) and (1991-2004); Ghosh (2010) studying 1960-2007, finding strong σ divergence beginning around 1970-2007; Nayyar (2008) from 1978-2003; Purfield (2006) from 1970-2004; Rodrik & Subramanian (2004) from 1960-2000; Trivedi (2002) from 1960-1992; Ahluwalia (2002) studies 1980s and 1990s, and finds acceleration in σ divergence from 1986 to the late 1990s; and Nagaraj et al. (2000) studying 1960-1993, finding strong σ divergence beginning around 1970. With an exhaustive review of the literature, we have been unable to locate definitive results finding σ convergence across Indian states; therefore, we conclude that σ convergence is not occurring across Indian states.

In line with the results of the abovementioned results, our final measure employed in the analysis of convergence across states was the Theil index. Although its implementation in the literature is not nearly as widespread as either the β or σ convergence typically referenced in research similar to the current study, we find its inclusion valuable in confirming the findings from our β and σ tests. With the exhaustive empirical analysis applied to cross-state convergence, the Theil index helps us clearly see that the 16 states of India studied herein have observed an increase in cross-state inequality, and have certainly not experienced convergence of income levels.

5.0 Concluding Remarks

The well-known case of India's miracle growth over the last three decades conceals the overlooked truth that the gains from this economic expansion have not been distributed in an equitable fashion across states.

We have analysed 16 of the most economically relevant and populous states both before and after the 1991 financial crisis, specifically 1980-2010. In accordance with a multitude of similarly focused studies, our results confirm that the poorest states did not grow faster than the richest states (β convergence) and that the cross-state dispersion of income levels did not decrease throughout our observation period (σ convergence). Our calculation of the Theil index allowed us to track the levels of inequality arising solely from disparities in levels of income over time; the findings indicated that inequality across states has grown over time, and the Theil index reinforces the results from both the β and σ tests that convergence is not occurring.

Our analysis from table one suggests that the poorest states may be weighed down by pronounced levels of poverty and damagingly low levels of literacy, potentially explaining their difficulty in growing as fast as the richest states. If both federal and state governments allow this trend of divergence to continue unchecked, these prominent cross-state differences in economic prosperity could lead to an unstable social and political environment. Such instability may call into question the likelihood of India remaining on its current path towards successful and constant economic development.

Improvement in educational opportunities, especially focused on high poverty and low literacy areas, would be one of many potential policy recommendations. Massive populations in the poorest regions of India are placing additional stress on the already weakest economies, further complicating potential for successful balanced growth. Previous authoritative works, for example Nagaraj et al. (2000) and Purfield (2006), had long signalled the potential for unequal regional growth to compromise efforts aimed at economic stabilization and future growth prospects. Considering India's growing importance on the world stage, the implications concerning the wide disparity in macroeconomic conditions across states certainly merits future research and close attention from policymakers.

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