

Regional Disparities in Per Capita GSDP / NSDP in the Seven Sister States in India: Convergence and Divergence

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Abstract

The main theme of the 12th five-year plan (2012-17) is faster, sustainable, and more inclusive growth, but the regional disparities have broadened significantly in the recent decades, and there is weak evidence of convergence. This study attempted to probe this question by analyzing the (GSDP) per capita income in the Seven Sister States in North East India during the period of the first decade of the 21st century by estimating the convergence and divergence. Regional disparities in the gross state domestic product have widened much more significantly, but there is weak evidence of conditional convergence controlling for some variables as an inverse relationship was found between average state expenditure of GSDP and CAGR per capita growth. The study results showed that agriculture growth is positively interrelated and is not significant to the compound annual growth rate of per capita gross state domestic product. The study showed that the Seven Sister States experienced a degree of convergence in the per capita GSDP during the period from 1999/00 (coefficient of variation : 0.0114), but during the 2010/11 period, the coefficient of variation increased (coefficient of variation : 0.0172). Therefore, divergence was also found to have increased continuously in these states. In contrast, groups' wise coefficient of variation decreased considerably for per capita NSDP.

Keywords: regional disparity, per capita GSDP, convergence and divergence

JEL Classification: O47, R11, R12

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Regional disparity in the economy is a pure feature of development, growth, and variations in states. The variations in the North -East region of India are vast with respect to per capita income, standard of living, financial allocation, investment, expenditure, and so on. Few states of North-East have achieved the highest rate of growth in recent years; while others have not; this is attributable to the concern of neoclassical assumptions of diminishing returns to capital. Attributing to this, disparities have widened in a developing country like India. During the 1990s, disparities widened and there was no proof of convergence. More specifically, Ahluwalia found that the Gini coefficient increased from 0.16 to 0.23. Results have shown that disparities increased over the period from 1986/87 to 1997/98. Many studies have focused on the highly populous states, and their results offered little evidence about convergence. However, there may be some convergence of the North -Eastern states with the rest of the country. However, studies have found more evidence of divergence rather than convergence (Ahluwalia, 2000, 2002 ; Cherodian & Thirlwall, 2013 ; Nayyar, 2008; Ramaswamy, 2007 ; Sachs, Bajpai, & Ramiah, 2002). The seven sister states experienced a degree of convergence in the per capita GSDP during the period from 1999/00 (coefficient of variation was 0.0114) , and during the 2010/11 period, the coefficient of variation increased (coefficient of variation was 0.0172). Therefore, divergence has increased continuously in the North -East Himalayan Seven Sister States. The present study further divided the

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Seven Sister States into groups and found that group wise coefficient of variation decreased considerably. The results showed little convergence (group wise) of the states.

Economists and policy makers have known that the main indeterminate portion for growth and development of the North-East region are the disadvantages posed due to geographical location, flooded area, less developed infrastructure, and international borders. The North-East States are not able to attract considerable FDI due to the above-mentioned challenges. The North-East part of India remained disconnected with other parts of the country for a long time. Lack of infrastructure (mainly transportation and electrification) and natural calamities, especially floods in the monsoon season have been the main obstructions in the development process (Das, 2013). The main objectives of 12th five-year plan are to deal with the disparity of income and wealth, bring about balanced regional development, and bring in govt. intervention required for development of infrastructure. The Ministry of Development of North Eastern Region is a separate ministry of the Govt. of India, which is trying to run development programs across the region. Gupta (2014) suggested that there is an urgent need to provide better education, medical facilities, earning avenues - a combined plan of development and incentives is required to improve the lives of people living at high altitudes. The contribution of the present paper to the literature on the subject is twofold. First, it describes and analyzes these differences over the period of 1999/00 and 2010/11 (GSDP), 2004/05 and 2012/13 (NSDP) and tests for convergence and divergence across the North-Eastern Seven Sister States. Second, it adopts a cross-sectional approach to analyze the long-term relationship, and it takes some of the same control variables.

Review of Literature

There have been several previous studies on the convergence and divergence or otherwise of per capita incomes (measured by GSDP) across various regions of India. The study differs in the division of regions taken, the period covered, and the method of estimation so that a broad consensus emerges.

In the context of rising regional disparity, some scholars have tested the convergence/divergence hypothesis as postulated by Solow (1956). In this context, Nair (1983) analyzed only 14 major states, and found that interstate disparities in per capita NSDP, as measured by the coefficient of variation (CV), declined over the period from 1950-51 to 1964-65, but increased between 1964-65 and 1976-77. Das and Barua (1996) observed several dimensions of regional economic disparities among the 23 states /union territories during the period from 1970-92. The study found that interstate inequality had increased in almost all the states. Cashin and Sahay (1996) observed the presence of 'unconditional' and 'conditional' convergence during the period of 1961-1991. Bajpai and Sachs (1996) also found the presence of convergence over the entire period.

Contrary to these studies, Ghosh, Marjit, and Neogi (1998) used data for 35 years and 15 states considering the time period from 1960-61 to 1994-95 and tested the hypothesis of absolute convergence and found strong evidence of divergence. Nagaraj, Varoudakis and Veganzones (1998) found the average per capita SDP growth during the three sub periods from 1960 to 1994. Furthermore, they found that regional inequalities in India increased over time. Nagaraj (2000) used panel data for 17 states, and suggested that focusing investment efforts on physical infrastructure (electricity, irrigation, and railways) and social infrastructure (human development) would raise the overall effectiveness of public investment and would raise the levels of growth. Rao, Shand, and Kalirajan (1999) and Dasgupta, Maiti, Mukherjee, Chakrabarti, and Sarkar (2000) found evidence of divergence in the Indian economy. Mathur (2001) found a steep acceleration in the coefficient of variation of per capita incomes in the post-reform period of 1991-96. While divergence was evident within the groups of high and low income states, convergence was noticed within the group of middle-income states.

Ahluwalia (2000, 2002) found rising regional inequality, as measured by an increase in the Gini-coefficient from 1986-87 to 1997-98. Sachs et al. (2002) found that inequality rose by (between 1980 and 1998) 2.39% per annum in the given time periods. Trivedi (2002) came up with results similar to Aiyar (2001) for 16 major states in India during the period from 1960-1992, and found strong evidence for absolute divergence, but conditional convergence. Adabar (n.d.) found that divergence indicated that the rich states were growing faster than the poor

states during the period from 1983 to 1999/2000. Shetty (2003) found that interstate disparities and economic performance across states over the period from 1980/81-2000/01 and long-term time paths of per capita gross state domestic product (GSDP) across states showed convergence. Pal and Ghosh (2007) found a sharp increase in regional inequality in India during the 1990s. Nayyar (2008) observed that there existed no evidence of absolute β -convergence between 1978-79 and 2002-03 among 16 major states, but robust evidence of 'conditional' β -convergence did exist. Gaur (2010) found disparities in the convergence hypothesis during the time period from 1980-2002, and lower growth for hill states as compared to the developed states.

Economic reforms have resulted in widening of inter-state disparities. Ghosh (2010) found that states diverged in per capita income, particularly after the implementation of large-scale economic reforms. Agarwalla and Pangotra (2011) suggested a convergent trend in regional incomes, conditional upon growth rates of inputs, and rate of technological progress. Kumar and Subramanian (2011) found divergence or rising inequality across states. On an average, the richer states in 2001 grew faster in 2001-09. Birthal, Singh, and Kumar (2011) observed that there was absolute divergence in income across the states over the period from 1980-81/2004-05. Singh (2012) found that all the poor states, except Madhya Pradesh, witnessed lower economic growth in the 90s as compared to the 80s. Raju (2012), however, disagreed with this observation as he found convergence of the states between 2002-03 and 2008-09. Recently, Cherodian and Thirlwall (2013) found that regional differences in gross state domestic product per head in India have continued to widen, as they did in previous decades. There was no evidence of unconditional beta convergence across the 32 states; there was weak evidence of conditional beta convergence.

In sum, two key points emerge from the prevailing literature analyzing convergence across states. First, there is robust proof of unconditional divergence or the shortage of unconditional convergence. Second, the proof of conditional convergence is not entirely conclusive.

Data Sources and Methodology

The present study attempts to cover only two periods : 1999/2000 to 2010/11 and 2004/05 to 2012/13 with reference to the per capita GSDP and per capita NSDP, respectively. This study is completely based on secondary data collected from government documents, journal papers, RBI website, and so on. For estimating the growth rate (per annum) of NSDP and PCGSDP, the most popular method of fitting exponential (log-linear) trend equation was used. The existence of convergence/divergence is typically measured in two ways. The first is to run a regression of the growth of income per head on the initial level of per capita income (measured in logs) to test whether initially, poor regions grow faster than initially rich regions first without conditioning variables. This is testing for β convergence unconditional and conditional. The second (σ -convergence) measure is to compute the standard deviation (SD) or the coefficient of variation (CV) of the log of per capita income over time to see whether the dispersion rises or falls. The entire data was analyzed using MS Excel. The states considered for the present study are the North Eastern Himalayan Seven Sister States. Simple log, regression, multiple regression, compound annual growth rate, standard deviation, coefficient of variation, simple statistics, and so on were used as the tools of analysis.

Regional Disparities in Seven Mountain Sister States in India (Convergence and Divergence)

India is a country of strange diversity. Indian states differ from each other in terms of social, economic, geographical, and other parameters. In India, there are many reasons for interstate diversity in income levels - for example, distribution of poverty, unfair and different policy issues, and so on. Regional disparities among Indian states are both huge and persistent. The results of previous studies have shown conditional convergence, which implied long-term growth rate and initial income levels. The Table 1 depicts the level of per capita GSDP

Table 1. The Seven Sister States and Per Capita GSDP in the Period from 1999/00 and 2010/11

Seven Sister States	1999/00 per capita GSDP (₹)	2010/11 per capita GSDP (₹)	% of per capita GSDP (1999/00) to (2010/11)	% differences of per capita GSDP between 1999/00 and 2010/11	Compound annual growth rate per capita GSDP (%) in 1999/00 to 2010/11	Loga: (log of 1999/00 per capita GSDP)	Logb: (log of 2010/11 per capita GSDP)
Mizoram	17813	28942	38.098 to 61.901	23.803	4.13	4.25	4.46
Meghalaya	15823	25991	37.841 to 62.158	24.317	4.22	4.19	4.41
Tripura	15426	29400	34.413 to 65.586	31.173	5.52	4.18	4.46
Arunachal Pradesh	15032	27118	35.663 to 64.336	28.673	5.04	4.17	4.43
Manipur	14461	20567	41.284 to 58.715	17.431	2.98	4.16	4.31
Nagaland	14063	30321	31.684 to 68.315	36.631	6.61	4.14	4.48
Assam	13277	19526	40.474 to 59.525	19.051	3.27	4.12	4.29
S.D.							
Coff.of variation						0.0415	0.0759
						0.0114	0.0172

Sources: Central Statistical Organisation (CSO) and Author's Calculations

Table 2. Regression Statistics Between the Log of Per Capita GSDP 2010/11 and 1999/00

Finding	Multiple R	R square	Adjusted R square	Standard Error	F	Sig. F	Coeff. Intercept /P-value
Value	0.502	0.252	0.102	0.072	1.68	0.25	0.579 / 0.85

Sources: Central Statistical Organisation (CSO) and Author's Calculations

measured in rupees during the base years of 1999/00 in the North Eastern states. The state of Mizoram was ranked first in terms of per capita income and Assam was ranked last in the base years (in ₹).

There are significant variations in the compound annual growth rate. In case of two states - Nagaland and Tripura, the percentage increase in per capita GSDP was quite high, and in case of Manipur and Assam, the increase in percentage of per capita income was low during the period from 1999/00 to 2010/11. Nagaland, Tripura, and Arunachal Pradesh had a high rate of compound annual growth rate per capita GSDP during the period from 1999/00 to 2010/11. The standard deviation has increased in the two-time periods on the basis of log 1999/00 and 2010/11; in the first period (1999/00), the standard deviation is 0.0415, and in the second period (2010/11), the same is 0.0759. Therefore, there was an increase in inequality of 0.034% *between* the time period from 1999-2011.

The standard deviation measures the dispersion of returns; the coefficient of variation measures their relative dispersion. This study shows that the coefficient of variation increased from 0.0114 to 0.0172 during the whole period. Thus, it appears that the states practiced a mark of convergence in the period of time from 1999/00 (dispersion : 0.0114), and during 2010/11, there was no convergence because the dispersion increased (dispersion 0.0172). The results, therefore, clarify that divergence increased in the period from 2010/11 in the Seven Sister States. However, there was a degree of convergence in the period from 1999/00.

Next, I tested for unconditional convergence (Table 2). In particular, a common divert is supposed by eradicating the state static effects, and all measured variables are absent. The p -value = 0.25 > 0.05, so the coefficient value is not the significant and sig. $F = 0.25 > 0.05$, it is probably better to stop using the set of independent variables (loga of 1999/00 per capita GSDP). Sig. $F = 0.25 > 0.05$, hence, we do not reject the H_0 at a significance level of 0.05 (5 %). Multiple R is the correlation coefficient, it tells how strong is the relationship; the value 0.50 implies a positive relationship between logb 2010/11 per capita GSDP and loga 1999/00 per capita

GSDP. R^2 is the coefficient of determination, it tells how many logb points fall on the regression line; $R^2 = 0.252$; it means that 25 % of the variation of logb 2010/11 per capita GSDP around the mean is explained by the loga 1999/00 per capita GSDP value. Adjustment $R^2 = B1 * \log a$ per capita GSDP ; $R^2 = 0.252$ represents 25% of the variance in the logb 2010/11 per capita GSDP is explained by the model and also, R^2 indicates that not a good deal of the variability of loga per capita GSDP 1999/00 is captured by the model. The p -value is greater than 0.05; so, the null hypothesis is not true and the regression model is not a significantly good fit. The equation is:

$$\text{Growth of logb 2010/11 per capita GSDP } \{Y\} = \alpha + \beta (\log a \text{ per capita GSDP 1999/00 } \{X\}) + \varepsilon r$$

$$Y = 0.579 + 0.917 * X \text{ (Equation 1)}$$

The coefficient on the lagged per capita GSDP terms, $1 + \beta$, is a 0.917; so the 0.083 value of the β is with an implied convergence rate λ of - 0.0069. The estimated β equals 0.083, which is positive. This indicates absolute divergence at the rate of 0.69% per annum over a 12-year period. Moreover, I estimated a cross sectional regression for the entire period between 1999/00 and 2010/11 and found a statistically not significant, positive beta coefficient, suggesting unconditional divergence.

The Figure 1 show that the log of 2010/11 per capita GSDP shows vast divergence as compared to the log of

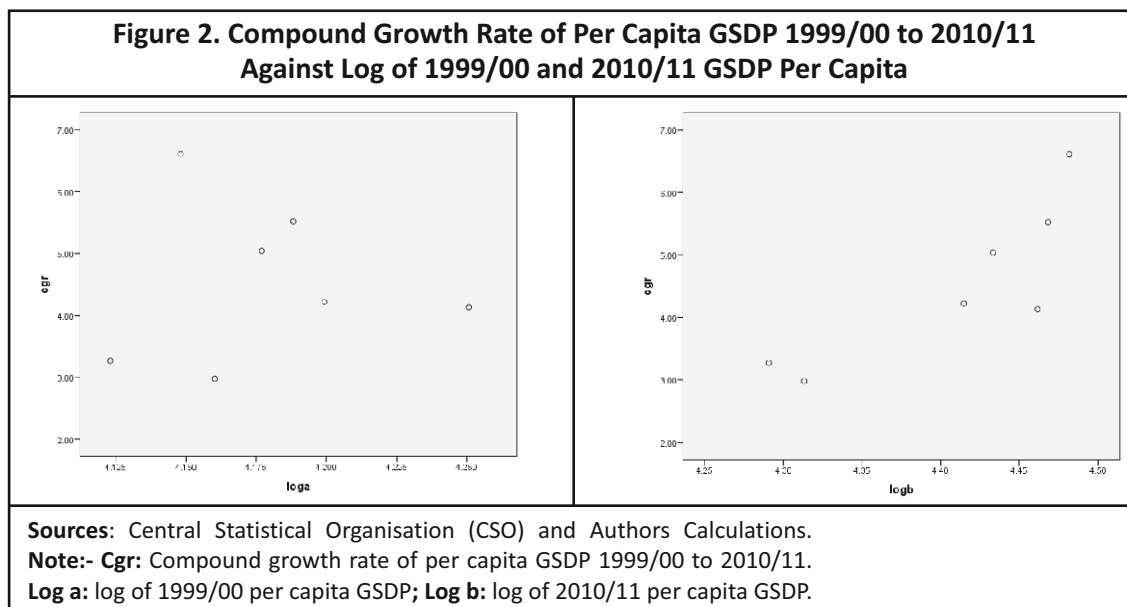
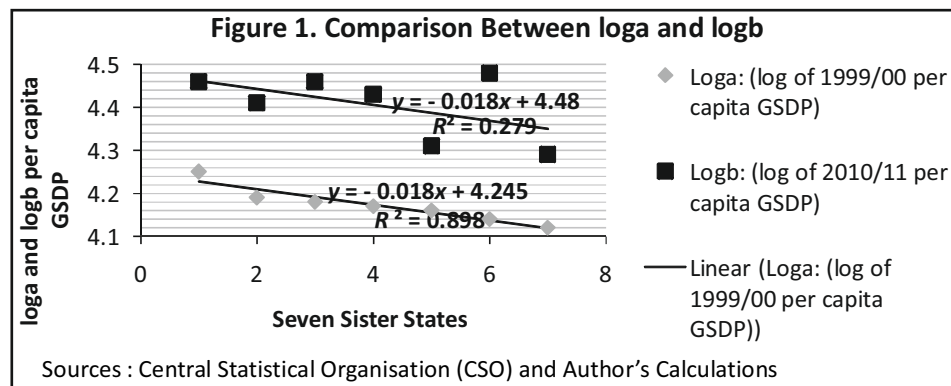


Table 3. Control Variables and Convergence & Divergence

States	log of 1999/00 per capita GSDP	Population growth (%)	Average Male literacy rate	Average share of agriculture	average state expenditure in GSDP	Compound annual growth rate of per capita GSDP (%) in 1999/00 to 2010/11	Logb: (log of 2010/11 per capita GSDP)
ARUNACHAL PRADESH	4.25	2.33	68.76	26.73	30.27	4.13	4.46
ASSAM	4.19	1.58	75.05	28.85	4.72	4.22	4.41
MANIPUR	4.18	1.72	83.01	26.36	16.3	5.52	4.46
MEGHALAYA	4.17	2.48	71.3	21.26	11.74	5.04	4.43
MIZORAM	4.16	2.07	92.22	17.34	24.13	2.98	4.31
NAGALAND	4.14	-0.05	77.23	58.14	12.03	6.61	4.48
TRIPURA	4.12	1.39	86.6	24.7	9.6	3.27	4.29

Sources: Central Statistical Organization (CSO), Reserve Bank of India, Population & Male Literacy Data from 2011 Census, Expenditure Data from Planning Commission, Government of India 2011 and Author's Calculations

Table 4. Correlation Between the Variables

Variables	1999/00	Population growth (%)	Average Male literacy rate	Average state expenditure in GSDP	Average share of agriculture	Compound annual growth rate of per capita GSDP (%) in 1999/00 to 2010/11
1999/00	1					
Population growth (%)	0.5	1				
Average Male literacy rate	-0.6	-0.14	1			
Average state expenditure in GSDP	0.6	0.418	-0	1		
Average share of agriculture	-0.2	-0.9	-0.24	-0	1	
Compound annual growth rate of per capita GSDP (%) in 1999/00 to 2010/11	-0	-0.56	-0.44	-0	0.76404	1

Sources: Central Statistical Organization (CSO), Reserve Bank of India, Population & Male Literacy Data from 2011 Census, Expenditure Data from Planning Commission, Government of India 2011 and Author's Calculations

1999/00 per capita GSDP over the period of time. In 1999/00, per capita GSDP loga shows some convergence in the Seven Sister States and 2010/11 per capita income shows higher divergence in the states, because all points (per capita GSDP 2010/11) are away from the linear line. Lastly, the beta coefficient is significantly positive at the 95% confidence level, which rejects the hypothesis of unconditional convergence. On the contrary, the evidence shows that there is unconditional divergence in the Seven Sister States. The compound annual growth rate is very different in all the states taken together.

The scatter diagram (Figure 2) shows that the divergence widened over a period of time because the states' CAGR, loga, and logb show that all points are away from each other, but it shows few convergences in the period of 2010/11 in per capita GSDP and CAGR in the Seven Sister States.

The Table 3 shows the value of all the variables and the relationship with the CAGR and LOG of 2010/11 per capita GSDP. The Table 4 shows the correlation between all variables. The results show that there is a negative correlation of log of 1999/00 with per capita GSDP, population growth, average male literacy rate, and average state expenditure in GSDP; however, there is a positive relationship with average share of agriculture. Studies have found that population growth exerts a significant negative effect on the state per capita income growth in states (Adabar, 2004; Chikte, 2011 ; Cherodian & Thirlwall, 2013). Cherodian and Thirlwall also found that the

Table 5. Regression Between the CAGR Per Capita GSDP (1999/00 & 2010/11) and All Variables

	Coefficients	Standard Error	P-value
Intercept	-54.56	132	0.75
1999/00 log GSDP per capita	5.563	27.1	0.87
Population growth (%)	5.91	5.34	0.47
Average Male literacy rate	0.199	0.25	0.57
average state expenditure in GSDP	-0.123	0.14	0.53
Average share of agriculture	0.424	0.33	0.42

Sources: Central Statistical Organization (CSO), Reserve Bank of India, Population & Male Literacy Data from 2011 Census, Expenditure Data from Planning Commission, Government of India 2011 and Author's Calculations

Table 6. Regression Statistics

Finding (Table 6)	Multiple R	R square	Adjusted R square	Standard Error	F	Sig. F
Value	0.91	0.846	0.07	1.231	1.1	0.617

Sources: Central Statistical Organization (CSO), Reserve Bank of India, Population & Male Literacy Data from 2011 Census, Expenditure Data from Planning Commission, Government of India 2011 and Author's Calculations

positive relation between average share of agriculture and all other variables was negative insignificant for all the states.

In the regression statistics between the CAGR per capita, GSDP (1999/00 & 2010/11), and all the variables like population growth percentage, average male literacy rate, average state expenditure in GSDP, log of per capita GSDP 1999/00, and average share of agriculture, only (Table 5) one coefficient and intercept value is negative; average state expenditure value is negative (-0.123) and all the other variables are positive in beta coefficient and are insignificant. Hence, the Seven Sister States are very different because for the other states of India, population growth, literacy rate, and percentage of agriculture have a negative effect on the per capita income growth in India. But in case of the North Eastern states, they are different because there is a positive relationship between CAGR per capita GSDP and population growth, average male literacy, and average share of agriculture. However, there is a negative relationship between average state expenditure and CAGR per capita GSDP. The Table 5 shows a negative relationship between the average state expenditure in GSDP and the compound annual growth rate. The value of Multiple R has a strong linear relationship with the variables.

According to the Table 6, the value of 0.92% shows a positive relationship between CAGR and the variables; in contrast, there is a negative relationship of the average state expenditure with the GSDP. The R^2 value (0.846) reveals how many points fall on the regression line; 0.846 means that it is a very good fit, 85% of the variation of CAGR per capita GSDP is explained by all the independent variables. All the P and F values are greater than 0.05; we can say that some variables are effecting the CAGR per capita GSDP. From the conditioning variables, it can be said that a necessary condition for the states' convergence to take place would be less dependence on the average state expenditure on GSDP, a higher rate of average share of agriculture in the North-Eastern states, and a higher rate of average male literacy in the slow growing Seven Sister States of North East India as compared to the rest of India.

Per Capita Net State Domestic Product (NSDP) at Constant (2004-05) Prices

In the first decade of the twenty-first century, regional differences in per capita net state domestic product (PCNSDP) in India have continued to broaden, as they did in the previous decades. Solow (1956) predicted that regional differences in income per head should converge on a common level of income per head if tastes and preferences (i.e. saving, investment, and population growth) and technologies are the same across the regions.

Table 7. PCNSDP 2004/05 and 2012/13 at Factor Cost (₹)

Seven Sister States	2004/05 Per capita net state domestic product (base year 2004/05)	2012/13 Per capita net state domestic product (base year 2004/05)	Compound annual growth rate of Per capita net state domestic product 2002/03 and 2012/13 (%)	Log 2012/13 per capita net state domestic product and base of 2004/05 per capita NSDP	log 2004/05	log 2012/13
ARUNACHAL PRADESH	2672100	3705100	3.70	1.02	6.426	6.568
ASSAM	1678200	2344800	3.79	1.02	6.224	6.370
MANIPUR	1864000	2399600	2.85	1.01	6.270	6.380
MEGHALAYA	2408600	3862700	5.39	1.03	6.381	6.586
MIZORAM	2466200	4093000	5.79	1.03	6.392	6.612
NAGALAND	3044100	4688900	4.92	1.02	6.483	6.671
TRIPURA	2439400	4231500	6.31	1.03	6.387	6.626
				S.d. Coeff. Of variation	0.0895	0.1204
					0.0141	0.0184

Sources: Reserve Bank of India (RBI) and Author's Calculations

Table 8. Regression Between the Log of Per Capita NSDP 2012/13 and 2004/05

Finding Table 8	Multiple R	R square	Adjusted R square	Standard Error	F	Sig. F	Coeff. Intercept /P-value	Coeff. Log of 2004/05 per capita GSDP / P-value
Value	0.942	0.887	0.865	0.044	39.3	0.00	-1.53 / 0.29	1.268 / 0.00

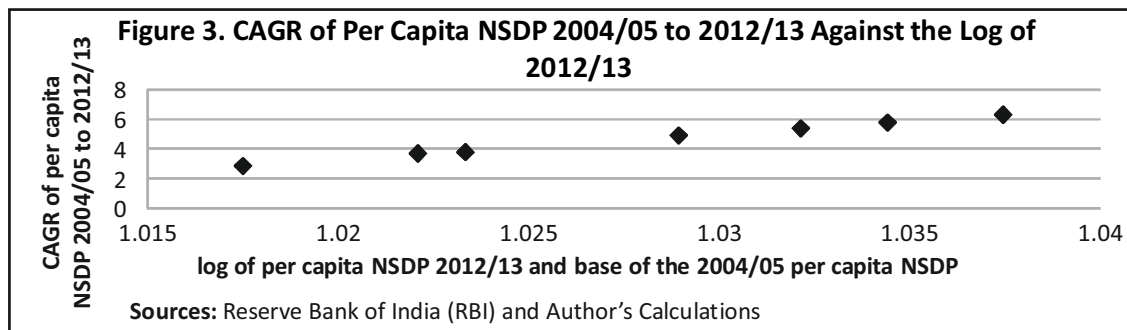
Sources: Reserve Bank of India (RBI) and Author's Calculations

According to the neoclassical theory, the main assumption is that due to the "diminishing return to capital," the little marginal products of capital in the poor regions are low and are higher in the richer regions, that is, there is more capital per head.

The Table 7 shows that three regions have higher annual compound growth rate - Tripura, Mizoram, and Meghalaya; one state - Nagaland is in the middle, and the lower CAGR states are Assam, Arunachal Pradesh, and Manipur. The States are very different in terms of CAGR and per capita net state domestic product. The results show the widened disparity of the North -East Seven Sister States in terms of CAGR and per capita net state domestic product.

At the outset, I tested for unconditional convergence. In particular, a common divert is supposed by eradicating the state static effects, and all measured variables are absent. The p -value = 0.00 < 0.05, so the coefficient value is significant and sig. F = 0.00 > 0.05, it is probably better to use the set of independent variables (log of 2004/05 per capita NSDP). Sig. F = 0.00 < 0.05, so that it is significant on the 0.05 level (5 %). The S.D. and coefficient of variation show that the divergence increased in the period from 2012/13 as compared to the period from 2004/05 in case of the per capita NSDP. The Table 7 shows that the divergence is higher in the period from 2004/05 with per capita NSDP among the North -Eastern Seven Sister States. The state with the highest per capita NSDP level in 2004/05 was Nagaland at ₹ 3044100 per year, and the state with the lowest NSDP per capita was Assam at ₹ 1678200 per year. In terms of compound growth rates from 2004/05, Nagaland grew at 4.92% per annum and Assam at 3.79% per annum. The Table shows that this made Nagaland the fastest growing state and Assam the slowest growing state among the Seven Sister States. The only notable exception is Tripura, which had the lowest NSDP per capita in 2004/05, but was the fastest rising state in the period. All States grew up commonly in a way that continues to show divergent tendencies during the period.

As can be inferred from the Table 8, the multiple R is the correlation coefficient, it tells how strong the relationship is; the value of 0.942 implies that there is a perfect positive relationship with the log of per capita



NSDP 2012/13 and log 2004/05 per capita NSDP. R^2 is the coefficient of determination, it tells how many points fall on the regression line; $R^2 = 0.887$; it means that 88.7 % of the variation of log of 2012/13 per capita NSDP around the mean is explained by the log of 2004/05 per capita NSDP value. Adjustment $R^2 = B1 * \log$ per capita NSDP (2004/05), $R^2 = 0.887$ shows that 89% of the variance in the log of 2012/13 per capita NSDP is explained by the model and also, R^2 indicates that a good deal of the variability of log of per capita NSDP 2004/05 is captured by the model. The p -value is less than 0.05; so, the coefficient value is significant, and the regression model is a significantly good fit. Hence, the null hypothesis is true.

The equation is:

$$\text{Growth of log 2012/13 per capita NSDP } \{Y\} = a + \beta (\log \text{ of per capita NSDP 2004/05 } \{X\}) + \varepsilon r$$

$$Y = -1.53 + 1.268 * X \text{ (Equation 2)}$$

The coefficient on the lagged per capita NSDP terms, $1 + \beta$ is a 1.268; so, the 0.268 value of the β and the implied convergence rate λ is - 0.0297. The estimated β equals 0.268; which is positive. This indicates that absolute divergence at the rate of 2.97% per annum completed a 9-year period. Moreover, I estimated a cross sectional regression for the entire period between 2004/05 and 2012/13. I found that a statically significant, positive beta coefficient, showed unconditional divergence.

Regression lines can be used as a way of visually depicting the relationship between the variables in the graph. A straight line depicts a linear trend in the data. The Figure 3 represents the data of the dependent and the independent variables. This data represents that the linear relationship between the data form and the four States is more than 4 - 6 % of the CAGR because these States have a very high compound annual growth rate as Tripura has the highest CAGR (6.31 %) and the lowest is that of Manipur (2.85 %). The diagram also shows that the CAGRs are very different for all the Seven Sister States, and there is much widened disparity with reference to the compound annual growth rate over the period from 2004/05 to 2012/13. Log of 2012/13 on the base of 2004/05 has a minimum difference in the log of the states for 2012/13, but in contrast, the CAGR records a huge difference in the per capita NSDP in 2004/05 and 2012/13. Lastly, the beta coefficient is significantly positive; so there has been a divergence in the North -Eastern Seven Sister States.

Table 8A. Regression with the CAGR and Log of Per Capita NSDP over the Period

Finding	Multiple R	R square	Adjusted R square	Standard Error	F	Sig. F	Coeff. Intercept /P-value	Coeff. Log of 2004/05 per capita NSDP / P-value
Values	0.51	0.26	0.11	1.19	1.8	0.243	-41 / 0.3	7.19 / 0.2
Finding	Multiple R	R square	Adjusted R square	Standard Error	F	Sig. F	Coeff. Intercept /P-value	Coeff. Log of 2012/13 per capita NSDP / P-value
Values	0.769	0.591	0.51	0.884	7.23	0.00	-48.1 / 0.06	8.058 / 0.04

Sources: Reserve Bank of India (RBI) and Author's Calculations.

Table 9. Group Wise Distribution of States

Groups	States	Coefficient of variations in 2012/13 (per capita NSDP)
High income group	Mizoram, Nagaland, & Tripura	0.004636
Middle income group	Arunachal Pradesh & Meghalaya	0.001944
Low income group	Assam and Manipur	0.001112

Sources: Reserve Bank of India (RBI) and Author's Calculations

Table 9A. High Income Group1 (Table 9A)

STATE / years	MIZORAM	NAGALAND	TRIPURA	log Miz.	log Ng	log Tr.	S.D.1	Mean	CV group1
2012	4093000	4688900	4231500	6.612042	6.671071	6.626494	0.03076904	6.636536	0.004636
2011	4038700	4510500	3938200	6.606242	6.654225	6.595298	0.0313436	6.618588	0.004736
2010	4007200	4399200	3671800	6.602841	6.643374	6.564879	0.03925436	6.603698	0.005944
2009	3469900	4059000	3454400	6.540317	6.608419	6.538373	0.03989189	6.56237	0.006079
2008	3192100	3904100	3171100	6.504076	6.591521	6.50121	0.05133359	6.532269	0.007858
2007	2846700	3731700	2902200	6.454342	6.571907	6.462727	0.06558962	6.496325	0.010096
2006	2630800	3507400	2755800	6.420088	6.544985	6.440248	0.06705192	6.46844	0.010366
2005	2582600	3307200	2568800	6.412057	6.51946	6.40973	0.06269183	6.447083	0.009724
2004	2466200	3044100	2439400	6.392028	6.483459	6.387283	0.05420928	6.420923	0.008443

Sources: Reserve Bank of India (RBI) and Author's Calculations

It can be seen from the regression Table 8A, that overall, there is a positive coefficient, but in 2004/05, there is no significant positive relationship between the period and the CAGR, but there is a significant relationship between 2012/13 and CAGR. The regression value of *R* square shows a high variability (variation) in the CAGR through the log of 2012/13 per capita NSDP and low variability (variation) in CAGR by the log of 2004/05. The multiple *R* value shown in the Table 8A shows that there is a 77% positive relationship between CAGR and log of 2012/13 per capita NSDP and 2004/05 per capita NSDP, and there is a 51% positive relationship with the compound annum growth rate per capita NSDP and CAGR.

Both regressions show a positive relationship between the periods, indicating more divergence in the 2012/13 period as compared to the 2004/05 period; the beta coefficient shows that the divergence is highest in the period of 2012/13, and a degree of convergence is also there. However, 2004/05 divergence is less than the 2012/13 per capita NSDP, and also, convergence is high as compared to the 2012/13 period between the CAGR and per capita NSDP in all North-Eastern Seven Sister States.

The Table 9A shows that only two states are included in the high income group 1 - Mizoram and Nagaland. In these states, the coefficient of variation decreased continuously since 2006 and became less than what it was before 2006. The results show that convergence increased since 2006 in the states of Mizoram and Nagaland. The Table 9B depicts that the middle income group states are Arunachal Pradesh and Meghalaya and low income groups states are Assam and Manipur. Both groups show that convergence increased in the time "between" 2004 to 2012 because the coefficient of variation decreased from 0.0049 to 0.0019 in the middle income group states and decreased from 0.0051 to 0.0011 in the low income group states during the time period from 2004 to 2014. The Table 9 shows the distribution of the Seven States, their standard of deviation, coefficient of variation, and group wise distribution of States in the above table for the given the period of time. It also shows the per capita income of NSDP during the period from 2004/05 and 2012/13. The results show that high income group states have a high coefficient of variation as compared to the middle income group and low income group states.

The Table 10 shows that the year wise coefficient of variation in the Seven Sister States are very different. In 2004, coefficient of variation (CV) is only 0.014% in the Seven Sister States, but CV increased continuously from the years 2004 to 2010. In the period from 2011/12 and 2012/13, the coefficient of variation decreased from

Table 9B. Group Wise Distribution of States in Per Capita Income NSDP

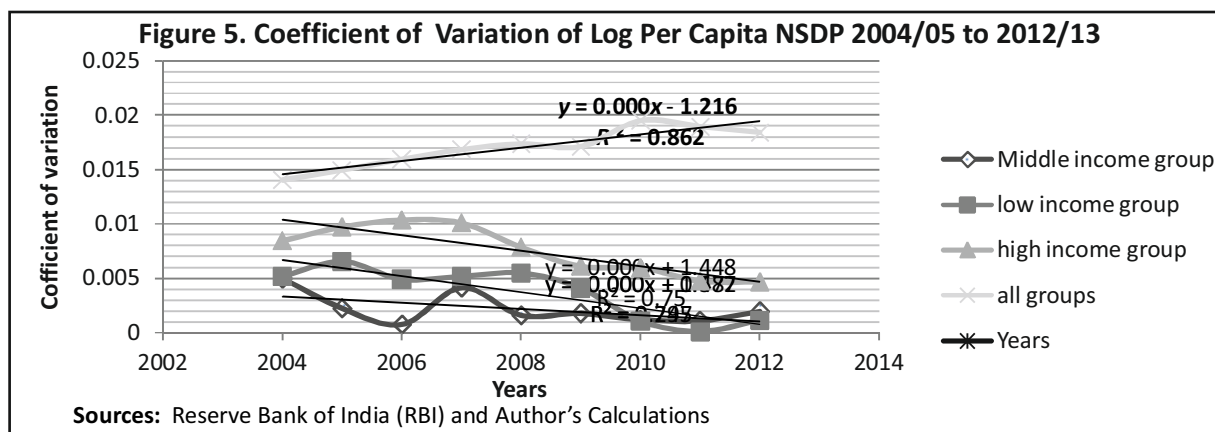
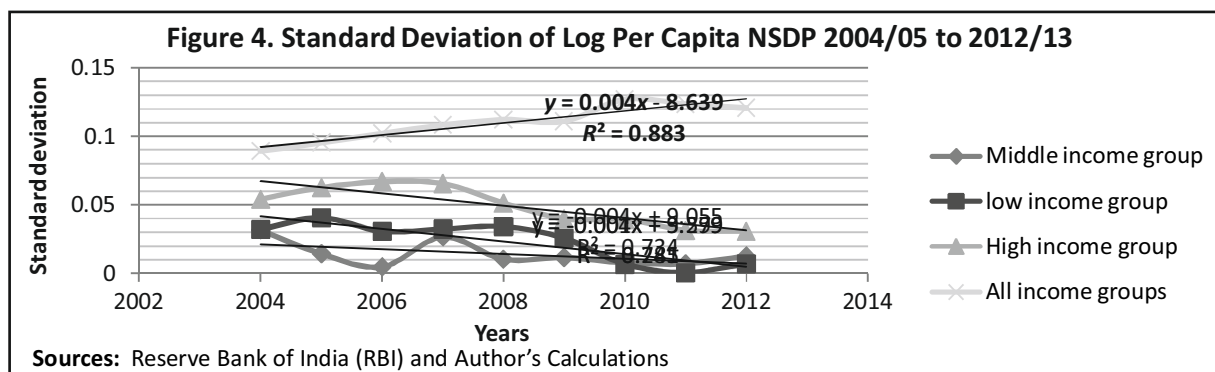
Middle income group 2				Low income group 3										
STATES / years/ S.D. / C.V.	ARUNACHAL PRADESH	MEGHALAYA	log Ar.	log Mg	S.D.2	Mean	CV group2	ASSAM	MANIPUR	log As.	log Mn.	S.D.3	Mean	CV group3
2012	3705100	3862700	6.5688	6.586891	0.012792	6.577845	0.00194476	2344800	2399600	6.370106	6.380139	0.007094	6.375122	0.00111283
2011	3609100	3693900	6.557399	6.567485	0.007132	6.562442	0.0010868	2242000	2245700	6.350636	6.351352	0.000506	6.350994	7.9733E-05
2010	3447000	3536300	6.537441	6.548549	0.007854	6.542995	0.00120043	2161100	2114600	6.334675	6.325228	0.00668	6.329952	0.00105527
2009	3382500	3256900	6.529238	6.512804	0.01162	6.521021	0.00178195	2040600	2219700	6.309758	6.346294	0.025835	6.328026	0.00408265
2008	3202800	3096300	6.50553	6.490843	0.010385	6.498186	0.00159816	1892200	2116900	6.276967	6.3257	0.03446	6.301334	0.00546863
2007	3028700	2776400	6.481256	6.443482	0.02671	6.462369	0.00413322	1808900	2010600	6.257415	6.303326	0.032464	6.28037	0.00516913
2006	2767500	2724200	6.442088	6.435239	0.004843	6.438663	0.00075213	1757900	1943100	6.244994	6.288495	0.03076	6.266745	0.00490842
2005	2687000	2564200	6.429268	6.408952	0.014365	6.41911	0.00223791	1705000	1947900	6.231724	6.289567	0.040901	6.260646	0.00653298
2004	2672100	2408600	6.426853	6.381765	0.031882	6.404309	0.00497822	1678200	1864000	6.224844	6.270446	0.032246	6.247645	0.00516124

Sources: Reserve Bank of India (RBI) and Author's Calculations

Table 10. Year Wise Coefficient of Variation in the Seven Sister States

STATE / years	log Ar.	log Mg	log As.	log Mn.	log Miz.	log Ng	log Tr.	S.D.1	Mean	CV all group
2012	6.5688	6.586891	6.370106	6.380139	6.612042	6.671071	6.62649435	0.120498	6.545078	0.01841
2011	6.5574	6.5674851	6.350636	6.351352	6.606242	6.654225	6.59529777	0.123588	6.526091	0.018938
2010	6.53744	6.5485491	6.334675	6.325228	6.602841	6.643374	6.56487902	0.126829	6.508141	0.019488
2009	6.52924	6.5128044	6.309758	6.346294	6.540317	6.608419	6.53837262	0.11091	6.4836	0.017106
2008	6.50553	6.490843	6.276967	6.3257	6.504076	6.591521	6.50120994	0.112114	6.45655	0.017364
2007	6.48126	6.443482	6.257415	6.303326	6.454342	6.571907	6.46272734	0.108214	6.424922	0.016843
2006	6.44209	6.435239	6.244994	6.288495	6.420088	6.544985	6.4402477	0.102046	6.402305	0.015939
2005	6.42927	6.4089519	6.231724	6.289567	6.412057	6.51946	6.40973029	0.095353	6.385823	0.014932
2004	6.42685	6.3817647	6.224844	6.270446	6.392028	6.483459	6.38728302	0.089379	6.366668	0.014039

Sources: Reserve Bank of India (RBI) and Author's Calculations



0.0189% to 0.0184%. The results show that convergence increased in the per capita income of NSDP because the coefficient of variation increased from 0.0189% to 0.0184% after the time period of 2010.

Sigma Convergence and Divergence

I also know that the β -coefficient is not a satisfactory condition for the standard deviation or coefficient of variation of the states' per capita income towards coverage. I needed to estimate directly the evaluation of the S.D. and C.V. of NSDP per capita across the Seven States (Table 9). I divided the States into three sub groups based on their NSDP per capita as high-income group, middle income group, and low-income group. Group 1 includes the states with per capita NSDP over INR 4000000 to 5000000, group 2 includes the states with per capita NSDP between 3500000 to 4000000, and group 3 includes states with per capita NSDP to be less than INR 2000000 to 2500000 per capita.

The evaluation of the S.D. and C.V. for all the groups are depicted in the Figures 4 and 5. For both SD and CV, the time trend for the whole sample and all the states is significantly positive. Therefore, rise in σ inequality is driven by the increase in inequality in the entire group; like as high, middle, and low-income group and States in the North-East. The states were divided into the base of current 2012 years per capita NSDP in groups. The results show that in terms of income disparities across the Seven Sister States, the poor club consists of Assam and Manipur; and the middle-income group consists of Arunachal Pradesh and Meghalaya.

The standard deviation measures the dispersion of returns; the coefficient of variation measures their relative dispersion. The coefficient of variation increased from 0.014 to 0.018 in the whole period. Thus, it seems that the Seven Sister States experienced a mark of convergence in the period of time from 2004/05 (coefficient of variation : 0.014) and from 2012/13, there was no convergence because the coefficient of variation increased in the period from 2012/13 (coefficient of variation : 0.018). The found value reveals that the divergence increased in the period from 2012/13 in the Seven Sister States; however, the degree of convergence occurred during the

period from 2004/05 within all States in the North -East - Group1 (high-income states), Group 2 (middle-income states), and Group 3 (low-income states). There was a decreased coefficient of variation for all groups - Groups 1, 2, and 3 during the period from 2004/05 to 2012/13. Hence, the high, middle, and low income states experienced a degree of convergence as depicted in the Figures 4 and 5. In contrast, all the groups differed with respect to the coefficient of variation values; it also shows that much divergence (disparities) occurred in the Seven Sister States in India on account of the per capita NSDP during the period from 2004/05 to 2012/13.

Discussion and Conclusion

Mostly, studies are not available on all the Seven Sister States in India. The studies that are available only included a few states of the North Eastern region. So, there is not much evidence available on convergence and divergence on all the Seven Sister States. The findings in the literature have shown huge disparities in GSDP, PCGSDP, NSDP, NSDP in different sectors, PCSDP, income, infrastructure, Gini coefficient per capita, net state domestic product, economic performance, and GSDP per head in India (Adabar, 2004 ; Ahluwalia, 2002 ; Aiyar, 2001 ; Bhattacharya & Sakthivel, 2004 ; Das & Barua, 1996 ; Dasgupta et al., 2000 ; Nair, 1983; Rao et al., 1999; Sakthivel & Kar, 2007; Trivedi, 2002, and so forth [refer to list of references]). These studies are related to the major states and the all India level, but there is no study that has been conducted exclusively with reference to the Seven Sister States. The results of current study have shown that disparities increased in the per capita GSDP during the period from 1999/00 to 2010/11 and also for the PCNSDP during the period from 2004/05 to 2012/13 because the coefficient of variation increased from 0.014 to 0.18% and in case of the PCGSDP, the coefficient of variation also increased from 0.011 to 0.017% in the Seven Sister States.

Cherodian and Thirlwall (2013), Raju (2011), and Birhthal et al. (2011) also found similar results at the all India level and for the major states of India. Sachs et al. (2002) found little evidence of the convergence of the most popular states, while there may have been some convergence of the small North Eastern States with the rest of the country. The results of the current study have shown that there was convergence for the 1999/00 period because the coefficient of variation was less as compared to the 2010/11 period, but the divergence increased continuously since 1999/00. Cherodian and Thirlwall (2013) found a negative effect of population growth, male literacy rate, share of state expenditure, and percentage of agriculture growth on the state per capita income growth in India. But the current study found negative effect of state expenditure on GSDP, and did not observe a negative effect of agriculture, population, and male literacy on per capita income growth on the North Eastern States. Cherodian and Thirlwall (2013) found Manipur, Nagaland, and Assam to be poor states, and the present study found Nagaland to be a high income group state and Manipur and Assam to be low income group states. It is also concluded that the inequality in PCGSDP & PCNSDP between the Seven Sister States rose over the time period.

Limitations of the Study and Scope for Future Research

The current study is based on secondary data on PCNSDP and PCGSDP for the Seven Sister States only, so the results are not applicable to the whole of India. The research was also limited to examining the convergence and divergence within the Seven Sister States. The growth of the Seven Sister States was measured and is limited to the five factors, that is, population growth, male literacy rate, data on GSDP of agriculture and allied sectors, state governments' expenditure, outstanding credit or change in credit (%) of scheduled commercial banks (SCBs).

The present study can be extended by looking at the regional disparities in the other states of India and by conducting a comparison with the different regions. The present study used only five factors, but other factors are also important, so there is further scope to include other variables at the all India level. Future studies can be conducted by considering the convergence and divergence with respect to other factors, for example, educational, economic, social, cultural, political, non-economical, and sector wise factors for the Seven Sister States and other Indian states.

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