VOLATILITY AND DISPERSION IN STATE DOMESTIC PRODUCT OF INDIAN STATES

Dr. A.K.GAUR
Professor & Head
Department of Economics
Faculty of Social Sciences
Banaras Hindu University
VARANASI 221 005
INDIA
Mail:gaurecobhu@gmail.com

Abstract

The present paper examines the structure of interstate disparity in State Domestic Products (SDPs)/ Per Capita SDPs for twenty Indian States for the period 1980-2012. Volatility in SDPs/Per Capita SDPs over the period has been examined with several techniques as unit root test (ADF/PP Test), ARCH and GARCH effects, Clemente-Montances-Reyes unit root and structural break test (Double mean shift – AO model), inequality indices based on properties of Lorenz curve and Herfindahl indices, and Generalized Kuznets curve. Empirical results revel that SDPs/per capita SDPs have been volatile in terms of ADF/PP unit root tests. GARCH (1, 1) also have been found for all states over the period indicating volatility in this regard. Structural break test results also indicate twin kinks in SDPs for Indian States which also have been responsible for growing inequality in this regard. Inequality indices as Gini, RMD, Theil, Kakwani and Herfindahl indices also indicate that inter-state inequality in SDPs/per capita SDPs has risen over the period 1980-2012. Finally, Gini led Kuznets curve in this regard also indicate that inequality among states in terms of SDPs/per capita SDPs has been rising over the period.

Rising inter-state inequality in SDPs/per capita SDPs of Indian States is a potential threat for Indian federation. These need urgent steps to be taken by the Central Government/State Governments especially 15th Finance Commission to curb the menace.

Key words: SDPs, ADF/PP Unit root test, ARCH/GARCH, Clemente- Montances-Reyes structural break test, inequality indices, Gini led Kuznets curve.

*Paper submitted for Annual conference of IARNIW to be held at Vishakhapatnam during March 19-20,2020.

I-INTRODUCTION

Regional economic growth and disparity have been a major concern for states and policy makers at global level as well as for Indian economy. Accordingly, the issue has been examined and debated by the scholars/academicians and policy makers globally as well as for India. India which is second most populous country in the world containing about 17.5 percent of the world's population and also seventh largest in the world with a total area of 3,287,263 square kilometers is a federal state. India is a federal country with 30 (Telengana being the new state, which came into existence recently) states as its federating units. These states are heterogeneous in terms of natural endowments as well as in terms of several socio-economic parameters. For instance, in terms of Per-Capita income, at current prices 2011-12, states as Goa, Delhi and Harayana occupied top 1st, 2nd and 3rd positions with ` 192652, ` 175812 and ` 109227 respectively while states namely Bihar, Uttar Pradesh and Jharkhand occupied bottom ranks with ` 24681, ` 29417 and ` 31982 respectively as their Per-Capita income (www.mospi.nic.in/mospi_new/upload/state_wise-SDP_2004-05_14march12.pdf). Similarly, five states namely Bihar, Madhya Pradesh (M.P.), Rajasthan, Odisha and Uttar Pradesh (U.P.), as per census 2011, contain 48.89 percent of total population of the country [(Draft Twelfth Five Year Plan (2012-17), Planning commission, Govt. of India]. These five states contain 1431.25 Lakh persons below poverty line which is about 53.05 percent of total number of person below poverty line at national level [Press Note on Poverty Estimates, 2011-12, Planning Commission, Govt. of India, July 2013)]. Inter-state divergence is also obvious in terms of human development indicators. For instance, as per 2011 census, highest literacy rate was observed for Kerala (93.91) while lowest literacy was noted for Bihar (63.82) [www.censusindia.gov.in]. Facts show that in terms of Human Development Index (HDI) ranking for 1999-2000, Kerala and Himachal Pradesh occupied 1st and 2nd rank respectively with HDI index as 0.677 and 0.581 while Madhya Pradesh and Bihar occupied bottom positions with respective HDI index as 0.285 and 0.292. For natural average, the HDI index stood at 0.387 (Economic Survey 2015-16, Govt. of India, New Delhi).

Rectification of existing inter-states disparities has been the focal theme among one of the most cherished objectives of the Central Government and states. In this connection steps have been initiated by the Union Government. For instance, Finance Commissions (www.fincomindia.nic.in), the statutory body, in its scheme of devolution of funds by way of tax & grants share for the states, have given due focus to mitigate horizontal inequalities among the states. Similarly, the Planning Commission (http://planningcommission.nic.in) in its scheme of devolution of funds by way of grants and loans, has assigned due weightage to bridge the gap among economically affluent states, backward states and hill-states. Despite of these efforts at national level, inter-state disparities in India have risen. For instance, the World Bank (2006) in its reported entitled, "*India-Inclusive Growth and Service Delivery: Building of India's Success*" has observed sharp differentiation across states since the early 1990s reflects acceleration of growth in some states but declaration in others. The report further adds that more worryingly, growth failed to pick up in states such as Bihar, Orissa and U.P. that were initially poor to start with, with the result that the gap in performance between India's rich and poor states widened dramatically during the 1990s. The Draft Eleventh Five Year Plan (2007-2012, Vol. I), has also admitted that regional disparities have continued to grow and the gap have been accentuated as the benefits of economic growth have been largely confined to the better developed areas. Apart from that, the issue has been examined, in depth, by the scholars like; Chattopadhyaya, R.N. and M.N. Pal (1972), Nair, K.R.G. (1973, 1982), Sampat, R.K. (1977), Mohapatra, A.C. (1978), Mathur, Ashok (1983, 1987, 1992), Datt and Ravallion (1993, 1998, 2002), Dreeze and Sen (1995), Dreeze and Srinivasan (1996), Marie-Ange Veganzones (1998), Rao, M. Govinda, Ric Shand and K.P. Kalirajan (1999), Ramiah (2002), Ahluwalia, M. (2002), Ravindra H. Dholakia (2003), Majumdar, R. (2004), Shatakshee Dhongde (2006), Dev, S.M. and Ravi, C. (2007), Misra, B. Swarup (2007), Ghosh, Madhusudan (2008), Gaurav Nayyar (2008), Misra, Biswa (2010), Das S., Sinha G. and Mitra Tushar K. (2010), Rasika P. Chikte (2011), Agarwalla, Astha and Pangotra, Prem (2011), Singh, A.K. (2012), Rowan Cherodian and A.P. Thirlwall (2013), Ghosh M., Ghoshray A. and Malki I. (2013), Yasmin E., and Bhat, F. Ahmad (2015), Mittal P. and Jyoti Devi (2015), Gaur, A.K. (2004, 2010, 2011, 2016).

Since introduction of market-oriented economic reforms in 1991, no doubt, India has enjoyed an upsurge in GDP growth, in average annual terms. Nevertheless, the Indian Government will need to tackle major economic challenges and maintain the pace of economic reforms if the country is to continue on its path of economic development. One such major challenge will be to attain balanced regional/inter-state growth and convergence in income across the states. Thus, factors accounting for long-run Indian growth trends are best understood from a regional standpoint and therefore, examining long-run growth trends and convergence across

Indian states has considerable interest, not only analytically, but from view point of continuing economic reforms that have been undertaken since 1991.

The issue of regional disparities in economic growth across Indian states becomes significant since: **(i)** Regional disparities entail a potential threat of political instability because of large social, cultural and political difference among Indian states. It is significant to note that prevailing socio-economic disparities among units/states of the Soviet Union, have among others, led collapse of USSR [Galbraith, J.K. (2004), Bradshaw M., and Vartapetov K. (2003), Federov L. (2002), Kislitsyana, O. (2003), Mikheeva N. (1999), Sheviakov A., Kiruta A. (2001), **(ii)** The present system of fiscal federalism an adopted by India gives rise to major pressures for increased transfer of funds from the Central Government, as per recommendations of the successive Finance Commissions and the Planning Commission to the slow growing and 'poorest' states, which have ultimately resulted in difficulties in raising sufficient revenue for the centre. This puts considerable strain on the central budget and makes it even more difficult to reduce federal deficit. Attaining fiscal adjustment is currently important for reducing real interest states and ensuring long-run sustainable growth, **(iii)** In the context of fiscal adjustment, the constraints on capital and maintenance expenditure in less developed states/regions as U.P., Bihar, Rajasthan, Odisha and M.P. and hill states aggravate disparities in growth of social and economic infrastructures among states, and **(iv)** Existence of inter-states disparities leads to undue migration of labour from less developed states like U.P., Bihar, Odisha, Rajasthan etc to better off states like Punjab, Delhi, Maharashtra, Karnataka, Tamilnadu etc. This migration has caused, in recent years, socio-economic-political frictions among states, which is pernicious for stability of a federal nation like India. It is therefore, if economic reforms to continue successfully, it will be necessary to allocate the limited public resources through growth-oriented programmes at regional level with balanced growth among the states of Indian federation.

It is against this backdrop, the present paper attempts to examine inter-state inequality in state domestic product of twenty major Indian states of Indian federation. For this purpose, time series data of state domestic product (in total and per capita terms) for 32 years have been taken for the period 1980-2012. For sake of comparison, SDP data will be converted at two base years i.e. 1980 and 2005. Section II presents data structure and research method while section III examines theoretical underpinnings of Kuznets curve. Empirical results and discussion are contained in section IV, while major findings and future outlook are contained in section V.

II- DATA AND RESEARCH METHOD

Data pertaining to SDPs for 20 Indian states for the period 1980-2012 have been taken from various issues of "Handbook of statistics on Indian Economy", a Reserve Bank of India (RBI) publication (http://www.rbi.org.in). SDPs data have been converted at base 1980-81 and at base 2004-05, in order to make them comparable. Regressions have been performed through Excel, and Eviews–6. Programmes have been developed in FORTRAN to estimate various inequality indices.

The present study is based on several inequality indicies that are based on properties of Lorenz curve as Gini coefficient, Theil inequality indices, Relative Mean Deviation (RMD), Kakwani inequality index. Herfindahl's indices (H_1, H_2 and H_3) have also been used to strengthen the present empirical investigation. Kuznet's hypothesis has been tested for SDPs and its components with help of Gini coefficient. Further, trend and pattern in SDP of Indian states have been examined with help of slope and intercept duumy variable technique. In order to detect volatility in SDP, unit root test (ADF/PP) have been applied. Further, inorder to detect structural breaks, if any , in time series data of SDPs, Clemente-Montances-Reyes Unit Root & Structural break test, and ARCH/GARCH techniques also have been applied.

2.1 Growth Rate Estimation with Slope and Intercept Dummy Variable Technique:

In order to estimate average annual growth in Inter-state SDPs as well as its several components in the present study, semi long model (Johnston, J. and Dinardo, J., 1997) has been applied. For this purpose, the regression equation of type;

$$ln\left(yi\right) = \alpha_0 + \alpha_1 t + ui \qquad \text{...(2.1)}$$

is appropriate, where $ln\left(yi\right)$ = State Domestic Product and its components, in log form, 't'= time trend, 'α_0'= constant term, 'α_1'= intercept form and 'ui'= random disturbance term. In equation (2.1), average annual growth is measured by $\alpha_1 x100$.

The average annual growth in inter-state SDP and its components has been measured keeping in view the possibility of any shift due to introduction of economic reforms of 1991. In order to do so, dummy variables [Damodar, G. (1970, 1995, 1999, 2005), Suits (1957)] have been used and following type of regression equation has been fitted:

$ln(y) = \alpha + \beta t + \gamma D_1 + \theta(D_2 t) + U_i$ ……………………………………………..(2.2)

where, $ln(yi)$ = State Domestic Product and its components in 'ln' form,

t = time trend;

D_1 = first dummy for the period 1980-81 to 1990-91,

D_2 = second dummy for the period 1991-92 to 2011-12.

tiD_2 = An interaction variable to capture the interaction effect of the presence of the attribute in the second period (1992-2012) and the time trend on dependent variable i.e. 'yi'.

β = intercept in the first period (1981-91)

γ = differential intercept in the second period (1992-2012)

β = regression coefficient of time-trend in the first period (1981-91) which shows the magnitude of rate of response of SDP and its components w.r.t time;

θ = differential coefficient of time trend in the second period (1992-2012) to allow a shift/ break/structural change in the magnitude of rate of response of SDPs and its components w.r.t. time;

ui = error term.

In equation 2.2, **(i)** $\left(\beta^* + \theta^*\right)$, (*shows statistically significant) shows an upward shift in SDP and its components w.r.t. time in the second period (1992-2012); **(ii)** $\left(\beta^* - \theta^*\right)$ shows a downward shift in SDP and its components w.r.t. time in the second period (1992-2012) while **(iii)** $\left(\beta^* \pm \theta^*\right)$(where, **shows statistically insignificant) shows no shift/ no structural change in inter-state expenditure on SDP and its components w.r.t. time in the second period (1992-2012).

2.2 Measures of Inequality Indices:

In the present research, inequality indices based on properties of Lorenz curve and Herfindahl's concentration have been used.

The Lorenz curve may again be generated by defining the income earner units, say, quintile shares where q_i, i = 1, 2,..n reveals the share of ith income earner. Let, incomes are arranged in ascending order i.e.

$$o \le q_1 \le q_2 .... \le q_i ..... \le q_n \le 1 \quad \text{...} (2.3)$$

From the order of the incomes as shown by Eq. (2.3), several well-known income inequality measures may be derived (Slottje, D.J., Basmann, R.L. and Nieswiadomy, M., 1989).

For example, the Gini (1912) measure of income inequality is given by

$$G = 1 - \frac{1}{n} - \frac{2}{n} . \sum_{i=1}^{n-1} (n-i) q_i ... \quad \text{...} (2.4)$$

and the relative mean deviation (Cowell, 1980)

$$R = \frac{1}{2} . \frac{n}{n-1} \left[\sum_{i=1}^{n} \left| q_i - \frac{1}{n} \right| \right] \quad \text{...} (2.5)$$

Theil's (1967) entropy measure (normalized) is given by;

$$T = 1 + \frac{1}{\ln(n)} \left[\sum_{i=1}^{n} q_i . \ln(q_i) \right] \quad \text{...} (2.6)$$

Kakwani's (1980a, 80b) measure is defined by

$$K = \frac{\left\{ \sum_{i=1}^{n} \left[\sqrt{q_i^2} + 1/n^2 \right] - \sqrt{2} \right\}}{2 - \sqrt{2}} \quad \text{...} (2.7)$$

The survey of literature on income inequality reveal that Gini coefficient suffer with serious drawbacks. For instance, the simple aging of a populations will raise income inequality (Morgan, 1962). The Gini Coefficient is also insensitivity to non-money components and differential price indices between states which exaggerate income inequality in rural areas (Jonish and Kau, 1973). It is found that Gini ratio is more responsive to changes in income of the middle class rather than among the rich or poor (Allison, 1978 and Osberg, 1984). Reynolds and Smolensky (1977) have concluded that despite of major changes in taxation and welfare during 1950-70 in United States, inequality as measured by Gini Coefficient remained unchanged. It is obvious that the Kakwani measure and the Gini ratio measure every different properties of the Lorenz Curve (Basmann, R.L., Slottje, D.J., 1987). Further, the relative mean deviation violates the principle of transfer since it is insensitive to transfer between income units on the same side of the mean. Theil (1967) proposed a decomposable measures based upon the Lovenz Curve that satisfy Dalton's Principle of Transfer (Allison, 1978). Theil index is similar to the Gini index since it is too sensitive to movements in the middle part of the income distribution (Osberg 1984).

Apart from aforesaid measures of income/wealth inequality, Herfindah's index (1950) is one that measures the concentration in income/wealth and more specifically in industrial sector. This index contains the feature of decomposability (Gaur, A.K., 2002), the feature of decomposability governments in a federation such that their respective SDPs and components are given by $Y_i,\ i = 1, 2, ...n$, then, the Herfindahl's index of concentration is given by :

$$H_i = \sum_{i=1}^{n} \left\{ \frac{S_i}{\sum_{i=1}^{n} S_i} \right\}^2 = \frac{1}{\left\{ \sum_{i=1}^{n} S_i \right\}^2} \sum_{i=1}^{n} S_i^2 \qquad \text{... (2.8)}$$

The Herfindahl's index of concentration can again be generated by defining the expenditure gainer units on, say quintile shares, where $q_i,\ i = 1, 2, ...n$ represents the ith quintile expenditure share, letting,

$$0 \le q1 \le q2 \le q3 \ \ldots\ldots\ldots\ldots \le q1 \le 1 \qquad \text{...(2.9)}$$

from this simple ordering, the Herfindah;s index may be written as;

$$H_i = \sum_{i=1}^{n} \left\{ \frac{q_i}{\sum_{i=1}^{n} q_i} \right\}^2 \qquad \text{...(2.10)}$$

since $\sum_{i=1}^{n} q_i = 1$, Eq. 2.10 may written as;

$$H_i = \sum_{i=1}^{n} (q_i)^2 \qquad \text{...(2.11)}$$

The properties as well as alternative forms of the Herfindahl's index have been reviewed by Theil (1967), Srivastava and Aggarwal (1979), Gaur, A.K. (2002). For instance, the other two form of the Herfindahl's index are;

$$H_2 = \frac{n}{n-1} \sum_{i=1}^{n} (q_i)^2 \qquad \text{...(2.12)}$$

$$H_3 = \frac{1}{3}\left[n \sum_{i=1}^{n} q_i^2 - 1 \right] \qquad \text{...(2.13)}$$

The range of variation of the alternative form of the Herfindahl's index are;

$$\frac{1}{n} \le H_i \le 1 \quad \text{...} (2.14)$$

$$\frac{1}{n-1} \le H_2 \le \frac{n}{n-1} \quad \text{...} (2.15)$$

and, $0 \le H_3 \le 1$ ....(2.16)

It is obvious that when only comparison over time is desired, one would fine H_3 better H_2 (since the extreme valves of H_3 are independent of number of observations) and H_2 better than H_1. However, when decomposing is needed, H_1 and H_2 are better than H_3. In the present study, the following measures of inequality have been employed in order to measure the inter-state inequality in SDPs as well as its components (total as well as Per-Capita, both) among twenty Indian states during the period 1980-2012: **(i)** the Gini coefficient, **(ii)** Relative mean deviation (RMD), **(iii)** Theil's measure, **(iv)** Kakwani's measure, **(v)** Herfindahl's – H_1, (Herfindahl's – H_2, and (vii) Herfindahl's – H_3.

2.3 Unit Root Theory: ADF and PP test:

Consider a simple AR (l) process:

$$y_t = \rho y_{t-1} + x_t{}'\delta + \varepsilon_{t'} \qquad (2.17)$$

where x_t are optional exogenous regressors which may consist of constant, or a constant and trend, ρ and δ parameters to be estimated, and the ε_t are assumed to be white noise. If $|\rho| \geq 1$,y is a nonstationary series and the variance of y increases with time and approaches infinity. If $|\rho|<1$,y is a (trend-) stationary series. Thus, the hypothesis of (trend-) stationarity can be evaluated by testing whether the absolute value of ρ is strictly less than one.

The unit root test the null hypothesis H_0 : ρ = 1 against the one-sided alternative H_1: p < 1. In some cases, the null is tested against a point alternative. In contrast, the KPSS Lagrange Multiplier test evaluates the null of H_0: ρ < 1 against the alternative H_1:ρ=1.

The Augmented Dickey-Fuller (ADF) Test

The standard DF test is carried out by estimating Equation (2.17) after subtracting γ_t - 1 from both sides of the equation:

$$\Delta y_{t-1} + x_t'\delta + \varepsilon_{t,} \tag{2.18}$$

where $\alpha = \rho - 1$. The null and alternative hypotheses may be written as,

$$H_0: \alpha = 0$$

$$H_1 = \alpha < 0 \tag{2.19}$$

and evaluated using the conventional *t*- ratio for α :

$$t\alpha = \hat{a}/(se(\hat{a})) \tag{2.20}$$

where $\hat{a}$ is the estimate of α, and $se(\hat{a})$ is the coefficient standard error.

Dickey and Fuller (1979) show that under the null hypothesis of a unit root, this statistic does not follow the conventional Student's *t*-distribution, and they derive asymptotic results and simulate critical values for various test and sample sizes. More recently, MacKinnon (1991, 1996) implements a much larger set of simulations than those tabulated by Dickey and Fuller. In addition, MacKinnon estimates response surfaces for the simulation results, permitting the calculation of Dickey-Fuller critical values and ρ-values for arbitrary sample sizes.

The simple Dickey-Fuller unit root test described above is valid only if the series is an AR(1) process. If the series is correlated at higher order lags, the assumption of white noise disturbances ε_t f t is Violated. The Augmented Dickey-Fuller (ADF) test constructs a parametric correction for higher-order correlation by assuming that the *y* series follows an AR(*p*) process and adding *p* lagged difference terms of the dependent variable *y* to the right-hand side of the test regression:

$$\Delta y_t = \alpha y_{t-1} + x_t'\delta + \beta_1 \Delta y_{t-1} + \beta_2 \Delta y_{t-2} + \ldots + \beta_p \Delta y_{t-p} + u_t \quad {\scriptstyle (6)} \tag{2.21}$$

This augmented specification is then used to test Eq(2.19) using the *t* -ratio Eq(2.20). An important result obtained by Fuller is that the asymptotic distribution of the *t*-ratio for α is independent of the number of lagged first differences included in the ADF regression. Moreover, while the assumption that y follows an autoregressive (AR) process may seem restrictive.

The Phillips-Perron (PP) Test:

In order to control serial correlation in uni-variate, Phillips and Perron (1988) proposed an alternative (nonparametric) method of unit root test. The PP method estimates the non-augmented DF test equation (3), and modifies the t-ratio of the α coefficient so that serial correlation does not affect the asymptotic distribution of the test statistic. The PP test is based on the statistic:

$$\tilde{t}_{\alpha} = t_{\alpha}\left(\frac{\gamma_0}{\int_0}\right)^{1/2} \frac{T(\int_0 - \gamma_0)(se(\hat{\alpha}))}{2\int_0^{1/2} s} \tag{2.22}$$

where $\hat{\alpha}$ is the estimate, and t_α the t-ratio of α, se($\hat{\alpha}$) is coefficient standard error, and s is the standard error of the test regression. In addition, γ_0 is a consistent estimate of the error variance in Eq(2.18) (calculated as $(T\text{-}K)s^2 / T$, where k is the number of regressors). The remaining term, f_0 is an estimator of the residual spectrum at frequency zero.

Unit Root and Structural Breaks: Clemente-Montances-Reyes Test:

Existence of structural breaks in a uni-variate time series, especially when break dates are unknown have been discussed extensively by scholars as Rappoport and Reichlin (1989); Perron (1989, 1990, 1995), Banerjee et al. (1992); Christiano (1992); Zivot and Andrews (1992); Vogelsang and Perron (1995), Lumsdaine and Papell (1997), Montafies and Reyes (1997) etc.

In the present paper, an attempt has been made to extend the Perron and Vogelsang (1992) tests to the case of two changes in the mean of the variable being studied. Thus, we wish to test the null hypothesis:

$$H_0 : y_t = y_{t-1} + \delta_1 DTB_{1t} + \delta_2 DTB_{2t} + u_t \tag{2.23}$$

as against the alternative hypothesis:

$$H_A : y_t = \mu + d_1 DU_{1t} + d_2 DTB_{2t} + e_t \tag{2.24}$$

In the previous equations DTB_{it} is a pulse variable that takes the value 1 if $t = TB_i + 1$ (i = 1, 2) and 0 otherwise, $DU_{it} = 1$ if $t > TBi$ $(i = 1,\ 2)$ and 0 otherwise. TB_1 and TB_2 are the time periods when the mean is being modified. For the sake of simplicity, we suppose that $TB_i = \lambda_i T$ (i = 1, 2), with $0 < \lambda_i < 1$, and also that $\lambda_2 > \lambda_1$.

Thus, if we consider the case where the two breaks belong to the innovational outlier, we can test the unit root hypothesis by first estimating the following model:

$$y_t = \mu + \rho y_{t-1} + \delta_1 DTB_{1t} + \delta_2 DTB_{2t} + d_1 DU_{1t} + d_2 DU_{2t} + \sum_{i=1}^{k} c_1 \Delta y_{t-i} + e_t \qquad (2.25)$$

and, subsequently, by obtaining the minimum value of the pseudo *t*-ratio for testing whether the autoregressive parameter is 1 for all the break time combinations. In order to derive the asymptotic distribution of this statistic, we assume that $0 < \lambda_0 < \lambda_1, \lambda_2 < 1 - \lambda_0 < 1$. Therefore, the test is not defined at the limits of the sample, and it is necessary to choose some trimming value (λ_0). Following the arguments used by Zivot and Andrews (1992), which are also assumed by Perron and Vogelsang (1992); Lumsdaine and Papell (1997), we adopt the largest window possible and, consequently, λ_1 and λ_2 take values in the $((k + 2) / T, (T - 1) / \mathrm{T})$ interval. We also restrict the study by imposing $\lambda_2 > \lambda_2 + 1$, which implies that we are eliminating those cases where the breaks occur in consecutive periods. Under these assumptions, the statistic is distributed as follows:

$$\min t_{\hat{\rho}}^{IO}(\lambda_1, \lambda_2) \Rightarrow \inf_{\lambda \in \Lambda} \frac{H}{[\lambda_1(\lambda_2 - \lambda_1)(1 - \lambda_2)]^{1/2} \; K^{1/2}} \qquad (2.26)$$

with:

$$H = \frac{\lambda_1(\lambda_2 - \lambda_1)(\lambda_1 - \lambda_2)}{2}\left[W(1)^2 - 1\right] - (1 - \lambda_2)(\lambda_2 - \lambda_1) W(\lambda_1) \int_0^1 W(r)\, dr$$

$$+ (1 - \lambda_2)\left[\lambda_2 W(\lambda_1) - \lambda_1 W(\lambda_2)\right] \int_{\lambda_1}^1 W(r)\, dr + \lambda_1 \left[(1 - \lambda_1) W(\lambda_2) - (1 - \lambda_2) W(\lambda_1)\right.$$

$$\left. - (\lambda_2 - \lambda_1)\; \mathrm{W}(1)\right] \int_{\lambda_2}^1 \mathrm{W(r)\ dr} \qquad (2.27)$$

$$K = \lambda_1(\lambda_2 - \lambda_1)(1 - \lambda_2) \int_0^1 W(r^2)\, dr - (1 - \lambda_2)\lambda_2 \left[\int_{\lambda_1}^1 W(r)\, dr\right]^2 - (1 - \lambda_1)\lambda_1 \left[\int_{\lambda_2}^1 W(r)\, dr\right]^2$$

$$- (1-\lambda_2)\,(\lambda_1-\lambda_2)\left[\int_0^1 W(r)\,dr\right]^2 + 2(1-\lambda_2)\left[\lambda_1 \int_{\lambda_2}^1 W(r)\,dr\right.$$

$$\left. + (\lambda_2-\lambda_1)\int_0^1 W(r)\,dr\right]\int_{\lambda_1}^1 W(r)\,dr \qquad (2.28)$$

and with $\Rightarrow$ denoting weak convergence. $W(r)$ means a Wiener process defined on C [0, 1], the space of all real defined functions in the [0, 1] interval. Similarly, $\lambda \in \Lambda$ denotes that the values of the λ_1 and λ_2 parameters belong to a closed subset of the (0, 1) interval.

If we consider that the shifts are better represented as additive outliers, then we can test the unit root null hypothesis through the following two-step procedure. First, we should remove the deterministic part of the variable by estimating the following model:

$$y_t = \mu + d_1 DU_{1t} + d_2 DU_{2t} + \tilde{y}_t \qquad (2.29)$$

and, subsequently, carry out the test by searching for the minimal t-ratio for the $\rho = 1$ hypothesis in the following model:

$$\tilde{y}_t = \sum_{i=0}^{k} \omega_{1i}\, DTB_{1t-i} + \sum_{i=0}^{k} \omega_{2i}\, DTB_{2t-i} + \rho\, \tilde{y}_{t-1} + \sum_{i=1}^{k} c_i \Delta \tilde{y}_{t-i} + e_t \qquad (2.30)$$

III- KUZNETS'S HYPOTHESIS: THEORETICAL UNDERPINNINGS:

It is about sixty years ago, Prof. Simon Kuznets (1955, 1963) formulated a hypothesis which maintains that given a two-sector economy with not too distinct degrees of sectoral mean incomes, a perennial shift of population from one sector to another will initially raise aggregate inequality and it will decrease at later stage. This formulation has been labeled as the 'Inverted U' (I-U) hypothesis or Kuznets cycle (Branlke 1983). There exists difference of opinion as to what the I-U hypothesis actually stands for. Sometimes, it is argued that inverted shape is merely a technical property of some inequality measures (Knight 1976) while Robinson (1976) showed the same to hold true if the variance is taken as measure of inequality. The other group of experts [Oshima (1962), Adelman and Morris (1973), Paukert (1973), Della Valle and Oguchi (1976)] have interpreted the I-U hypothesis as a theory about the nexus between economic development and inequality. There have been several attempts

[Ahulwalia (1976), Sen (1984), Harris (1986), Braun (1988), Deaton (1989), Anand and Kanbur (1993), Hadd and Kanbur (1992), Alperovich (1992), Branlke (1983), and Shreman Robinson (1976)] to test this hypothesis empirically, in case of only two sector. The more realistic assumption would be to explore the possibility of existence I-U hypothesis in case of multi-sectoral/region economy. The existence of 'I-U' hypothesis, for a multi-sectoral economy has its far-reaching consequences over the policy decisions of the modern welfare states. For instance, in the light of this hypothesis, the poorer states/regions of the economy may be well identified during the process of change in the degree of inter-sectoral economic inequality. Accordingly, the government may introduce corrective measures to check the unwarranted degree of inter-sectoral/inter-regional economic inequality. In the present chapter, an attempt has been made to test the existence of 'I-U' hypothesis/Kuznets cycle for a multi-sectoral/ multi regional economy under the framework of basic assumption of Neo-classical and Neo-Keynesian growth models.

III.1 Neo-Classical and Neo-Keynesian Growth Models: Major Assumptions:

The Neo-Classical economist [Solow (1956, 57, 70), Swan (1960)] have derived the conditions of steady state economic growth under certain assumptions. Prof. Solow has taken the assumption of aggregate homogeneous production function, continuously substitutable inputs of labour and capital, fixed technology and constant growth in the labour force. Under these assumptions, Prof. Solow has established a unique growth path that displayed full employment of all resources where the rate of growth of total income equal to the rate of growth of labour force. This growth path is one where total output grows, but output per head remains constant.

In the Neo-Keynesian approach to economic growth, Kalechi (1954, 71), Steindl (1952), Kaldor (1955, 56, 60) and Pasinetti (1962, 77, 81) have explained the inter-relationship between income distribution and economic growth in a lucid manner. The Kalechi-Steindl (K-S) model assumes that the firms set the price level as a mark up on the prime costs; the mark up rate is given[1]. Next, the firms have a higher desired rate of accumulation if the profit rate is higher or the rate of capacity utilization is higher. On the basis of these assumptions, the K-S models concludes that reduction in the industrial concentration raises the real wage and provides a re-distribution of income towards workers and it ultimately results in a higher degree of capacity utilization. In other words, a better distribution of income is associated with a higher rate of economic growth.

The effect of skewed income distribution on economic growth is also explained by the growth models of Kaldor and Pasinetti (K-P). The K-P model assumes that income (Y) is divided into two broad categories, wages (W) and profit (P). Next, the model assumes that the marginal propensity to save for wage earners is less than those of capitalists. Further, assuming the identity between the saving and the investment i.e. I≡S, the K-P model concludes that the share of profit in income is direct positive function of ratio of investment to profit. In other words, the skewed income distribution in favor of profit earner class is an essential condition for steady state economic growth.

III.1.1 Generalized Inverse-U hypothesis: Theoretical Justification:

As it is obvious from the narrations contained in section III that the economic growth is closely associated with the distribution of income, we shall consider here the 'I-U' hypothesis as a theory about the nexus between economic growth and inequality. The basic assumptions of Neo-classical and Neo-Keynesian growth models will be taken here to test the existence of 'I-U' hypothesis for a multi-sectoral economy. Since there is a very close positive correlation between Per-Capita Gross Domestic product (GDP) and economic growth, the Per-Capita GDP is considered as good indicator of country's economic growth.

Let us assume n sectors/states in an economy whose respective GDP are;

$$Y_1, Y_2, Y_3 \ldots\ldots\ldots, Y_n \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(3.1)$$

In a developing economy, sectoral income (Y_i) may be taken as direct positive function of time (t). There would be various functional forms explaining the relationship between Y_i and t. Let us assume linear relationship between Y_i and t, which is given by eq. (3.2) as;

$$Y_i = \alpha + I_Y\, t + u_i \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(3.2)$$

Where, 'α_0' is constant, 'I_Y' is a constant which reveals some form of inter-sectoral economic inequality in the sectoral domestic products and 'U_i' is the random disturbance term. Differentiating Eq. (3.2) w.r.t. time (t), we get,

$$\frac{dYi}{dt} = I_y \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(3.3)$$

Obviously, Eq. (3.3) corroborates the basic sprit of Neo-Keynesian model of economic growth. Economic disparity among various sectors is governed by several socio-economic factors but for simplicity, only two factors i.e. GDP (Y_i) and population of respective sectors (P_i) have been taken in the present model. In other words,

$$I_Y = \phi\left(\mathrm{Y_i},\ \mathrm{P_i}\right) \qquad i = 1, 2 \ldots\ldots n \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(3.4)$$

from (3.3) and (3.4)

$$\frac{dY_i}{dt} = \phi(Y_i, P_i) \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(3.5)$$

Let us assume that population of the various sectors are growing at a constant rate m. Thus, growth in populations of the sectors will be function of time (t), and we may write.

$$P_i(t) = P_i(o).e^{mt} \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(3.6)$$

Where, '$P_i(t)$' is population of the ith sector at time 't', '$P_i(o)$' is the initial population of ith sector at time 't' and m is its growth rate.

Substituting population growth rate as specified by Eq. (3.6) in the inequality function (Eq. 3.5), we get,

$$\frac{dY_i}{dt} = \varphi\left[Y_i, P_i\left(O\right).e^{mt}\right] \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(3.7)$$

Equation (3.7) reveals the time path that change in GDP of the various sectors must follow when respective population of the sectors grow at the constant rate (m). It now helps us to investigate the behavior of ratio of GDP of the sectors, and their respective population. To do this, let us introduce a new variable 'q' (Per-Capita GDP of the sectors) where $q_i = Y_i / P_i$ or $Y_i = q_i.P_i$ and substituting this relationship into (3.6), we get,

$$Y_i = q_i.P_i\left(o\right).e^{mt} \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(3.8)$$

Differentiating Eq. (3.8) with respect to time, we get,

$$\frac{dY_i}{dt} = q_i.m.P_i(0).e^{mt} + \frac{dq_i}{dt}.p_i(0).e^{mt} \quad \Rightarrow \frac{dy_i}{dt} = \left[q_i m + \frac{dq_i}{dt}\right].P_i\left(0\right).e^{mt} \qquad \ldots\ldots\ldots\ldots(3.9)$$

From Eq. (3.8) and Eq. (3.9), we get

$$\left[\frac{dq_i}{dt} + q_i m\right].P_{i(o)}.e^{mt} = \varphi\left[Y_i.P_i\left(0\right).e^{mt}\right] \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(3.10)$$

In order to express Eq. (3.10) into more meaningful way, let us make use of the assumption that the inequality function follows constant returns to scale. This shows that the inequality function is homogeneous of degree 1. Applying the properties of homogeneous function, Eq. (3.10) can be written as;

$$\left[\frac{dq_i}{dt}+q_i m\right].P_{i(o)}.e^{mt}=P_{i(0)}.e^{mt}.\varphi\left[\frac{Y_i}{P_i(0).e^{mt}},1\right] \qquad \text{(3.11)}$$

or

$$\frac{dq_i}{dt}+q_i m=\varphi\left[\frac{Y_i}{P_i(0).e^{mt}},1\right] \qquad \text{(3.12)}$$

or

$$\frac{dq_i}{dt}=\varphi\left[\frac{Y_i}{P_i(0).e^{mt}},1\right]-q_i m \qquad \text{(3.13)}$$

Substituting '$q_i = Y_i / P_{i(0)}.e^{mt}$' in Eq. (3.13), we get,

$$\frac{dq_i}{dt}=\varphi(q_i,1)-q_i m \qquad \text{(3.14)}$$

Equation (3.14) is a differential equation with Per-Capita GDP (q_i) as its variable and it yields several interesting results.

For instance, if Per-Capita GDP is constant over time then $\frac{dqi}{dt}=0$ and therefore the GDP of various sectors must be growing at the same rate m, as the population of the sectors. In this case, from Eq. (3.14), we get

$$q_i m=\varphi(q_i m) \qquad \text{(3.15)}$$

In the next situation, consider the behavior of the inequality function when Per-Capita GDP is changing i.e. '$q_i m \neq \varphi(q_i 1)$'. Here, we will consider two limiting cases. First, there is no inter-sectoral income inequality i.e. inequality function is zero and Eq. (3.14) reduces to;

$$\frac{dqi}{dt}=-q_i m \quad \Rightarrow \frac{dq_i}{dt}/q_i=-m \qquad \text{(3.16)}$$

It is obvious from Eq. (3.16) that proportionate change in Per-Capita GDP is minus the proportionate rate of change in population of the sectors. In order to derive the second limiting case, assume that '$m=0$' i.e. population of the various sectors is constant over time. Now Eq. (3.14) reduces to;

$$\frac{dq_i}{dt} = \varphi(q_i,1) \quad \Rightarrow \frac{dq_i}{dt} / q_i = \frac{1}{q_i}\varphi(q_i,1) \qquad \text{..(3.17)}$$

$$\Rightarrow \frac{dq_i}{dt} / q_i = \frac{P_i}{Y_i}.\varphi\left(\frac{Y_i}{P_i},1\right) \qquad \text{..(3.18)}$$

$$\Rightarrow \frac{dq_i}{dt} / q_i = \varphi\frac{(Y_i, P_i)}{Y_i} \qquad \text{..(3.19)}$$

It is obvious from Eq. (3.19) that proportionate change in Per-Capita GDP of the various sectors is equal (when $m = 0$) to ratio of inequality function to GDP of the sectors.

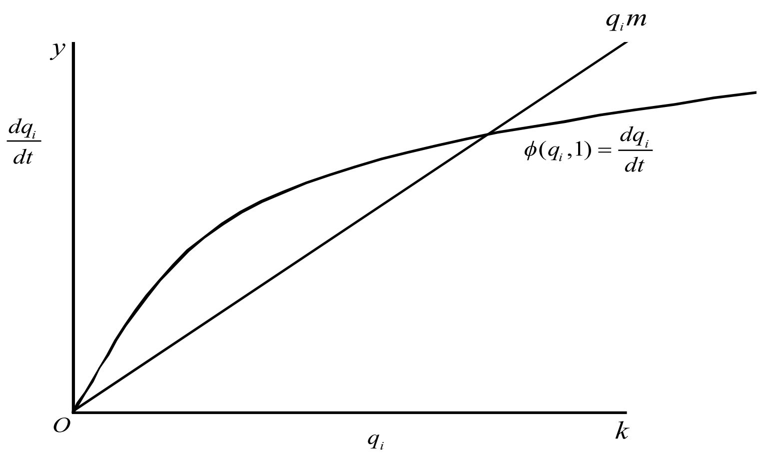
Equation (3.16) and (3.19) reveal that $\frac{dq_i}{dt}$ in Eq. (3.14) is sum of two components as explained by equations (3.16) and (3.19).

In order to plot $q_i m$ and '$\phi(q_i,1)$', let us assume that 'q_i' is plotted on the X-axis and $\frac{dq_i}{dt}$ on the Y-axis. To get the line '$q_i m$', we set '$\phi(q_i,1) = 0$' and plot the relationship between 'q_i' and $\frac{dq_i}{dt}$, ignoring the negative sign. This line, which has a slope of m, reveals how fast Per-Capita GDP would be declining for a given rate of growth of population for various sectors.

To obtain '$\phi(q_i,1)$', let us assume that '$q_i m$' is zero and plot the relationship between 'q_i' and $\frac{dq_i}{dt}$ which is given by $\frac{dq_i}{dt} = \varphi(q_i,1)$. Here it is important to consider the shape of curve '$\phi(q_i,1)$'. The expression '$\phi(q_i,1)$' may be interpreted as inter-sectoral economic inequality curve with sectoral population input held constant at one unit and Per-Capita GDP of the sectors as the variable factor. The assumption of diminishing returns to one factor is enough to assume that the slope of '$\phi(q_i,1)$' must decline as 'q_i' is increased.

Is obvious from Fig.1 that the inequality function '$\phi(q_i,1)$' is strictly concave everywhere for all the possible values in the range '$(0, q_i*)$'. The economic inequality function (inter-sectoral economic inequality in Per-Capita GDP) increases, reaches to maximum and then declines as Per-Capita GDP of the sectors increases. More specifically, the inter-sectoral economic inequality in Per-Capita GDP takes the shape of 'inverse U' with respect to time. Next, the relationship between '$\phi(q_i,1)$' determines optimal size of Per-Capita GDP of the n sectors of the economy given the "inverse U' shape in inequality in Per-Capita GDP.

Figure 1: Kuznets's Hypothesis and Shape of Inequality Function.



IV- RESULTS AND DISCUSSION

In India, regional imbalance has been one of the major concerns before policy makers and planners. There had been a huge gap between active and vibrant regions and hinterland during pre-independence period in terms of availability of facilities and this has resulted in the form of unequal levels of development both in terms of economic and human. After independence, reduction in inter-state disparities has been emphasized during successive Five Year Plans, but the menace accelerated unabated. For instance, The Draft Twelfth Five Year Plan (2012-2017, Vol. I), has also admitted that regional disparities have continued to grow and the gap have been accentuated as the benefits of economic growth have been largely confined to the better developed areas. The draft Twelve Plan further adds that, inter-State inequalities in PCIs have been last three decades for two reasons. First, the rates of growth of State Domestic Product (SDP) of many of a cause of concern. These have been rising in the States in the south, west and northern regions, like Punjab, Himachal Pradesh, Gujarat, Karnataka and Tripura, have been quite high as compared to some of the other States, like Uttar Pradesh (UP), Bihar and Rajasthan. Second, the rate of growth of population in some of the low PCI States has been fairly high. This has resulted in widening of PCIs and consumption in different States.

The second nature of inequality has been within the States themselves. A number of these States of the Indian Union have large areas and growth in them is uneven. Even in some of the States with comparatively small geographical area, the levels of development are very uneven, especially in the Himalayan region of Nagaland, Mizoram, Arunachal Pradesh, Jammu & Kashmir (J&K), Himachal Pradesh and Uttarakhand. The unequal levels of development in the larger States, including several regions like Vidarbha region of Maharashtra; Koraput, Bolangir and Kalahandi (popularly known as KBK districts) of Orissa; Bundelkhand region, Eastern UP and parts of Central UP, northern Bihar, tribal areas of Jharkhand and Chhattisgarh, Andhra Pradesh, Maharashtra, UP and north Karnataka are a few examples.

In order to examine contour of inter-state disparity in State Domestic Product (SDP) in India, time series data for thirty two years (1980-2012) pertaining to SDP of twenty states of Indian federation have been taken in total as well as per capita terms. These figures are available for various base years i.e. 1980, 1991, 1995, 2005 etc which are not comparable in true sense. According, SDP data have been converted at base 2004-05 (current prices) in order to ensure their comparability.

Descriptive statistics pertaining to SDP (Current prices, 2004-05) for twenty Indian states for the period 1980-2012 are presented in table 1. Facts show that during the period, minimum SDP, on an average, was recorded for Assam (Rs. 31400.72 Cro) while maximum SDP, on an average, was noted for state of Maharashtra (Rs. 263837.3 Cro). Variation in SDP in terms of standard Deviation (SD) was found minimum for state of Assam (Rs. 29473.28 Cro) while maximum SD was noted for state of Maharashtra (Rs. 295407.7 Cro) during 1980-2012. Similarly, minimum Kurtosis was observed for state of Manipur (Rs. 2.8891 Cro) while maximum Kurtosis was noted for state of Bihar (Rs. 5.3004 Cro).

Table 2 presents descriptive statistics pertaining to per capita SDP (Current prices, 2004-05 prices) for the period 1980-2012. Facts show that average to per capita SDP was found maximum for Haryana (Rs. 26803.43) while minimum was noted for Bihar (Rs. 6417.33) during the period 1980-2012. Similarly, maximum variation in terms of SD was observed in case of Gujarat (Rs. 20963.18) while minimum variation was noted for Bihar (Rs. 5784.62). Maximum Kurtosis was listed for Bihar (Rs. 5.26) while minimum was observed for Nagaland (Rs. 2.47) during the period 1980-2012.

Fluctuations in SDP of Indian states over the period 1980-2012 have been examined through several tests of Unit root theory i.e. Augmented Dicky Fuller (ADF) and Phillip-Person (PP) tests. These unit root tests have been performed in all three models i.e. without intercept', 'With intercept' and 'With intercept and intercept', in test equation. These test results for twenty Indian states under present study are presented in Table 3. ADF and PP test results indicate that SDP of twenty Indian States i.e. AP, Assam, Bihar, Gujarat, Himachal Pradesh, J & K, Karnataka, Kerala, M. P., Maharashtra, Manipur, Nagaland, Punjab, Rajasthan, Tamil Nadu, Tripura and Uttar Pradesh contained unit root at level data. In other words raw/level data pertaining to SDPs of these states have been volatile and contained kink at some points of time during the period 1980-2012. However, test statistics, mostly at 1% LS, for ADF/PP tests indicate the SDPs of these states were found stationary at first difference which is corroborated by order of integration which was found I(1) for all states.

In macroeconomic parameters like SDPs, structural breaks are also vital factor for emergence of inequalities among these. Accordingly, the present study examines clement-Montances-Reyes Unit root and structural breaks (Double mean shift – AO model) for SDPs of Indian states for period 1980-2012 and results are shown in table 4. Results contained in table 4 indicate existence of Twin structural breaks in SDPs of Indian states over the period 1980-2012. Twin structural breaks are 1996 and 2006, 1996 and 2006, 1996 and 2006, 1998 and 2007, 1998 and 2006, 1996 and 2005, 1996 and 2006, 1997 and 2006, 2001 and 2009, 1996 and 2006, 1996 and 2006, 1997 and 2005, 1996 and 2006, 1996 and 2006, 1996 and 2006, 1999 and 2006, and 1996 and 2006 respectively for states as AP, Assam, Bihar, Gujarat, HP, J & K, Karnataka, Kerala, M.P., Maharashtra, Manipur, Nagaland, Punjab, Rajasthan, Tamil Nadu, Tripura and Uttar Pradesh over the period 1980-2012. Significant to observe here that by and large all structural break years are distinct among the states which have been responsible for growing inter-state disparate in SDPs of Indian sates over the period 1980-2012.

Under conventional econometric analysis, variance of the disturbance terms is assumed to be constant over time (homoskedasticity assumption). But in real world, most of the macro economic variables which are time series in nature, exhibit periods of unusually high volatility followed by more tranquil periods of low volatility. Therefore, it is preferable to examine patterns that allow the variance of the time series parameter, to depend upon its history. This pattern is examined through regressive conditional heteroskedasticity/generalized auto regression conditional heteroskedasticity (ARCH/GARCH) (Engle, 1982, 1995).

In order to examine inter-state volatility in SDPs of Indian states, which are one important fact for charges in inter-state disparity in SDPs, ARCH/GARCH models for SDPs/Per Capita SDPs of Indian states have been estimated and results are shown in table 5 to table 8. ARCH(i) regression total SDPs of 20 Indian states for period 1980-2012 have been estimated and results are presented in table 5. Table 5 clearly shows that Z-statistics for all twenty states are significant at 5% LS and 10% LS. This means, null hypothesis of homoskedasticity is mean in SDPs of Indian states is rejected or that ARCH(1) effects in SDPs are present. Similarly, table 6 presents ARCH(1) regression results for per capita SDPs of 20 Indian states for the period 1980-2012. It is obvious from table 6 and Z-statistics for all twenty states are significant at 5% LS and 10% LS. This indicates rejection of null hypothesis of homoskedsticity is means in per capita SDPs of Indian states or that ARCH (1) effects in per capita SDPs are present.

According to Engle (1995), one of the limitation of ARCH specification was that it looked more like a MA specification than an autoregression. This has led inclusion of logged conditional variance terms as autoregressive terms [Tims Bollerslev (1986)]. The general GARCH (p, q) model has following form:

$$Y_t = \alpha + \beta' X_t + U_t \qquad \text{(I)}$$

$$U_t = |\Omega_t \grave{} \sim \text{iid } N(O, h_t) \qquad \text{(II)}$$

where,

$$h_t = \gamma_0 + \sum_{i=1}^{p} \delta_i h_{t-1} + \sum_{j=1}^{q} \gamma_j U_{t-j}^2 \qquad \text{(III)}$$

Which signifies that the value of the variance scaling parameter h_t now depends both on past valves of the shocks, which are captured by the logged squared terms, and on past valves for itself, which are captured by logged h_t terms. It should be clear here that for $p = O$, the model reduces to ARCH (q). The simplest form for the GARCH (p, q) model is GARCH(1, 1) model for which the variance equation has the form:

$$h_t = \gamma_0 + \delta_1 h_{t-1} + \gamma_1 U_{t-1}^2 \qquad \text{(IV)}$$

Consider eq (IV) in order to establish that the GARCH (1, 1) is a parsimonious alternative to an infinite ARCH(q) process. Successive substation into RHS of equation (IV) given:

$$h_t = \gamma_0 + \delta h_{t-1} + \gamma_1 U_{t-1}^2 \tag{V}$$

$$= \gamma_0 + \delta \left(\gamma_0 + \delta h_{t-2} + \gamma_1 U_{t-2}^2\right) + \gamma_1 U_{t-1}^2$$

$$= \gamma_0 + \gamma_1 U_{t-1}^2 + \delta\gamma_0 + \delta^2 h_{t-2} + \delta\gamma_1 U_{t-2}^2 \tag{VI}$$

.

.

.

$$= \frac{\gamma_0}{1-\delta} + \gamma_1\left(U_{t-1}^2 + \delta U_{t-2}^2 + \delta^2 \gamma_1 U_{t-3}^2 + \ldots\ldots\ldots\ldots.\right)$$

$$= \frac{\gamma_0}{1-\delta} + \gamma_1 \sum_{j=1}^{\infty} \delta^{j-1} U_{t-j}^2 \tag{VII}$$

Now, equation (VII) shows GARCH (1, 1) specification which is equivalent to an infinite order ARCH model with coefficients that decline geometrically.

GARCH (1, 1) for SDPs/per capita SDPs of twenty Indian states for the period 1980-2012 have been estimated and results are presented in table 7 and table 8. GARCH (1, 1) effect in SDPs of Indian states are shown in table 7. Z-statistics in variance equation for 8 states i.e. A.P., Assam, Karnataka, Kerala, Rajasthan, Tamil Nadu, U.P. and West Bengal are not significant, revealing non-existence of GARCH(1, 1) in SDPs for the these states over the period. At the same time, Z-statistics in the variance equation for remaining 12 states i.e. Bihar, Gujarat, Haryana, H.P., J & K, M. P., Maharashtra, Manipur, Nagaland, Orissa, Punjab and Tripura are significant at 1% LS, indicating existence of GARCH (1, 1) is SDPs of these states over the period 1980-2012. Similarly, table 8 shows non significant Z-statistics for per capita SDPs of 10 states i.e. Assam, Haryana, Karnataka, Kerala, Maharashtra, Manipur, Orissa, Punjab, Tripura and West Bengal. This indicates non-existence of GARCH (1, 1) in per capita SDPs of these states over the period 1980-2012. Contrary to it, Z-statistics for remaining 10 states i.e. A.P., Bihar, Gujarat, H.P., J & K, M.P., Nagaland, Rajasthan, Tamil Nadu, and Tripura were found significant at 1% LS indicating existence of GARCH (1, 1) in per capita SDPs of these states over the period 1980-2012.

Variation in per annum growth in SDPs over the period among states is also held responsible for emergence of inequality in SDPs. Accordingly, average annual growth in SDPs/per capita SDPs have been measured in semi log model with slope and intercept dummy variable technique with 1991 as a kink year when economic reforms were introduced in Indian and results are presented in table 9 to table 12. Slope and intercept dummy regression results of SDPs of 20 Indian states are shown in table 9 and per annum growth in SDPs during pre economic reform (1980-1990), reform period (1991-2012) and shift in per annum growth, if any, during the reform period (1991-2012) are shown in table 10. Table 10 shows that per annum growth in SDPs of thirteen states i.e. AP, Assam, Bihar, Karnataka, M.P., Maharashtra, Manipur, Nagaland, Punjab, Rajasthan, Tamil Nadu, U.P. and W.B. has fallen during the economic reform (1991-2012) period as compared to pre-economic reform period (1980-1990). At the same time, per annum growth in SDPs of remaining seven states i.e. Gujarat, Haryana, H.P., J & K, Kerala, Orissa and Tripura has surged during the reform era (1991-2012) as compared to the pre-reform era (1980-1990). Similarly, Slope and intercept dummy regression results regarding per annum growth in per capita SDPs of twenty states are shown in table 11. Based on regression coefficients as shown in table 11, per annum growth in per capita SDPs of 20 Indian states are presented in table 12. Table 12 clearly shows that per annum growth in per capita SDPs of eleven Indian states i.e. Assam, Bihar, Karnataka, M.P., Maharashtra, Manipur, Nagaland, Punjab, Rajasthan, Tamil Nadu and U.P. has fallen during the economic reform (1991-2012) era as compared to pre-economic (1980-1990) era. Contrary to it, per annum growth in per capita SDPs of nine states i.e. A.P., Gujarat, Haryana, H.P., J & K, Kerala, Orissa, Tripura and W.B. has surged during the reform period (1991-2012) as compared to the pre-economic reform (1980-1990) period.

It is significant to observe here that, per annum growth in SDPs / per capita SDPs has surged for economically developed states as Gujarat, Haryana, H.P., and Kerala during the economic reform (1991-2012) era as compared to pre economic reform (1980-1990) era while per annum growth in this regard has fallen for economically poor states as Bihar, M.P., Rajasthan, U.P. and some hill states as Assam and Manipur during the reform period as compared to the pre economic reform period. This has perhaps the main cause for growing inter-state disparity in SDPs/ per capita SDPs among Indian stets during 1980-2012.

Inequality in SDPs / per capita SDPs for twenty Indian states over the period 1980-2012 have been examined with help of indices based on properties of Lorenz Curve i.e. Gini, Relative mean Deviation (RMD). Theil's index, Kakwani index and also based on properties of Hertindahl's index i.e. H_1, H_2 and H_3. These results are shown in table 13 and table 14. Family of inequality indices pertaining to SDPs of 20 Indian states for the period 1980-2012 are presented in table 13. Facts reveal that all measures of inequality i.e. Gini, RMD, Theil's index, Kakwani index, H_1, H_2 and H_3 for SDPs have risen during the period 1980-2012. For example, Gini and Theil's index in the regard stood at 0.4283 and 0.1075 respectively in the year 1981 and they increased further and finally stood at 0.4519 and 0.1208 respectively in the year 2012. Similarly, inequality indices for per capita SDPs of 20 states have also risen during the period 1980-2012. For instance, Gini and RMD index in this regard were noted at 0.1405 and 0.1097 respectively in 1981 and have risen further and were finally noted at 0.2167 and 0.1735 respectively in 2012.

Interstate inequality in SDPs/per capita SDPs of 20 Indian states over the period 1980-2012 reveal several interesting results. First of all, inter-sate inequality indices in SDPs were much higher than those of interstate inequality in per capita SDPs during the period 1980-2012. Second, inter-state inequality indices in per capita SDPs have risen much faster than interstate inequality in SDPs during this period 1980-2012. Third, Inter-state disparity in SDPs/per capita SDPs have risen during the period 1980-2012. Fourth, Gini led Kuznets curve for SDP of twenty Indian states (Fig.2) reveal that inter-state inequality in this regard is still rising over the period 1980-2012 and perhaps it yet did not attain maximum inequality or decline phase. Fifth and finally, Gini led Kuznets curve for per Capita SDP of twelve Indian states is also still surging over the period 1980-2012 and neither it attain maximum inequality nor deckling phase.

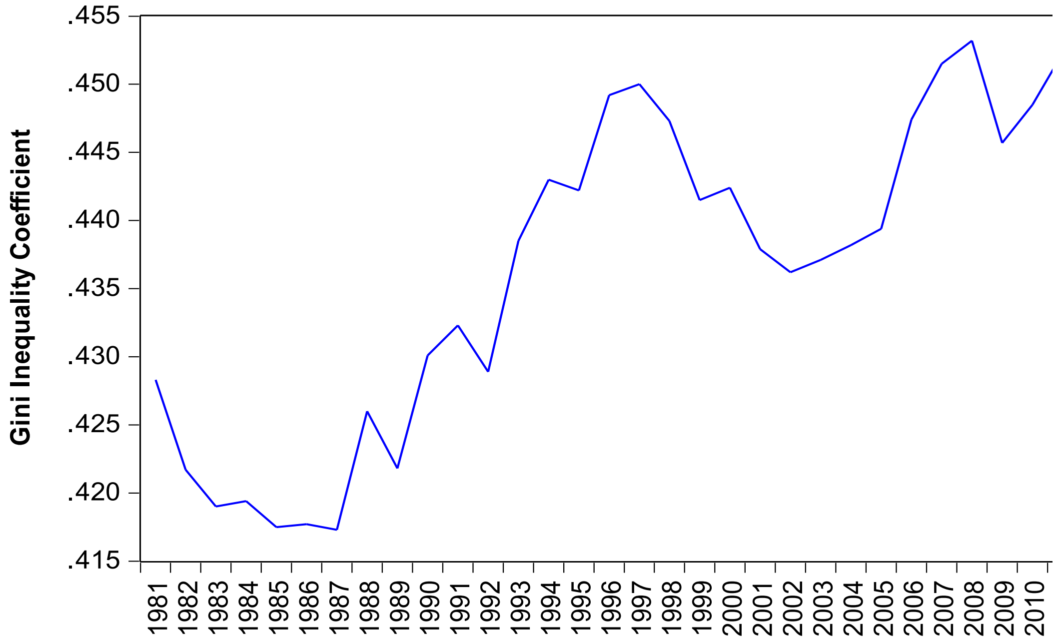


Figure 2. Gini led Kuznets's Curve for SDP Base 2004-05 (Current Prices).

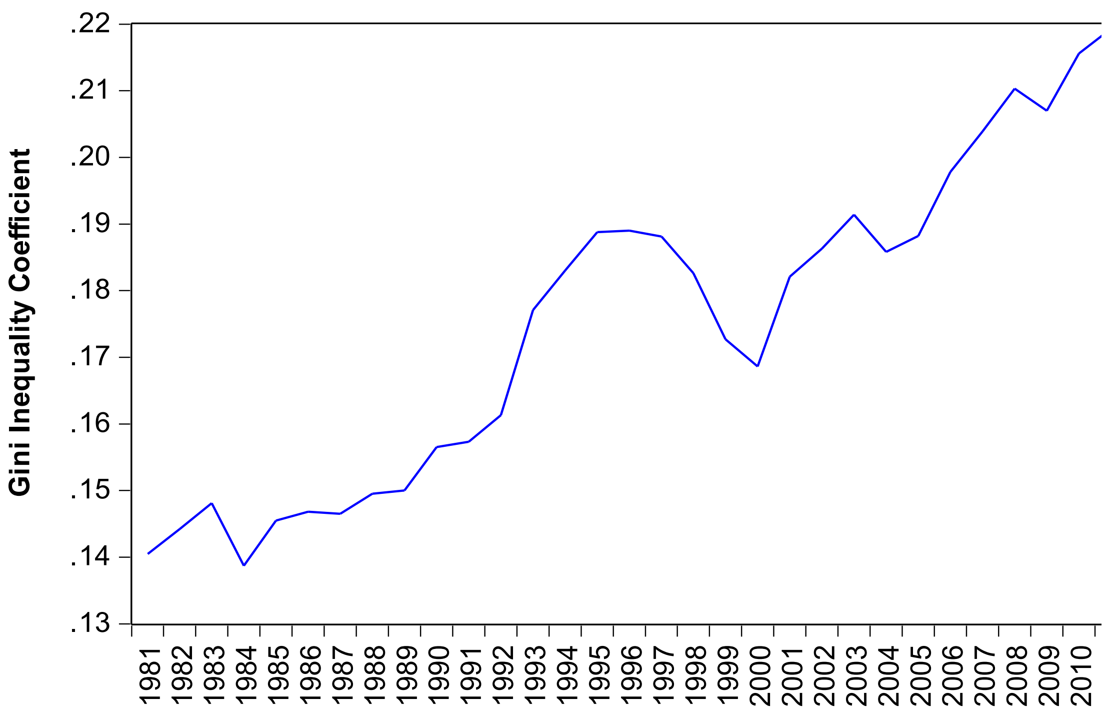


Figure 3. Gini led Kuznets's Curve for Per-Capita SDP Base 2004-05 (Current Prices).

V- CONCLUSION AND POLICY SUGGESTION

Rising inter-state inequality in SDPs/per capita SDPs of Indian states over the period 1980-2012, especially after introduction of economic reforms by Indian Government in 1991, has posed serious challenges before the policy makers and states. For example, growth in per capita SDPs for economically poor states as U.P., Bihar, M.P., Rajasthan and for hills States as Assam, Tripura, Manipur etc. has been insipid while the same has been significant for well off states as Gujarat, Haryana, Kerala, H.P. etc. This has resulted in widening gap in terms of per capita SDPs among Indian states. This has led undue migration of labour force from poor states to the rich states and has resulted in undue friction among states on the one hand and undue pressure on available resources like education, health, electricity, housing in metro cities/urban areas. Next states with poor SDPs are putting demand for higher funds with centre thereby causing severe resource crunch for the center inform of growing various types of budgetary deficits of the centers. And finally growing inter-state disparity is a potential threat for stability of a federal nation like India.

In view of the above, urgent steps are needed on part of the center as well as states Governments to curb this menace. As a corrective measure, centre must provide higher funds to economically backward/hills states as their shares in central divisible pool of taxes and grants. Further, economically poor/hill states like Bihar, U.P., M.P. Rajasthan, Assam, Tripura, Manipur etc. must mobilize adequate resources in commensurate to their respective tax/resources potential such that SDPs/per capita SDPs of these states are augmented.

Table 1: SDP (Current Prices 2004-05) Period (1980-2012) : Descriptive Statistics

	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	Probability	Sum	Sum Sq. Dev.	Observations
AP	139804	83566.28	587539	8455.4	155711.6	1.442496	4.203731	13.02952	0.001481	4473727	7.52E+11	32
ASSM	31400.72	21557.82	114695	2861.71	29473.28	1.29612	3.948339	10.15874	0.006224	1004823	2.69E+10	32
BIH	52805.97	34027	225482	5413.12	54205.02	1.676119	5.300449	22.03943	0.000016	1689791	9.11E+10	32
GUJ	121696.6	75653.17	533390	7915.51	137746.5	1.550187	4.618216	16.30793	0.000288	3894293	5.88E+11	32
HAR	60622.16	31952.31	280140.6	3566.33	72613.46	1.637517	4.85394	18.88393	0.000079	1939909	1.63E+11	32
HP	13310.84	7614.155	51546	981.34	13925.37	1.251954	3.674866	8.966669	0.011296	425947	6.01E+09	32
J_K	14650.77	9254.215	52575.5	1632.84	13796.28	1.160644	3.482689	7.495159	0.023575	468824.5	5.90E+09	32
KARNTKA	102870.3	62855.14	412784	7083.35	110185.3	1.364554	3.942892	11.11611	0.003856	3291849	3.76E+11	32
KERAL	69761.16	44906.4	280870.8	5470.58	73648.98	1.355604	4.00877	11.15769	0.003777	2232357	1.68E+11	32
MAHA	263837.3	167220.2	1150616	17282.59	295407.7	1.524008	4.574239	15.69151	0.000391	8442795	2.71E+12	32
MANIPR	2867.023	2081.72	9279.06	267.65	2536.953	0.944009	2.889133	4.769203	0.092126	91744.75	2.00E+08	32
MP	71860.63	50911.96	276900.1	6940.51	69792	1.364613	4.211492	11.88852	0.002621	2299540	1.51E+11	32
NAGALA	3345.685	2226.65	11376.94	160.37	3330.37	1.007973	2.882561	5.437103	0.06597	107061.9	3.44E+08	32
ORISSA	45919.66	28218.43	176906.5	4369.4	48341.45	1.382962	3.862641	11.19265	0.003711	1469429	7.24E+10	32
PUNJAB	61459.54	41482.63	232410.2	4946.32	61204.33	1.297789	3.857235	9.962497	0.006865	1966705	1.16E+11	32
RAJAS	82369.63	54417.46	367914.7	5677.76	89676.2	1.628703	5.192995	20.5599	0.000034	2635828	2.49E+11	32
TAMIL	139392.3	86480.98	572019.8	9386.18	151421.5	1.443408	4.230817	13.13149	0.001408	4460554	7.11E+11	32
TRIPURA	4943.806	2618.615	18268.58	394.25	5051.603	1.147244	3.290927	7.132419	0.028263	158201.8	7.91E+08	32
UP	163774.3	118362	609518.2	16435.87	157544.5	1.323163	3.997717	10.66463	0.004833	5240776	7.69E+11	32
WB	126379.5	75777.67	496927.3	11181.26	129566	1.353661	4.040268	11.21566	0.003669	4044144	5.20E+11	32

Table 2 : Per Capita SDP (Current Prices 2004-05) Period (1980-2012) : Descriptive Statistics

	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	Probability	Sum	Sum Sq. Dev.	Observations
AP	17865.5	11500.83	71540	1584.83	18731.1	1.422281	4.188435	12.67188	0.001771	571696	1.09E+10	32
ASSM	11261.05	8708.575	33633	1608.45	8797.605	0.996459	3.090959	5.306659	0.070416	360353.5	2.40E+09	32
BIH	6417.334	4727.075	24681	1045.08	5784.62	1.66463	5.259944	21.58842	0.000021	205354.7	1.04E+09	32
GUJ	22109.06	16579	75115	2334.1	20963.18	1.165502	3.2954	7.361125	0.025209	707489.8	1.36E+10	32
HAR	26803.42	17088.91	109227	2765.93	27997.28	1.504232	4.475231	14.96955	0.000562	857709.5	2.43E+10	32
HP	21219.03	13818.9	73608	2381.64	19824.29	1.097274	3.281781	6.527253	0.038249	679008.9	1.22E+10	32
J_K	14133.37	10322.71	41833	2700.75	11009.25	0.948011	2.892927	4.808486	0.090334	452267.9	3.76E+09	32
KARNTKA	18819.09	12749.72	69493	1916.61	18415.02	1.273671	3.712044	9.327941	0.009429	602210.9	1.05E+10	32
KERAL	21462.94	14665.22	83725	2173.04	21579.33	1.340856	4.036353	11.02081	0.004044	686814	1.44E+10	32
MAHA	25142.22	18883.12	83471	2744.01	23777.31	1.145674	3.240087	7.077228	0.029054	804551	1.75E+10	32
MANIPUR	12046.45	10068.68	32284	1901.01	8839.752	0.700717	2.422986	3.062614	0.216253	385486.5	2.42E+09	32
MP	11201.57	9339.445	32222	1820.86	8747.54	0.952408	3.009196	4.837881	0.089016	358450.2	2.37E+09	32
NAGALA	21225.86	19360.01	56116	2722.22	15627.31	0.694177	2.472458	2.941105	0.229798	679227.7	7.57E+09	32
ORISSA	12226.65	8156.705	46150	1663.47	11959.65	1.412614	4.072463	12.17612	0.00227	391252.8	4.43E+09	32
PUNJAB	23960.89	18569.04	78171	2973.05	20597.2	1.097128	3.366424	6.598705	0.036907	766748.4	1.32E+10	32
RAJAS	13131.41	10898.33	42434	1421.34	11569.45	1.029242	3.168252	5.687555	0.058205	420205	4.15E+09	32
TAMIL	21169.8	14525.17	72993	1929.36	20698.06	1.182689	3.343241	7.617104	0.02218	677433.6	1.33E+10	32
TRIPURA	14936.71	8536.72	50750	1944.37	13876.15	1.060079	3.065262	5.999111	0.049809	477974.7	5.97E+09	32
UP	9426.226	7966.9	29417	1558.54	7507.734	1.089222	3.44691	6.593791	0.036998	301639.2	1.75E+09	32
WB	15389.85	10120.37	55864	2053.7	14318.77	1.287424	3.879949	9.872198	0.007183	492475.3	6.36E+09	32

Table 3: **State Domestic Product (1980-2012) of Indian States (at 2004-05 Prices) : Unit Root Results**

States	ADF Test (t-statistics)			Phillip-Perron Test (Adj-t statistics)			Order of Integration
	Without Intercept in equation	With intercept in equation	With intercept and trend in equation	Without Intercept in equation	With intercept in equation	With intercept and trend in equation	
A.P.	-0.3514	-5.5801*	-5.4837*	-1.4100	-5.5971*	-5.5136*	**I(1)**
Assam	-0.2030	-5.0743*	-4.8340*	-1.8769**	-5.1595*	-4.8840*	**I(1)**
Bihar	0.0651	-1.6476	-7.8350*	-2.4834**	-7.3671*	-7.3518*	**I(1)**
Gujarat	-0.4454	-7.4803*	-7.4233*	-2.6192*	-7.4802*	-7.4232*	**I(1)**
HP	-0.1083	-5.9117*	-5.8101*	-1.1472	-5.9081*	-5.8246*	**I(1)**
J & K	0.0239	-6.3034*	-6.1984*	-1.2639	-6.2998*	-6.1962*	**I(1)**
Karnataka	-0.5994	-4.7815*	-4.6995*	-1.0703	-4.7965*	-4.7157*	**I(1)**
Kerala	-0.5291	-3.8299*	-3.7506**	-0.0344	-3.8743*	-3.8173*	**I(1)**
M.P.	-0.3595	-6.5520*	-1.6888	-1.7659***	-6.4490*	-6.3544*	**I(1)**
Maharashtra	-1.0397	-3.9604*	-3.9070**	-0.7117	-3.9611*	-3.9146**	**I(1)**
Manipur	-0.9014	-5.7752*	-5.9814	-1.9647**	-5.7653*	-6.1800*	**I(1)**
Nagaland	-1.0325	-3.7256*	-4.5505**	-1.5593	-3.6446*	-4.4725*	**I(1)**
Punjab	-9.6554*	-9.4777*	-9.2859*	-0.9180	-3.7943*	-3.7038**	**I(1)**
Rajasthan	-14.3443	-14.1078*	-13.9586*	-2.3359**	-6.7886*	-6.6874*	**I(1)**
Tamil Nadu	-1.3061	-3.9489*	-3.8797**	-1.1650	-4.0368*	-3.9766**	**I(1)**
Tripura	-0.7876	-5.0317*	-4.9341*	-1.2552	-5.0317*	-4.9341*	**I(1)**
Uttar Pradesh	-0.5109	-3.8930*	-3.8463**	-0.3904	-4.0845*	-4.0335**	**I(1)**

Note :

(1) * indicates the rejection of H_0 of Non-stationary (ADF) and (PP) at 1% LS.

(2) **indicates the rejection of H_0 of Non-stationary (ADF) and)PP) at 5% LS.

(3) *** indicates the rejection of H_0 of Non-stationary (ADF) and (PP) at 10% LS.

(4) H_0, First difference data contain unit root.

Table 4: Clemente-Montances-Reyes Unit Root and Structural Break test (Double mean shift – AO Model) for SDP (1980-2012) for Indian States : Regression Results

States	**Constant**	**du_1**	**du_2**	**$\rho^{(-1)}$**	**AR lags**	**Optimal break years**
A.P.	3.040e+04	117660.46 (5.078)	269715.82 (9.086)	-0.8358 (-1.221)	5	**1996, 2006**
Assam	9800.16	25779.68 (5.511)	46457.15 (7.753)	-0.4615 (-2.101)	0	**1996, 2006**
Bihar	1.583e+04	39408.46 (4.228)	92122.87 (7.715)	-1.2878 (-1.321)	6	**1996, 2006**
Gujarat	3.356e+04	113872.05 (5.472)	245209.04 (8.624)	-0.8023 (-3.638)	1	**1998, 2007**
HP	3627.59	13380.80 (6.304)	20422.12 (7.570)	-0.4735 (-2.095)	0	**1998, 2006**
J & K	4164.06	12239.82 (5.550)	19962.49 (7.485)	-0.3866 (-1.696)	0	**1996, 2005**
Karnataka	2.394e+04	86910 (5.618)	189222.15 (9.548)	-0.6037 (-2.347)	0	**1996, 2006**
Kerala	1.827e+04	62408.32 (5.575)	118583.07 (8.286)	-0.5162 (-2.113)	0	**1997, 2006**
M.P.	9.581e+04	342917.01 (7.446)	534878.03 (7.127)	-0.0531 (-0.100)	8	**2001, 2009**
Maharashtra	863.02	2637.20 (7.707)	3655.47 (8.339)	-0.9860 (-1.388)	7	**1996, 2006**
Manipur	2.095e+04	59798.94 (5.514)	112043.57 (8.065)	-1.7700 (-3.484)	4	**1996, 2006**
Nagaland	879.01	3052.93 (6.102)	4734.21 (7.838)	-0.3813 (-1.298)	6	**1997, 2005**
Punjab	1.661e+04	52003.47 (5.905)	100541.66 (8.913)	-0.4800 (-1.931)	0	**1996, 2006**
Rajasthan	2.003e+04	68444.05 (4.538)	149967.80 (7.762)	-1.4980 (4.443)	3	**1996, 2006**
Tamil Nadu	3.250e+04	115608.38 (5.203)	261810.27 (9.198)	-0.2231 (-0.264)	7	**1996, 2006**
Tripura	1492.93	5347.16 (7.110)	6819.13 (7.206)	-0.9189 (-0.1342)	6	**1999, 2006**
Uttar Pradesh	4.836e+04	135180.41 (5.732)	255043.22 (8.441)	-0.4567 (-1.956)	0	**1996, 2006**

Note :

(1) Figures in the paranthesis are t-valves

(2) dU_i; i=1,2 pulse variables in HA corresponding to pulse variables i.e. DTB_i ; I = 1,2 in HO.

Table 5: State Domestic Product (Total) of Indian States (Base 2004-05) at Current Prices: ARCH Effect

States	Cons.	Z-Stat.	Prob.	Variance Equation					
				Const.	ARCH (1)	Z-Statistics		Probability	
						Const.	ARCH (1)	Const.	ARCH (1)
	1	2	3	4	5	7	8	10	11
AP	74070.5	1.767	0.0772	1.54 E+10	0.7715	1.7316	0.5057	0.0833	0.6131
Assam	19467.9	2.5497	0.0108	5.53 E+8	0.7167	1.6371	0.5732	0.1016	0.5665
Bihar	31000.1	2.2802	0.0226	1.87 E+10	0.7749	1.7493	0.6285	0.0802	0.5295
Gujarat	64499.5	1.7102	0.0872	1.21 E+10	0.7999	1.7863	0.5013	0.0741	0.6162
Haryana	30038.1	1.4767	0.1393	3.36 E+09	0.8294	1.8345	0.8294	0.0666	0.6308
HP	7089.9	1.8875	0.0591	1.23 E+08	0.7449	1.6372	0.5070	0.1016	0.6121
J & K	8469.4	2.3152	0.0206	1.21 E+08	0.7261	1.5785	0.5300	0.1144	0.5961
Karnataka	56406.2	1.9310	0.0535	7.73 E+09	0.7533	1.6892	0.5097	0.0912	0.6103
Kerala	38692.8	2.00	0.0455	3.45 E+09	0.7457	1.6624	0.5262	0.0964	0.5987
MP	45335.4	2.6189	0.0088	3.10 E+09	0.7014	1.6017	0.6288	0.1092	0.5295
Maharashtra	142416.3	1.8030	0.0714	5.56 E+10	0.7845	1.7557	0.5284	0.0792	0.5972
Manipur	755.40	9.6999	0.0000	5561.6	1.3012	0.2600	0.8650	0.7948	0.3870
Nagaland	301.49	7.2966	0.0000	1322.0	1.3870	0.2906	1.1847	0.7713	0.2361
Odisha	25319.4	1.8981	0.0577	1.49 E+09	0.7734	1.7509	0.4696	0.0799	0.6386
Punjab	37055.9	2.3758	0.0175	2.38 E+09	0.7063	1.6152	0.5643	0.1063	0.5725
Rajasthan	48010.10	2.1225	0.0338	5.12 E+09	0.7585	1.7007	0.6454	0.0890	0.5186
Tamil Nadu	77765.9	1.9506	0.0511	1.46 E+10	0.7500	1.7015	0.5200	0.889	0.6030
Tripura	1151.87	5.8483	0.0000	156750.9	1.1560	0.6696	0.5916	0.5031	0.5539
UP	103047.0	2.5938	0.0095	1.58 E+10	0.6996	1.6093	0.5812	0.1075	0.5611
WB	71201.12	2.0931	0.0363	1.07 E+10	0.7415	1.6457	0.5448	0.0998	0.5859

Table 6: Per Capita State Domestic Product of Indian States (Base 2004-05) at Current Prices: ARCH Effect

States	Cons.	Z-Stat.	Prob.	Variance Equation					
				Const.	ARCH (1)	Z-Statistics		Probability	
						Const.	ARCH (1)	Const.	ARCH (1)
	1	2	3	4	5	6	7	8	9
AP	10149.1	2.051	0.040	2.23E+08	0.750	1.701	0.529	0.089	0.597
Assam	7872.2	3.479	0.001	4927008	0.661	1.528	0.543	0.126	0.587
Bihar	2734.5	11.902	0.000	48520.5	1.309	0.179	1.407	0.857	0.159
Gujarat	13548.1	2.461	0.013	2.80 E+08	0.686	1.621	0.524	0.105	0.600
Haryana	15324.4	2.041	0.041	4.99 E+08	0.771	1.751	0.524	0.080	0.600
HP	12495.9	2.390	0.016	2.50 E+08	0.706	1.557	0.523	0.119	0.600
J & K	9322.9	3.240	0.001	77158981	0.679	1.481	0.516	0.138	0.606
Karnataka	11302.9	2.373	0.017	2.16 E+08	0.717	1.626	0.531	0.104	0.594
Kerala	12558.5	2.260	0.024	2.96 E+08	0.729	1.631	0.558	0.103	0.576
MP	8329.8	3.891	0.000	48708796	0.594	1.428	0.613	0.153	0.539
Maharashtra	15637.4	2.526	0.0115	3.60 E+08	0.674	1.602	0.521	0.109	0.602
Manipur	8617.8	4.218	0.000	42502682	0.645	1.288	0.547	0.198	0.584
Nagaland	16745.7	4.273	0.000	1.55 E+08	0.583	1.368	0.514	0.171	0.607
Odisha	7288.1	2.253	0.024	91055903	0.764	1.732	0.497	0.083	0.619
Punjab	16450.9	3.246	0.001	2.70 E+08	0.648	1.504	0.589	0.132	0.556
Rajasthan	9097.3	3.324	0.001	85141169	0.606	1.427	0.647	0.154	0.517
Tamil Nadu	12763.1	2.392	0.017	2.73 E+08	0.678	1.602	0.535	0.109	0.593
Tripura	8215.03	2.085	0.037	1.23 E+08	0.750	1.599	0.449	0.110	0.654
UP	5567.02	4.938	0.000	11162998	0.852	1.110	0.625	0.267	0.532
WB	9404.1	2.552	0.010	1.31 E+08	0.717	1.599	0.567	0.110	0.571

Table 7: State Domestic Product (Total) of Indian States (Base 2004-05) at Current Prices: GARCH Effect

States	Cons.	Z-Stat.	Prob.	Variance Equation								
				Const.	ARCH (1)	GARCH (1)	Z-Statistics			Probability		
							Const.	ARCH (1)	GARCH (1)	Const.	ARCH (1)	GARCH (1)
	1	2	3	4	5	6	7	8	9	10	11	12
AP	139117.6	6.172	0.000	1.53 E+10	1.469	−1.314	0.579	0.619	−0.334	0.562	0.535	0.738
Assam	29181.3	5.422	0.000	5.47 E+08	1.622	− 1.277	0.213	0.399	−0.125	0.831	0.689	0.901
Bihar	52414.9	9.111	0.000	1.85 E+09	1.458	− 1.010	1.161	2.261	−7.739	0.246	0.024	0.000
Gujarat	69264.5	6.608	0.000	1.19 E+10	1.940	− 0.993	1.340	0.841	−17.807	0.180	0.400	0.000
Haryana	60293.6	7.210	0.000	3.32 E+09	2.041	− 0.998	1.048	3.397	−35.603	0.295	0.001	0.000
HP	11734.2	8.773	0.000	1.22 E+08	1.817	− 1.013	0.919	0.766	−7.151	0.358	0.443	0.000
J & K	6754.8	6.377	0.000	1.20 E+08	2.282	− 0.998	1.292	1.701	−68.52	0.197	0.089	0.000
Karnataka	102518	6.251	0.000	7.64 E+09	1.526	− 1.325	0.422	0.531	−0.259	0.673	0.596	0.795
Kerala	66295.7	6.331	0.000	3.42 E+09	1.381	− 1.293	0.476	0.531	−0.286	0.634	0.596	0.775
MP	71366.9	10.622	0.000	3.07 E+09	1.179	− 1.058	2.622	1.244	−7.678	0.009	0.213	0.000
Maharashtra	263659.8	19.034	0.000	5.50 E+10	2.330	− 1.003	1.059	4.868	−58.25	0.289	0.000	0.000
Manipur	1107.14	8.068	0.000	4052424	3.057	− 1.005	1.211	0.997	−74.03	0.226	0.349	0.000
Nagaland	2030.80	7.966	0.000	8984091	2.282	− 1.004	1.133	1.471	−32.66	0.257	0.141	0.000
Odisha	13683.6	8.439	0.000	1.4 E+09	3.939	− 1.003	1.372	2.122	−299.9	0.170	0.033	0.000
Punjab	82115.8	9.954	0.000	5.06 E+09	1.814	− 0.968	1.134	2.535	−17.18	0.257	0.011	0.000
Rajasthan	139120.7	6.039	0.000	1.44 E+10	1.533	− 1.336	0.292	0.373	−0.170	0.770	0.710	0.865
Tamil Nadu	54248.8	6.238	0.000	2.36 E+09	1.364	− 1.294	0.407	0.557	−0.241	0.684	0.577	0.810
Tripura	2315.5	7.033	0.000	16068800	1.824	− 1.008	1.340	2.282	−103.2	0.180	0.022	0.000
UP	163501.0	24393.7	0.000	1.56 E+10	1.605	− 1.289	0.223	0.241	−0.129	0.823	0.809	0.897
WB	109377.4	6.301	0.000	1.06 E+10	1.163	− 1.250	0.440	0.552	−0.243	0.659	0.580	0.808

Table 8: Per Capita State Domestic Product of Indian States (Base 2004-05) at Current Prices: GARCH Effect

States	Cons.	Z-Stat.	Prob.	Variance Equation								
							Z-Statistics			Probability		
				Const.	ARCH (1)	GARCH (1)	Const.	ARCH (1)	GARCH (1)	Const.	ARCH (1)	GARCH (1)
	1	2	3	4	5	6	7	8	9	10	11	12
AP	12136.7	16.266	0.000	2.21E+08	2.499	-1.006	1.011	0.560	-12.08	0.312	0.575	0.000
Assam	8573.8	5.523	0.000	48736456	1.3989	-1.239	0.602	1.004	-0.314	0.547	0.315	0.753
Bihar	4916.8	12.671	0.000	21070497	1.572	-1.008	1.295	1.058	-13.009	0.195	0.289	0.000
Gujarat	20548.7	15.304	0.000	2.77 E+08	1.589	-0.993	1.139	4.619	-20.758	0.254	0.000	0.000
Haryana	25696.0	6.603	0.000	4.94 E+08	1.382	-1.295	0.125	0.152	-0.073	0.900	0.878	0.941
HP	19797.8	10.028	0.000	2.47 E+08	1.880	-1.020	0.870	0.822	-4.751	0.384	0.411	0.000
J & K	8889.4	8.937	0.000	76320327	1.818	-1.008	1.118	0.720	-12.119	0.263	0.471	0.000
Karnataka	17133.9	6.486	0.000	2.14 E+08	1.423	-1.302	0.647	0.782	-0.402	0.517	0.433	0.687
Kerala	20040.4	6.339	0.000	2.93 E+08	1.330	-1.239	0.110	0.137	-0.063	0.912	0.891	0.949
MP	8021.2	5.174	0.000	48179905	1.288	-0.929	1.193	0.710	-1.871	0.232	0.478	0.061
Maharashtra	23144.9	6.378	0.000	3.56 E+08	1.508	-1.291	0.441	0.667	-0.264	0.659	0.504	0.791
Manipur	10042.0	8.834	0.000	49204425	1.348	-1.053	1.241	0.678	-4.362	0.215	0.479	0.800
Nagaland	20247.4	11.894	0.000	1.54 E+08	1.225	-1.007	1.686	1.243	-19.969	0.092	0.214	0.000
Odisha	10687.9	5.219	0.000	90066169	1.255	-1.260	0.687	1.118	-0.348	0.492	0.263	0.728
Punjab	19918.7	6.389	0.000	2.67 E+08	1.408	-1.251	0.501	0.879	-0.301	0.617	0.379	0.764
Rajasthan	4806.8	10.533	0.000	84283489	1.583	-1.001	1.246	1.120	-63.014	0.213	0.263	0.000
Tamil Nadu	19064.4	8.648	0.000	2.70 E+08	1.622	-1.011	1.060	1.371	-12.654	0.289	0.170	0.000
Tripura	13179.9	7.148	0.000	1.21 E+08	1.317	-1.246	0.727	0.656	-0.438	0.467	0.512	0.664
UP	7019.1	15.554	0.000	35493007	1.613	-1.035	1.097	1.893	-16.905	0.272	0.058	0.000
WB	13498.6	6.885	0.000	1.29 E+08	1.302	-1.244	0.850	0.969	-0.558	0.395	0.332	0.577

Table 9: Slope and Intercept Dummy Inter-State regression results for SDP Base 2004-05 (Current Prices).

States	Intercept	t	D_1	D_2t	R^2	$Ad_j\ R^2$	RSS	SER	D.W. Statistics	F
A.P.	8.903100 (0.0000)	0.133070 (0.0000)*	0.266854 (0.0008)	-0.00713 (0.3138)	0.997419	0.997143	0.130276	0.068211	0.714569	3607.366
Assam	7.942057 (0.0000)	0.129864 (0.0000)*	0.326947 (0.0000)	-0.02801 (0.0000)	0.997221	0.996923	0.091773	0.057250	0.607463	3348.634
Bihar	8.497623 (0.0000)	0.125918 (0.0000)*	0.117570 (0.2559)	-0.01790 (0.0802)	0.991983	0.991124	0.262881	0.096895	0.690909	1154.804
Gujarat	8.913808 (0.0000)	0.121788 (0.0000)*	0.084842 (0.4143)	0.005045 (0.6170)	0.994352	0.993747	0.268192	0.097869	0.981085	1643.123
Haryana	8.018593 (0.0000)	0.133259 (0.0000)*	0.051328 (04765)	0.002474 (0.7238)	0.997531	0.997266	0.129436	0.067991	0.577644	3770.667
HP	6.732411 (0.0000)	0.122176 (0.0000)*	0.162560 (0.0154)	0.001106 (0.8584)	0.997818	0.997584	0.101600	0.060237	0.722552	4267.648
J&K	7.355325 (0.0000)	0.100100 (0.0000)*	-0.06386 (0.3218)	0.010673 (0.0946) *	0.996923	0.996594	0.102558	0.060521	0.694362	3024.212
Karnataka	8.744411 (0.0000)	0.127516 (0.0000)*	0.263101 (0.0006)	-0.00729 (0.2813)	0.997430	0.997155	0.118701	0.065110	0.491289	3622.368
Kerala	8.473924 (0.0000)	0.115015 (0.0000) *	0.153519 (0.0218)	0.005009 (0.4227)	0.997711	0.997466	0.102105	0.060387	0.509387	4067.854
M.P.	8.655210 (0.0000)	0.129124 (0.0000)*	0.409363 (0.0001)	-0.02579 (0.0072) *	0.994170	0.993545	0.213047	0.087229	0.762135	1591.504
Maharashtra	9.558076 (0.0000)	0.132551 (0.0000) *	0.308920 (0.0018)	-0.00923 (0.2985)	0.995882	0.995441	0.204420	0.085444	0.609426	2257.227
Manipur	5.480765 (0.0000)	0.129434 (0.0000) *	0.503686 (0.0000)	-0.03129 (0.0000) *	0.996996	0.996674	0.105266	0.061315	0.835608	3097.751
Nagaland	4.949308 (0.0000)	0.164649 (0.0000) *	0.807352 (0.0000)	-0.05047 (0.0000) *	0.997962	0.997744	0.106693	0.061729	1.054935	4571.252
Odisha	8.279547 (0.0000)	0.109256 (0.0000) *	-0.04945 (0.5634)	0.009172 (0.2751)	0.995231	0.994720	0.182981	0.080840	1.108499	1947.644
Punjab	8.373078 (0.0000)	0.130402 (0.0000) *	0.425240 (0.0000)	-0.02236 (0.0021) *	0.997099	0.996788	0.117265	0.064715	0.421617	3207.998
Rajasthan	8.463524 (0.0000)	0.140188 (0.0000) *	0.440736 (0.0006)	-0.02504 (0.0323)	0.992694	0.991911	0.332737	0.109011	0.790033	1268.192
Tamil N.	8.994920 (0.0000)	0.133526 (0.0000)*	0.310436 (0.0010)	-0.01317 (0.1195)	0.996130	0.995715	0.181427	0.080496	0.451042	2402.420
Tripura	5.864291 (0.0000)	0.123252 (0.0000)*	-0.04286 (0.5743)	0.003141 (0.6722)	0.996613	0.996250	0.145439	0.072071	0.455537	2746.432
U.P.	9.539351 (0.0000)	0.124629 (0.0000)*	0.363832 (0.0001)	-0.02193 (0.0051) *	0.996039	0.995615	0.140057	0.070725	0.370302	2346.983
W. B.	9.209133 (0.0000)	0.118762 (0.0000)*	0.053026 (0.3792)	-0.00064 (0.9134)	0.997720	0.997476	0.090123	0.056733	0.509225	4084.877

Note:

(i) Regression Equations have been estimated with the help of semi-log model with slope and intercept dummy variable technique which is shown by following equation;

$$ln(y) = \alpha + \beta t + \gamma D_1 + \theta(D_2 t) + U_i$$

(ii) Figures in the parenthesis are probability values.

(iii) * - denotes statistically significant at 1% level of significance.

(iv) ** - denotes statistically insignificant at 5% level of significance.

(v) D_1=0 – First Dummy variable for pre-economic reform (1981-91) period;

(vi) D_2=1 – Second Dummy variable for post-economic reform (1992-2012) period.

Table 10. Average Annual Growth in SDP Base 2004-05 (Current Prices).

States	**Growth Rate (in percentage) during**		**Shift in per annum growth during Post –reform (1992-12) period**
	Pre-economic reform era (1980-81&1990-91)	**Post-economic reform era (1991-92 & 2011-12)**	
A.P.	13.307	12.594	Downward Shift
Assam	12.986	10.185	Downward Shift
Bihar	12.591	10.801	Downward Shift
Gujarat	12.178	12.682	Upward Shift
Haryana	13.325	13.572	Upward Shift
H.P.	12.217	12.327	Upward Shift
J&K	10.010	11.077	Upward Shift
Karnataka	12.751	12.022	Downward Shift
Kerala	11.501	12.001	Upward Shift
M.P.	12.912	10.333	Downward Shift
Maharashtra	13.255	12.332	Downward Shift
Manipur	12.943	9.814	Downward Shift
Nagaland	16.464	11.417	Downward Shift
Odisha	10.925	11.842	Upward Shift
Punjab	13.040	10.804	Downward Shift
Rajasthan	14.018	11.514	Downward Shift
Tamil Nadu	13.352	12.035	Downward Shift
Tripura	12.325	12.639	Upward Shift
U.P.	12.462	10.269	Downward Shift
W.B.	11.876	11.812	Downward Shift

Note: Growth rates for Pre-Economic and Post-Economic Reform period have been calculated on the basis of coefficients of t and D_2t as shown in Table 9.

Table 11. Slope and Intercept Dummy Inter-State regression results for Per-Capita SDP Base 2004-05 (Current Prices).

States	Intercep t	t	D_1	D_2t	R^2	Adj R^2	RSS	SER	D.W. Statistics	F
A.P.	7.250712 (0.0000)	0.111374 (0.0000)*	0.10424 3	0.004668 (0.5271)	0.99645 9	0.99607 9	0.14318 4	0.07151 0	0.612463	2626.182
Assam	7.390399 (0.0000)	0.108477 (0.0000)*	(0.1744) 0.27729 8	-0.02449 (0.0000) *	0.99724 9	0.99695 4	0.06183 5	0.04699 4	0.775803	3382.849
Bihar	6.872423 (0.0000)	0.104627 (0.0000)*	(0.0000) 0.02911 0	-0.01352 (0.2686)	0.98261 5	0.98075 2	0.38675 0	0.11752 7	0.514640	527.5141
Gujarat	7.706623 (0.0000)	0.102188 (0.0000)*	(0.8146) 0.14188 3	0.002642 (0.7908)	0.99232 8	0.99150 6	0.26223 0	0.09677 5	1.180198	1207.222
Haryana	7.788064 (0.0000)	0.109036 (0.0000)*	(0.1721) 0.01387 8	0.004913 (0.5148)	0.99591 6	0.99547 8	0.14949 9	0.07307 0	0.505049	2275.973
HP	7.634921 (0.0000)	0.103801 (0.0000)*	(0.8572) 0.12244 0	0.003397 (0.5716)	0.99729 2	0.99700 2	0.09490 8	0.05822 0	0.719357	3437.371
J&K	7.883892 (0.0000)	0.074713 (0.0000)*	(0.0541) -0.15703 (0.0173)	0.015221 (0.0075) *	0.99641 6	0.99603 2	0.07501 3	0.05176 0	0.869923	2594.730
Karnataka	7.450692 (0.0000)	0.107930 (0.0000)*	0.18369 4	-0.00094 (0.8914)	0.99652 8	0.99615 6	0.12501 7	0.06682 0	0.446753	2678.638
Kerala	7.564808 (0.0000)	0.101166 (0.0000) *	(0.0138) 0.07116 4	0.011175 (0.0909)	0.99711 0	0.99680 1	0.10980 5	0.06262 3	0.482622	3220.737
M.P.	7.341996 (0.0000)	0.105435 (0.0000)*	(0.2866) 0.40549 1	-0.02469 (0.0057) *	0.99229 3	0.99146 7	0.18308 6	0.08086 3	0.984083	1201.648
Maharashtr a	7.743941 (0.0000)	0.109730 (0.0000) *	(0.0000) 0.28923 0	-0.00699 (0.4018)	0.99486 2	0.99431 2	0.18210 3	0.08064 5	0.803056	1807.349
Manipur	7.465728 (0.0000)	0.103696 (0.0000)	(0.0019) 0.43884 2	-0.02628 (0.0002) *	0.99562 3	0.99515 4	0.09880 4	0.05940 3	0.865241	2122.912
Nagaland	7.841197 (0.0000)	0.123255 (0.0000) *	(0.0000) 0.73340 2	-0.04990 (0.0000) *	0.99575 6	0.99530 1	0.10430 4	0.06103 4	1.030139	2189.731
Odisha	7.333511 (0.0000)	0.091104 (0.0000) *	(0.0000) -0.16151 (0.0899)	0.016223 (0.0809)	0.99272 5	0.99194 6	0.21624 8	0.08788 1	0.948628	1273.618
Punjab	7.884427 (0.0000)	0.111543 (0.0000) *	0.41056 3	-0.02163 (0.0024) *	0.99610 4	0.99568 6	0.11318 4	0.06357 9	0.412038	2385.980
Rajasthan	7.145269 (0.0000)	0.110220 (0.0000) *	(0.0000) 0.43447 8	-0.01761 (0.1310)	0.98969 7	0.98859 3	0.34508 5	0.11101 6	1.037831	896.5342
Tamil N.	7.423909 (0.0000)	0.119164 (0.0000)*	(0.0002) 0.30564 0	-0.01102 (0.1737)	0.99566 7	0.99520 2	0.16790 0	0.07743 7	0.691371	2144.529
Tripura	7.489790 (0.0000)	0.093830 (0.0000)*	(0.0007) -0.27776 (0.0009)	0.020673 (0.0084) *	0.99545 6	0.99496 9	0.14331 5	0.07154 3	0.492502	2044.727
U.P.	7.204142 (0.0000)	0.101710 (0.0000)*	0.35109 0	-0.02030 (0.0091) *	0.99393 3	0.99328 3	0.14152 1	0.07109 4	0.369746	1528.953
W. B.	7.538310 (0.0000)	0.096828 (0.0000)*	(0.0001) -0.07692 (0.2028)	0.008603 (0.1457)	0.99699 3	0.99667 1	0.08903 1	0.05638 9	0.518543	3094.696

Note:

(i) Regression Equations have been estimated with the help of semi-log model with slope and intercept dummy variable technique which is shown by following equation;

$$ln(y) = \alpha + \beta t + \gamma D_1 + \theta(D_2 t) + U_i$$

(ii) Figures in the parenthesis are probability values.

(iii) * - denotes statistically significant at 1% level of significance.

(iv) ** - denotes statistically insignificant at 5% level of significance.

(v) D_1=0 – First Dummy variable for pre-economic reform (1981-91) period;

(vi) D_2=1 – Second Dummy variable for post-economic reform (1992-2012) period.

Table 12: Average Annual Growth in Per-Capita SDP Base 2004-05 (Current Prices).

States	Growth Rate (in percentage) during		Shift in per annum growth during Post –reform (1992-12) period
	Pre-economic reform era (1980-81&1990-91)	Post-economic reform era (1991-92 & 2011-12)	
A.P.	11.137	11.603	Upward Shift
Assam	10.847	8.398	Downward Shift
Bihar	10.462	9.110	Downward Shift
Gujarat	10.218	10.482	Upward Shift
Haryana	10.903	11.394	Upward Shift
H.P.	10.380	10.719	Upward Shift
J&K	7.471	8.993	Upward Shift
Karnataka	10.793	10.699	Downward Shift
Kerala	10.116	11.233	Upward Shift
M.P.	10.543	8.074	Downward Shift
Maharashtra	10.973	10.274	Downward Shift
Manipur	10.369	7.741	Downward Shift
Nagaland	12.325	7.335	Downward Shift
Odisha	9.110	10.732	Upward Shift
Punjab	11.154	8.991	Downward Shift
Rajasthan	11.022	9.261	Downward Shift
Tamil Nadu	11.916	10.814	Downward Shift
Tripura	9.383	11.450	Upward Shift
U.P.	10.171	8.141	Downward Shift
W.B.	9.682	10.492	Upward Shift

Note: Growth rates for Pre-Economic and Post-Economic Reform period have been calculated on the basis of coefficients of t and $D_2 t$ as shown in Table 11.

Table 13: Family of Inequality Indices related to SDP-Base 2004-05 (Current Prices).

Year	Inequality indices based on properties of Lorenz Curve				Inequality indices based on properties of Herfindahl Index		
	Gini	RMD	Theil	Kakwani	H_1	H_2	H_3
1981	0.4283	0.3192	0.1075	0.17	0.0790	0.0850	0.0321
1982	0.4217	0.3164	0.1038	0.1657	0.081	0.0852	0.0326
1983	0.419	0.3115	0.1033	0.1645	0.0792	0.0834	0.0308
1984	0.4194	0.3184	0.1031	0.165	0.0792	0.0834	0.0308
1985	0.4175	0.3106	0.1023	0.1641	0.0788	0.083	0.0304
1986	0.4177	0.3095	0.1028	0.1637	0.0783	0.0825	0.0298
1987	0.4173	0.3088	0.1024	0.1636	0.079	0.0831	0.0305
1988	0.426	0.3194	0.1057	0.1689	0.0787	0.0829	0.0302
1989	0.4218	0.3189	0.1038	0.1665	0.0799	0.0841	0.0315
1990	0.4301	0.3217	0.108	0.1713	0.0792	0.0833	0.0307
1991	0.4323	0.3294	0.1095	0.1738	0.0812	0.0854	0.0328
1992	0.4289	0.3236	0.108	0.1718	0.0815	0.0858	0.0331
1993	0.4385	0.3326	0.1124	0.1774	0.0808	0.085	0.0324
1994	0.443	0.3341	0.114	0.1793	0.0828	0.0871	0.0345
1995	0.4422	0.3361	0.1137	0.1797	0.0838	0.0882	0.0355
1996	0.4492	0.3414	0.1171	0.1839	0.083	0.0874	0.0348
1997	0.45	0.3431	0.1173	0.1848	0.0848	0.0893	0.0367
1998	0.4473	0.3422	0.1153	0.1826	0.0846	0.089	0.0364
1999	0.4415	0.3425	0.1122	0.1796	0.0838	0.0882	0.0356
2000	0.4424	0.3395	0.1129	0.1792	0.0819	0.0862	0.0336
2001	0.4379	0.3333	0.1103	0.1761	0.083	0.0874	0.0347
2002	0.4362	0.3326	0.1094	0.1749	0.0818	0.0861	0.0335
2003	0.4371	0.3352	0.1101	0.1752	0.0817	0.086	0.0333
2004	0.4382	0.3361	0.1107	0.1763	0.0823	0.0867	0.034
2005	0.4394	0.3385	0.1117	0.1773	0.0824	0.0867	0.0341
2006	0.4474	0.3481	0.1159	0.1831	0.0829	0.0872	0.0346
2007	0.4515	0.3502	0.1186	0.1863	0.0846	0.0891	0.0364
2008	0.4532	0.3524	0.1204	0.1885	0.0857	0.0902	0.0376
2009	0.4457	0.3438	0.1165	0.1839	0.0863	0.0909	0.0382
2010	0.4485	0.3444	0.1176	0.1853	0.0841	0.0886	0.0359
2011	0.4523	0.3508	0.1204	0.1883	0.0846	0.089	0.0364
2012	0.4519	0.3497	0.1208	0.1886	0.0859	0.0904	0.0378

Note: *Gini:* Gini coefficient, RMD: Relative Mean Deviation
Theil: Theil's Inequality Index
Kakwani: Kakwani Inequality Index
H_1, H_2 & H_3 are variants of Herfindahl's Inequality Index

Table 14: Family of Inequality Indices related to Per-Capita SDP-Base 2004-05Current Prices).

Year	Inequality indices based on properties of Lorenz Curve				Inequality indices based on properties of Herfindahl Index		
	Gini	RMD	Theil	Kakwani	H_1	H_2	H_3
1981	0.1405	0.1097	0.01046	0.01883	0.0529	0.0554	0.0031
1982	0.1442	0.1123	0.01104	0.01983	0.0531	0.0559	0.0032
1983	0.1481	0.1144	0.01153	0.02055	0.0533	0.0561	0.0034
1984	0.1387	0.1082	0.01031	0.01849	0.0535	0.0563	0.0037
1985	0.1455	0.108	0.01111	0.01985	0.0531	0.0559	0.0032
1986	0.1468	0.1103	0.01127	0.02009	0.0533	0.0561	0.0035
1987	0.1465	0.1108	0.01111	0.01987	0.0534	0.0562	0.0036
1988	0.1495	0.1074	0.01229	0.02171	0.0533	0.0561	0.0035
1989	0.15	0.1137	0.01196	0.02109	0.0538	0.0566	0.004
1990	0.1565	0.1184	0.01314	0.02319	0.0537	0.0565	0.0039
1991	0.1573	0.1199	0.01345	0.02368	0.054	0.0569	0.0042
1992	0.1613	0.125	0.01408	0.02481	0.0541	0.057	0.0044
1993	0.1771	0.1414	0.01661	0.02932	0.0543	0.0572	0.0045
1994	0.183	0.1407	0.01774	0.03114	0.0551	0.058	0.0053
1995	0.1888	0.1502	0.01863	0.033	0.0554	0.0584	0.0057
1996	0.189	0.1506	0.01921	0.03418	0.0556	0.0585	0.0059
1997	0.1881	0.1516	0.0186	0.03325	0.0556	0.0586	0.0059
1998	0.1826	0.1479	0.01786	0.03201	0.0555	0.0584	0.0058
1999	0.1727	0.1407	0.01637	0.02968	0.0552	0.0581	0.0055
2000	0.1686	0.1354	0.01577	0.02857	0.0546	0.0575	0.0049
2001	0.1821	0.1442	0.01767	0.03194	0.0544	0.0573	0.0047
2002	0.1863	0.1447	0.01875	0.03391	0.055	0.0579	0.0053
2003	0.1914	0.1508	0.01973	0.0357	0.0553	0.0582	0.0056
2004	0.1858	0.1453	0.01902	0.03445	0.0556	0.0585	0.0059
2005	0.1882	0.1495	0.01947	0.03529	0.0553	0.0582	0.0056
2006	0.1978	0.1605	0.02153	0.03896	0.0554	0.0584	0.0057
2007	0.2039	0.1662	0.02236	0.04032	0.056	0.059	0.0063
2008	0.2103	0.1725	0.0237	0.04266	0.0564	0.0593	0.0067
2009	0.207	0.1718	0.02293	0.04128	0.0568	0.0597	0.0071
2010	0.2156	0.1749	0.02443	0.04365	0.0566	0.0596	0.0069
2011	0.2193	0.1768	0.02509	0.04482	0.0571	0.0602	0.0075
2012	0.2167	0.1735	0.02493	0.04431	0.0574	0.0604	0.0078

Note: *Gini:* Gini coefficient, RMD: Relative Mean Deviation
Theil: Theil's Inequality Index
Kakwani: Kakwani Inequality Index
H_1, H_2 & H_3 are variants of Herfindahl's Inequality Index

REFERENCES

Adelman, I. and Morris C.T. (1973), "*Economic Growth and Social Equity in Developing Countries*", Stanford: Stanford University Press.

Agarwalla, A. and Pangotra, P. (2011), "*Regional Income Disparities in India and Test for Convergence 1980 to 2006*", W.P. No. 2011-01-04, IIMA- India.

Ahluwalia, M. (2002), "*State Level Performance under Economic Reforms in India"*, in Anne Krueger (eds.), Economic Policy Reform and the Indian Economy, Chicago: University of Chicago Press.

Ahluwalia, M.S. (1976), "*Inequality, Poverty and Development*", Journal of Development Economics Vol. 3(4), pp. 307-342.

Allison, P.D. (1978), "*Measure of Inequality*", American Sociological Review, 43, 865-880.

Alperovich, G. (1992), "*Economic Development and Population Concentration*", Economic Development and Cultural Change, Vol. 41, No. 1, pp. 63-74.

Anand, S. and R., Kanbur (1993), "*Inequality and development: A critique*", Journal of Development Economics 41, Jun, 19-43.

Banerjee, A., Lumsdaine, R., Stock, J., 1992. Recursive and sequential tests of the unit root and trend break hypothesis: Theory and international evidence. Journal of Business and Economic Statistics 10, 271–287.

Basmann, R.L. and Slottje, D.J. (1987), "*A New Index of Income Inequality – The B Measure*", Economic Letters, 4, 385-389.

Bradshaw M., Vartapetov K. (2003), "*A New Perspective on Regional Inequalities in Russia*", Eurasian Geography and Economics, 44, 403-429.

Brankle, M. (1983), "*A Note of Kuznets's U*", The Review of Economics and Statistics, pp. 135-139.

Braun, Denny (1988), "*Multiple measurements of U.S. Income Inequality*", The Review of Economics and Statistics 70(3), pp. 398-405.

Chattopadhyaya, R.N. and Pal, M.N. (1972), "*Some Comparative Studies on the Composition of Composite Regional Indices*", Indian Journal of Regional Sciences, 4(2).

Christiano, L., 1992. Searching for breaks in GNP. Journal of Business and Economic Statistics 10, 237–250.

Corrado, Gini (1912), Variability Mutabilita (Olonga).

Cowell, F.A. (1980), "*On the Structure of Additive Inequality Measures*", The Review of Economic Studies, 47, 521-532.

D.A. Dickey & W.A. Fuller (1979), "Distribution of the Estimators for Auto regressive Time Series with a Unit Root", Journal of the American Statistical Association, vol. 74, pp. 427-431.

D.A. Dickey & W.A. Fuller (1981), " Likelihood ratio statistics for autoregressive time series with a unit root", Econometrica, 49, 1057-1072.

Damodar, G. (1970), "*Use of Dummy Variable in Testing for Equality Between Sets of Coefficients in Two Linear Regressions*", American Statistician, Vol. 24, No. 1.

Damodar, G. (1995), Basic Econometrics, New York: McGraw Hill Inc.

Damodar, G. (1999), Essential of Econometrics, New York: McGraw Hill Inc.

Damodar, G. (2005), Basic Econometrics, New Delhi: Tata McGraw Hill Publishing Company Limited.

Das, S., Sinha G. and Mitra, T.K. (2010), "*Regional Convergence of Growth, Inequality and poverty in India: An Empirical Study*", Economic Modelling 27, pp. 1054-1060.

Datt, G. and Ravallion, M. (1993), "*Regional Disparities, Targeting and Poverty in India*", in Michael Lipton and J. Van Der Gaag (eds.) Including the Poor, World Bank: Washington, D.C.

Datt, G. and Ravallion, M. (1998), "*Why have Some Indian States Done Better than Others at Reducing Rural Poverty?*", Economica, Vol. 65.

Datta, G. and Ravallian, M. (2002), "*Why has Economic Growth been more Pro-poor in some states in India than others?*", Journal of Development Economics, 68.

Deaton, Angus (1989), "*Looking for Boy-Girl discrimination in household, expenditure data"*, World Bank Economic Review, Vol. 3(1), pp. 1-15.

Della, V., Philip A., and Noriyoshi, O. (1976), "*Distribution, the aggregate consumption function, and the level of economic development: Some cross-country Results*", Journal of Political Economy 84, pp. 1325-1334.

Dev, S.M. and Ravi, C. (2007), "*Poverty and Inequality: All India and States, 1983-2005"*, Economic and Political Weekly, 42(6), February 10.

Dreze, J. and Sen, A. (1995), "*India: Economic Development and Social Opportunity*", New Delhi: Oxford University Press.

Dreze, J. and Srinivasan, P.V. (1996), "*Poverty in India: Regional Estimates*", Discussion Paper No. 70, London School of Economics.

Economic Survey 2015-16, Ministry of Finance, Government of India, New Delhi.

Federov L. (2002), "*Regional Inequality and Regional Polarization in Russia, 1990-99*", World Development, 30, 443-456.

Finance Commission (1952): Report of the First Finance Commission (1952-57), Government of India, New Delhi (www.fincomindia.nic.in).

Finance Commission (1957): Report of the Second Finance Commission (1957-62), Government of India, New Delhi (www.fincomindia.nic.in).

Finance Commission (1961): Report of the Third Finance Commission (1962-66), Government of India, New Delhi (www.fincomindia.nic.in).

Finance Commission (1965): Report of the Fourth Finance Commission (1966-69), Government of India, New Delhi (www.fincomindia.nic.in).

Finance Commission (1969): Report of the Fifth Finance Commission (1969-74), Government of India, New Delhi (www.fincomindia.nic.in).

Finance Commission (1973): Report of the Sixth Finance Commission (1974-79), Government of India, New Delhi (www.fincomindia.nic.in).

Finance Commission (1978): Report of the Seventh Finance Commission (1979-84), Government of India, New Delhi (www.fincomindia.nic.in).

Finance Commission (1984): Report of the Eighth Finance Commission (1984-89), Government of India, New Delhi (www.fincomindia.nic.in).

Finance Commission (1990): Report of the Ninth Finance Commission (1989-95) (I[st] & II[nd] Report), Government of India, New Delhi (www.fincomindia.nic.in).

Finance Commission (1995): Report of the Tenth Finance Commission (1995-2000), Government of India, New Delhi (www.fincomindia.nic.in).

Finance Commission (2000): Report of the Eleventh Finance Commission (2000-2005), Government of India, New Delhi (www.fincomindia.nic.in).

Finance Commission (2004): Report of the Twelfth Finance Commission (2005-10), Government of India, New Delhi (www.fincomindia.nic.in).

Finance Commission (2009): Report of the Thirteenth Finance Commission (2010-15), Volume – I & Volume – II, Government of India, New Delhi (www.fincomindia.nic.in).

Finance Commission (2015): Report of the Fourteenth Finance Commission (2015-20), Volume – I & Volume – II, Government of India, New Delhi (www.fincomindia.nic.in).

Galbraith, J.K and Krytynskaia,L(2004), "*The Experience of rising Inequality in Russia and China during the Transition*", The European Journal of Comparative Economics, Vol.1, No.1, pp.87-106.

Gaur, A.K. (2002), "*Industrial Disparity Among Indian States: A Decompositon of Herfindahl Index*", Indian Journal of Regional Science, Vol. XXXIV, No. 2.

Gaur, A.K. (2004), "*Detection of Inter-State Kuznets Cycle through Neo-Classical and Neo-Keynesian paradigms: Indian Experience*", The Indian Journal of Economics, Vol. LXXXIV, No. 334.

Gaur, A.K. (2004), "*Detection of Inter-State Kuznets Cycle through Neo-Classical and Neo-Keynesian paradigms: Indian Experience*" Paper Presented at the International Conference on theme entitled, "*Third Annual Conference on Models and Methods in Economics*", Organised by Economics Research Unit (ERU), Indian Statistical Institute (ISI), Kolkata, during Jan. 15-17, 2004.

Gaur, A.K. (2010), "*Estimating Deprivation and Inequality in Human Well Being: A Case Study of Indian States*", Paper Presented at 31st General Conference of the International Association for Research in Income and Wealth (IARIW), St. Gallen, Switzerland, August 22-28, 2010.

Gaur, A.K. (2011), "*Inter- Regional Differences in Economic Growth: Evidence from Indian States*", Journal of Economics and Commerce, Vol. 2, No. 2.

Gaur, A.K. (2016), "*Concentration and Convergence in Economic Growth: A case Study of Indian States*" in Paswan, A. (eds.) Indian Democracy-Dimensions, Dilemmas and Inclusive Growth, New Delhi: Victorious Publishers.

Ghosh, M. (2008), "*Economic Reforms, Growth and Regional Divergence in India*", Margin: The Journal of Applied Economic Research, pp. 265-285.

Ghosh, M., Ghoshray, A. and Malki, I. (2013), "*Regional Divergence and Club Convergence in India*", Economic Modelling 30, pp. 733-742.

Hadd, l. and Kanbur, R. (1992), "*Is there an Intra household Kuznets Curve? Some evidence from the Philippines*", Public Finance, Supplement to Vol. 47, pp. 77-93.

Harriss, B. (1986), "*The Intra-Family Distribution of Hunger in South Asia*", in J. Dreze and A.K. Sen (Eds.), Hunger and Public Policy (Oxford university Press).

Herfindahl, O.C. (1950), "*Concentration in the Steel Industry*", Unpublished Ph.D. Dissertation, Columbia University.

Johnston, J. and Dinardo, J. (1997), Econometric Methods, The McGraw Hill Company Inc. New York.

Journal of the American Statistical Association 90, 268–281.

Kakwani, N. (1980b), Income Inequality and Poverty, Oxford University Press.

Kaldor, N. (1955,56). "*Alternative Theories of Distribution, Review of Economic Studies*", 23 (2), No. 61: 83-100.

Kaldor, N. (1960), Essays on Economic Stability and Growth, London: Duckworth.

Kalechi, M. (1954), Theory of economic dynamics, London: Allen and unwin.

Kalechi, M. (1971), Selected Essays on The Dynamics of The Capitalist Economy, 1933-70, Cambridge University Press.

Kislitsyna, O. (2003), "*Income Inequality in Russia during Transition: How can it be explained?*", Economics Education and Research Consortium Working Paper Series 03/08, ISSN 1561-2422.

Knight, J.B. (1976), "*Explaining income distribution in Less developed countries: A framework and an agenda*", Oxford Bulletin of Economics and Statistics 38, pp. 161-177.

Kuznets, S. (1955), "*Economic Growth and Income Inequality*", American Economic Review 45, 1-28.

Kuznets, S. (1963), "*Quantitative Aspects of the Economic growth of Nations: VIII. Distribution of Income by size*", Economic Development and Cultural Change ,Vol. XI, No. 2, Part II , pp. 1-80.

Lumsdaine, R.L., Papell, D.H., 1997. Multiple trends and the unit root hypothesis. The Review of Economics and Statistics, 79, 212–218.

Majumdar, R. (2004), "*Human Development in India : Regional Pattern and Policy Issues*" Munich Personal RePec Archive (MPRA) Paper No. 4821, (online at http://mpra.ub.uni-muenchen.de/4821).

Marie-Ange, V. (1998), "*Long-Run Growth Trends and Convergence Across Indian States*", OECD Technical Paper No. 131.

Mathur, A. (1983), "*Regional Development and Income Disparities in India: A Sectoral Analysis*", Economic Development and Cultural Change, 31 April.

Mathur, A. (1987), "*Why Growth rates Differ Within India- An Alternative Approach*", Journal of Development Studies 23(2).

Mathur, A. (1992), "*Regional Economic Change and Development Policy in India"*, Indian Journal of Applied Economics (12).

Mikheeva N. (1999), "*Differentiation of Social and Economic Situation in the Russian Regions and Problems of Regional Policy*", Economic Education and Research Consortium, Russian Economic Research Program, Working Paper 99/09.

Mishra, B. (2010), "*Changing Dimension of India's Growth Process: A State Level Analysis*", MPRA Paper No. 21848.

Mishra, B.S. (2007), "*Regional Growth Dynamics in India in the Post Economic Reform Period*," New York; Palgrave Macmillan.

Mittal, P. and Jyoti, D. (2015), "*An Inter-State Analysis of Regional Disparity Pattern in India*", International Journal of Management Research and Social Science, Vol. 2, Issue 4.

Mohapatra, A.C. (1978), "*An Alternative Model of Measuring Divergence-Convergence Hypothesis: A Study of Regional Per Capita Incomes in India"*, Indian Journal of Regional Science, 10(2).

Montan˜e´s, A., 1997. Level shifts, unit roots, and the misspecification of the breaking date. Economics Letters 54, 7–13.

Morgan, J. (1962), "*The Anatomy of Income Distribution*", The Review of Economics and Statistics.

Nair, K.R.G. (1973), "*A Note on the Inter-State Income Differentials in India, 1950-51 to1960-61*", Journal of Development Studies, 9th July.

Nair, K.R.G. (1982), Regional Experience in a Developing Economy, New Delhi: Wiley Eastern Ltd.

Nayyar, G. (2008), "Economic Growth and Regional Inequality in India", EPW, 43(6), pp. 58-76.

Osberg, L. (1984), "*Economic Inequality in the United States*", New York, M.E. Sharpe.

Oshima, H.T. (1962), "*The International comparison of size distribution of family income with special reference to Asia*", The Review of Economics and Statistics 44, pp. 439-445.

P.C.B. Phillips and P. Perron (1988), "Testing for a Unit Root in Time Series Regression", Biometrica, vol. 75, pp. 335-346.

Pasinetti, L. (1977), Lectures on the Theory of Production, London: Macmillan.

Pasinetti, L. (1981), Structural change and Economic Growth, Cambridge University Press.

Pasinetti, Luigi (1962), "*The rate of profit and income distribution in relation to the rate of economic growth*", Review of Economic Studies, 29: pp. 267-79.

Paukert, F. (1973), "*Income distribution at different levels of development: A survey of Evidence*", International Labour Review 108, pp. 97-125.

Perron, P., 1989. The Great Crash, the Oil Price Shock and the unit root hypothesis. Econometrica 57, 1361–1401.

Perron, P., 1990. Testing for a unit root in time series with a changing mean. Journal of Business and Economic Statistics 8, 153–162.

Perron, P., 1995. Further Evidence on Breaking Trend Functions in Macroeconomic Variables. Manuscript, Universite´ de Montreal, Canada.

Perron, P., 1995. Unit root test in ARMA models with data-dependent methods for the selection of the truncation lag.

Perron, P., Vogelsang, T., 1992. Nonstationarity and level shifts with an application to purchasing power parity. Journal of Business and Economic Statistics 10, 301–320.

Planning Commission (1951): Third Five Year Plan, New Delhi, (http://planningcommission.nic.in/).Planning Commission (1956): Second Five Year Plan, New Delhi, (http://planningcommission.nic.in/).

Planning Commission (1959): Fourth Five Year Plan, New Delhi, (http://planningcommission.nic.in/).

Planning Commission (1974), Fifth Five Year Plan, New Delhi, (http://planningcommission.nic.in/).

Planning Commission (1980), Sixth Five Year Plan, New Delhi, (http://planningcommission.nic.in/).

Planning Commission (1985): Seventh Five Year Plan, Volume - I, New Delhi, (http://planningcommission.nic.in/).

Planning Commission (1992): Eight Five Year Plan, Volume - I, New Delhi, (http://planningcommission.nic.in/).

Planning Commission (1997): Ninth Five Year Plan, Volume - I, New Delhi, (http://planningcommission.nic.in/).

Planning Commission (2002): Tenth Five Year Plan, Volume - I, New Delhi, (http://planningcommission.nic.in/).

Planning Commission (2006), "*An Approach to the 11th Five Year Plan – Towards Faster and More Inclusive Growth*", Government of India, June 14, 2006.

Planning Commission (2007): Eleventh Five Year Plan, Volume - I, New Delhi, (http://planningcommission.nic.in/).

Planning Commission (2012): Twelfth Five Year Plan, Volume - I, New Delhi, (http://planningcommission.nic.in/).

Planning Commission (2012): Twelfth Five Year Plan, Volume - I, New Delhi, (http://planningcommission.nic.in/).

Press Note on Poverty Estimates, 2011-12, Planning Commission, Government of India, July 2013.

Ramiah (2002), "*Understanding Regional Economic Growth in India*", CID Working Paper No. 88, Harvard University.

Rao, M.G., Ricshcand and Kalirajan, K.P. (1999), "*Convergence of Income Across Indian States: A Divergent View*", Economic and Political Weekly, March 27, April 2.

Rappoport, P., Reichlin, L., 1989. Segmented trends and non-stationary time series. The Economic Journal 99, 168–177.

Rasika P.C. (2011), "*Income Convergence and Regional Growth in India: Before and After the Economic liberalization*", South Asia Economic Journal 12 (2), pp. 239-269.

Ravindra, H.D. (2003), "*Regional Disparity in Economic and Human Development in India*", Economic and Political Weekly, September 27.

Reserve Bank of India (http://www.rbi.org.in)

Reynolds, M. and E. Smolensky (1977), Public Expenditures, Taxes, and the Distribution of Income, The United States, 1950, 1961, 1970, New York: Academic Press.

Robinson, Sherman (1976), "*A Note on the U Hypothesis relating income inequality and Economic development*", American Economic Review 66, pp. 437-440.

Rowan, C. and A.P. Thirwall (2013), "*Regional Disparities in Per Capita Income in India: Convergence or Divergence*," University of Kent, School of Economics Discussion Papers.

Sampath, R.K. (1977), "*Inter-State Inequalities in Income in India: 1951-1971*", Indian Journal of Regional Science, 9(1).

Sen, A. (1984), "*Family and Food: Sex Bias in poverty*", in A.K. Sen, (Eds.), Resources, Values and Development (Back Well), pp. 346-368.

Shatakshee, D. (2006), "*Decomposing Spatial Differences in Poverty in India*", in Ravi Kanbur, Anthony J. Venables and Guanghua Wan (Eds.) Spatial Disparities in Human Development, Tokyo: United Nations University Press (http://www.unu.edu).

Sheviakov A., Kiruta A. (2001), "*Economic Inequality, standards of living, and poverty of population in Russia*", Center for Socioeconomic Measurement, Russian Academy of Sciences and State Committee of the Russian Federation on Statistics.

Singh, A.K. (2012), "Regional Disparities in the Post Reform Period", Journal of Regional Development and Planning, Vol. 1 No. 1.

Slottje, D.J., Basmann, R.L. and Niewwiadomy, M. (1989), "*On the Empirical Relationship Between Several Well Known Inequality Measures*", Journal of Econometrics, 42, 49-66.

Solow R.M. (1970), Growth Theory: An Exposition, Oxford University Press.

Solow, R.M. (1956), "*A Contribution to The Theory of Economic Growth*", Quarterly Journal of Economics, pp. 65-94.

Solow, R.M. (1957), "*Technical Change and The Aggregate Production Function*", Review of Economics and Statistics, pp. 312-20.

Srivastava, D.K. and Aggarwal, P.K. (1979), "*Measuring Tax Revenue Centralization in Federal Fiscal Systems: A Case Study of India*", Public Finance, No. 3, pp. 414-433.

Steindl, J. (1952), Maturity and Stagnation in American Capitalism, Oxford, D\ Basil Blackwell.

Suits, D.B. (1957), "*Use of Dummy Variables in Regression Equations*", Journal of American Statistical Associations, 52.

Swan, T.W. (1960), "*Growth models of Golden ages and Production Functions*", in K.E. Berrill (eds.), Economic development with special reference to East Asia, Macmillan and St. Martin's Press, 1963.
Theil, H. (1967), Economics and Information Theory, Amsterdam, North-Holland.
Vogelsang, T., Perron, P., 1995. Additional Tests for a Unit Root Allowing for a Break in the Trend Function at an Unknown Time. Manuscript, Department of Economics, Ithaca, NY.
World Bank (2006), India-Inclusive Growth and Service Delivery: Building of India's Success, Washington : The World Bank.
www.Censusindia.gov.in
www.mospi.nic.in/mospi_New/upload/State_wise-SDP_2004-05_14 March12.pdf
Yasmin, E. and Bhat, F.A. (2015), "*Growth and Inter-State Disparity in India"*, International Journal of Interdisciplinary Research and innovation, Vol. 3, Issue 4, pp. 17-22.
Zivot, E., Andrews, D.W.K., 1992. Further evidence on the Great Crash, the oil-price shocks, and the unit-root hypothesis, Journal of Business and Economic Statistics 10, 251–270.