CHAPTER 3

RESEARCH METHODOLOGY OF THE STUDY

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Methodology has been adopted as per the problems and objectives concerned. This study is based on the secondary data which has been collected from different sources. The present study covers 17 major states of India and one union territory (Delhi). Delhi union territory has been included because it is the capital city of India and its per capita income is very high. The other 17 states include Andhra Pradesh, Assam, Bihar, Goa, Gujarat, Haryana, Himachal Pradesh, Karnataka, Kerala, Maharashtra, Madhya Pradesh, Orissa, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh and West Bengal. The newly formed states have been included as a part of their parent states such as Uttarakhand, Chhattisgarh, Jharkhand and Telangana. These States collectively account for more than 86 per cent of national income and 97 per cent of Country's population. The states of Special category (except than Assam, Himachal Pradesh & Uttarakhand) and union territories (except Delhi) have not been included because of their different economic structure as compared to other states of India. This study covered the time period from 1991-92 to 2016-17 to know the tendency of disparity in income and expenditure among the Indian states.

3.1 Splicing of NDP, NSDP and Per Capita NSDP

All the data is available on different base years, such as 1980-81, 1993-94, 1999-2000, 2004-05 and 2011-12. Therefore, for the consistency of the results the data has been converted in same base year 2011-12 prices by using simple splicing method. For this process, the data on new series is multiplied by

conversion factor which is calculated by the ratio of the common value of new and old series.

$$\text{Conversion Factor} = \frac{\sum_{i=1}^{j}(\text{Variable})\text{new}}{\sum_{i=1}^{j}(\text{Variable})\text{old}}$$

Where,

J = number of years common between new and old series of variable.

3.2 Trends and Patterns of NSDP and Per Capita NSDP

This section shows the trends and patterns of NSDP and per capita NSDP among the sectors and states respectively. Semi-log trend equation method has been used to measure the growth rate of per capita NSDP. To measure the sectoral composition of NSDP and its growth rate, percentage method and CAGR method have been used respectively.

3.2.1 Semi-log Trend Equation

$$ln\, Y_t = a + b_t$$

3.2.2 Compound Annual Growth Rate Method

CAGR (%) = [logest (Y_{t1}+Y_{t2}+Y_{t3}+……..Y_{tn})-1]*100

Where, Y= Variable under study

T=Time (1, 2, 3……..n) for each period

Further, rank analysis has been used to show the clearer picture of the relative position of states. Firstly in rank analysis, rank of all states is calculated for the period 1991-92 to 2016-17 and then the matrix of rank correlation is constructed in order to confirm that the ranks of states had not changed significantly over the time. Moreover, in order to check the consistency

between the rankings of the states, Kendall's coefficient of concordance is calculated.

3.2.3 Kendall's Coefficient of Concordance (W) defined as: -

$$W = \frac{12s}{m^2(k^3 - k)}$$

Where, $S = \sum_{i=1}^{k}(R_i - \bar{R})2$

m = total time period in which rank assigned to the states

k = number of objects

R_i= the rating rate j gives to subject i. For each subject i, let $R_i = \sum_{j=1}^{m} r_{ij}$.

$\bar{R}$ = mean of Ri

3.2.4 Index of Rank Concordance

Further to assess the inter-temporal mobility of the states in terms of ranking, on the basis of the income level, Index of rank concordance method is used which is proposed by Boyle and McCarthy (1997). This measurement is used to verify the results of Kendall's W Statistics. Actually, they advocated the two versions: -

(a) Multiannual Version (RC_t)

$$RC_t = \frac{Var[\sum_{t=0}^{\tau} R(Y_{it})]}{Var[(T+1)^* R(Y)_{i0}]}$$

Where, $R(Y)_{it}$ = Actual ranking of the i_{th} state's in per capita income in year t

$R(Y)_{i0}$ = Actual ranking of the i_{th} states' in the initial year 0 in terms of per capita income

(T+1) = Number of years for which data are used in calculating the index

(b) Binary Version (RC_{at})

$$RC_{at} = \frac{Var[R(Y)_{it} + R(Y)_{i0}]}{Var[2^{*}R(Y)_{i0}]}$$

3.3 Testing of Convergence Hypothesis

There are basically two types of convergence hypothesis. The first is σ-convergence and second is β-convergence. To check the presence of σ-convergence first of all CV of per capita NSDP is calculated at 2011-12 prices across the regions for each year.

$$\text{Coefficient of Variation} = \frac{\sigma}{\bar{X}} \times 100$$

Where, σ = standard deviation

$\bar{x}$ = Mean

Then a linear time trend is fitted over the series of CV for aggregate and for each sector separately.

$$CV = \alpha + \beta t$$

Secondly, β-convergence predicts a negative relationship between the initial per capita income and the growth rate of economies over the time. To check the presence of β-convergence first, the semi-log trend equation ($\boldsymbol{ln\, Y_t = a + b_t}$)for per capita NSDP is estimated of each region and after that the estimated value of b is regressed on Y_{1991}. The phenomena of β-convergence occur if the latter regression yields the negative value of coefficients for Y_{1991}. However, Y_{1991} is the weak indicator of the initial per capita income so an alternative

approach has been adopted i.e.; the average of first five years per capita NSDP has taken for initial condition.

3.4 Sector-wise Decomposition of Regional Disparity in India

In this section of the study, the regional disparity is measured among the states in terms of per capita income and development expenditure. In addition to this, contribution of each sector in total inequality has been also computed. To measure the disparity in development expenditure, coefficient of variation method has been used. Further, to measure the sectoral share in inequality, the methodology of structural divergence analysis is adopted as proposed by Kar and Sakthivel (2007).

3.4.1 Sectoral Inequality Measures

Let there be n states such that the aggregate output of each state is given by Xi, i = 1….n.

Let there be m sectors that contribute to each region's aggregate output Xi, such that the output of each sector in each region is given by Xij, i = 1…n, j = 1…m.

Then, $Xi = \sum_j Xij$……..(1)

Let $\overline{X}$ be the arithmetic mean of Xi and Xj be the arithmetic mean of Xij.

Pj is the ratio between the average output of the jth sector and the average output of the economy.

X Thus, $P_j = \frac{\overline{X_J}}{\bar{X}}$…….(2)

Let C(Xi) be the coefficient of variation of aggregate output and C(Xij) be the coefficient of variation of the jth sector's output, across regions. Here, $r_{ij,I}$ denotes the coefficient of correlation between the jth sector's output and the aggregate output, across regions.

Then, the percentage decomposition of total inequality is -

$$\sum_j \left(Pj\ rij, i \times \frac{(C(xij))}{(C(xi))} \right) = 1 \ldots\ldots\ldots\ldots\ldots\ldots (3)$$

Rearranging equation (3) we can write

$$C\ (Xi) = \sum (C\ (Xij) \times Pj \times rij,\ i)$$

Equation 3 indicates that the aggregate inequality in an economy (measured by the coefficient of variation of aggregate output across regions) can be decomposed to give each sector's contribution.

Furthermore, the contribution of each sector to total inequality is equal to the product of (a) the inequality within the sector (measured by the coefficient of variation of the particular sector's output across regions), (b) the relative size of the sector (measured by the average output of the sector as a proportion of the average output of the economy), and (c) the strength of the linkages between the sector and the economy (measured by the correlation coefficient between the sector's output across regions and the aggregate output across regions). This means that the inequality for the aggregate economy is affected not only by the sectoral inequalities but also by the relative size of the sectors and their inter-linkage with the economy. The size of the sectors adds a scale effect to the sectoral inequality, i.e. a larger sector adds more to the economy's inequality compared to a smaller sector. The inter-linkage of a sector with the whole economy is represented by the correlation coefficient between the two - also has an important role. This is because a high correlation between any sector and the economy implies that a region which has a relatively higher share of that sector also has a relatively higher aggregate output and vice versa. Thus for a given level of inequality in the sectors, an increase in the inter linkage increase the economy's inequality.

3.5 Data Source of the Study

The study is mainly based on the secondary data which has been collected from different sources such as MOSPI (Ministry of Statistics and Programme Implementation), GOI (Government of India), RBI (Reserve Bank of India), Economic and Political Weekly Research Foundation (EPWRF) and also used http://statisticstimes.com/economy/economy-statistics.php. The lack of data availability of NSDP West Bengal from 2012-13 onwards at 2011-12 constant prices has been calculated by using the interpolation and extrapolation method in STATA 21 software.

3.6 Variables Used in the Study

To fulfill the objectives of the study, various variables have been used such as NDP, NSDP, and PCNSDP at constant prices 2011-12. The data of above variables is categorized by industry of origin. Furthermore, Development expenditure has been used to know the disparity in expenditure among the states which is classified into two categories: Expenditure on economic services and social services. Moreover, population data is also used to make the data in per capita terms at sectoral level.