# CHAPTER 3

RESEARCH METHODOLOGY

### 3.1 Introduction

The design of any research work requires considerable attention to the research methods and the proposed data analysis techniques. This chapter of the study discusses in detail the research methodology and methods that has been adopted for this study. The method that has been adopted in this research was so carefully designed as to go well with the area of inquiry. The researcher discusses the theoretical frame work related to public expenditure, source of data, construction of variable and methods to analyse the data with appropriate model.

### 3.2 Methodology

The main objective of this study is to investigate the dynamic relationship between expenditure on educational and economic growth in Odisha using the annual data over a time period from 1990-91 to 2014-15. The two important variables of this study are government expenditure on education and economic growth. The GSDP (Gross State Domestic Product) is used as the proxy for economic growth in Odisha and the study takes economic growth by using the constant value of GSDP (Gross State Domestic Product) measured in Indian rupee.

This study aims to examine the association in long run and the causal relationship between the respective variable; Educational expenditure and Economic growth. The methodology adopted in this study is the cointegration and Vector Auto Regressive technique. The whole estimation procedure consists of three steps: unit root test, cointegration test, Granger Causality test in a VAR model framework, and the VECM model estimation.

#### 3.2.1 Research Hypothesis

- H0: there exists no long run relationship between GDP and EDU in Odisha.

  H1: there exists long run relationship between GDP and EDU in Odisha.

### 3.2.2 Data Variable and Data Sources

The two main variables considered in this study are economic growth, which is represented by real GSDP (Gross State Domestic Product) of Odisha and EDU (Total expenditure on education) of Government.

Information on both Elementary Educational expenditure and State domestic product has been collected over a period of 15 years i.e. from 1990-91 to 2014-15 for Odisha.

Beside this information on expenditure on elementary education and Gross District Domestic Product(GDDP) of all 30 districts has been collected over a time period of 14 year i.e. from 2002-03 to 2015-16. And information on different educational infrastructure is also collected for a time period from 2005-06 to 2015-16.

All required data for the time period are obtained from the respective sources like educational expenditure is collected from *Handbook of Statistics on state govt. finance, published by Reserve Bank of India* and *Odisha Primary Education Programme Authority(OPEPA).* GSDP is taken from *Odisha Economic Survey 2014-15 published by Directorate of Economic and Statistics, Bhubaneswar*. Infrastructure related data and other educational parameter are being collected from *District Information System for Education (DISE).*

### 3.2.3 Econometric Model Specification

The growth model for the study takes the form**: GSDP=f (EDU)** ……(1)

Where GSDP is Gross State Domestic Product and EDU is expenditure on education respectively. GSDP is used as explained and expenditure on education EDU as the only explanatory variable.

The association between growth (measured in GSDP) and expenditure on education (EDU) in Odisha can be evaluate using the following model in linear form:

**ln GSDP t = α + β ln EDUt + ε t** …… (1.1)

Where,

α and β > 0

GSDP t and EDU t show the Gross State Domestic Product and educational expenditure of government at a particular time. while εt stands for the "noise" or error term; α and β represent the slope and coefficient of regression. β indicates how a unit change in the independent variable (educational expenditure) can affects the dependent variable (gross district domestic product). To cater other things that may influence GSDP the error εt is incorporated in the equation.

### 3.2.4 Unit Root Test

In time series data, a number of statistical issues can control the estimation of parameters. The situation of spurious regression can also be found between two unrelated variables i.e. high R square in Ordinary Least Squares (OLS) estimation because of the non-stationarity of series.

A series is said to be stationary if the joint probability of the same doesn't change over the time i.e. mean and variance remain constant over time or mean and variance are time-invariant. simply implies that the mean [(E(Yt)] and the variance [Var(Yt)] of Y remain constant over time for all t. In other word,

**F(Yt) = F(Yt + k)**

Where, F is joint probability

Y is say, for an example GDP here

t is the time period

and k is the change in time period.

To test the stationary of series, the most often used test is Augmented Dickey Fuller (ADF) Test. The following equation in this study checks for the unit root of time series data used in the model:

$$\Delta y = \beta_1 + \beta_1 t + \delta y_{t-1} + \sum \alpha \Delta y_{t-1} + \varepsilon_t \quad \text{..... (2)}$$

Where,

εt is white noise error term in the model of stationarity test, with null hypothesis that variable has unit root.

The null hypothesis and alternative hypothesis for the existence of unit root in variable yt is Ho: $\delta = 0$ versus H1: $\delta < 0$. Rejection of the null hypothesis denotes stationarity in the variables.

Once the stationarity of series is assured, the further process before applying Johansen's (1988) co-integration test is to identify the maximum number of lags that can be used in estimation process.

### 3.2.5 Testing for Co-integration (Johansen approach)

The motive behind Cointegration test is, knowing the order of integration is crucial for building up any econometric model and to draw inferences. And to check for some theories which suggest that certain variables should be cointegrated showing long-run relationship. This test may be regarded as a long run equilibrium relationship among the variables.

The purpose is to determine in a bivariate framework whether or not expenditure on education (EDU) and (GSDP) variables have association in long-run. Engle and Granger (1987) introduced the concept of cointegration, where economic variables might reach a long-run equilibrium that reflects a stable relationship among them.

The approach which is used in this study to test for cointegration is called the Johansen cointegration approach. The Johansen approach can determine the number of cointegrated vectors for any given number of non-stationary variables of the same order.

### 3.2.6 The Granger Causality Test

Testing of causality among variables is one of the most crucial and yet one of the difficult issue in economics. The basic idea of Granger causality test can be; if the prediction of one-time series is improved by incorporating the knowledge of second time series then, the later said to have a causal influence on the first. Historically, Granger (1969) and Sim (1972) were the ones who formalized the application of causality in economics.

The null hypothesis (H0) is what we test in this case, that the X variable does not Granger cause variable Y and variable Y does not Granger cause variable X.

In summary, one variable (Xt) is said to granger cause another variable (Yt) if the lagged values of Xt can predict Yt and vice-versa.

The Granger method involves the estimation of the following equations:

If causation runs from EDU to GSDP,

$$ln\ GSDP_t = \Sigma\ \alpha_i\ lnGSDP\ t_{-i} + \beta_j\ lnEDU_{t-j} + \lambda_1 t + u_{1t} \quad \text{..... (3)}$$

If causation runs from GSDP to EDU, it takes the form:

$$ln\ EDUEXP_t = \Sigma\ \gamma_i\ lnEDUt_{-i} + \delta_j\ lnGSDP\ _{t-j} + \lambda_2 t + u_{2t} \quad \text{.....(3.1)}$$

### 3.2.7 VECM and Short-Term Causality Test

Error correction mechanism was first introduced by Sargan (1984), later adopted, and modified by Engle and Granger (1987). The foremost advantage of VECM is that it has noble interpretation with long-term and short-term equations. Error correction mechanism examines

the short-run behaviour of an economic variable with its long-run behaviour. A vector error correction model is a restricted VAR that has cointegration restrictions built in to the specification. So, it is designed for use with non-stationarity series that are known to be cointegrated. The VEC specification restricts the long-run behaviour of the endogenous variables to converge to their cointegrating relationship. The cointegration term is known as the error correction term which shows the speed of divergence or convergence towards the equilibrium in long-run and the deviation from long-run equilibrium is corrected gradually through a series of partial short-run adjustments. In case if there exist no cointegration between variables, only short run causality would be tested with the help of VAR model.