CHAPTER 3

Methodology

3.1 Introduction

Research methodology in Economics means using the scientific method to investigate and analyse economic phenomena. An appropriate research methodology starts with a problem, question or hypothesis and then constructs an argument. After stating with hypotheses, we then decide on a method of data collection and analysis. We often use complex mathematical equations, descriptive and inferential statistics to study our questions and hypothesis.

3.2 Data Collection

Our study ‘India’s Trade with European Union in the Post-Reform Period: Problems and Prospects’ has been conducted on the basis of secondary data collected for the year 1991-92 and onwards. For this study, we have collected the data from various sources viz. Indian Council of Social Science Research, New Delhi; Indian Institute of Foreign Trade, New Delhi; Indian Institute of Economic Growth, New Delhi; Foreign Trade and Balance of Payments published by Centre for Monitoring Indian Economy; The Economic Survey, Govt. of India; Ministry of Commerce, New Delhi; Monthly Statistics of Foreign Trade; Related Books, Magazines, Periodicals, News Reports etc.; Websites on the Internet and Some Other Agencies.

We have personally collected data from the documents of these sources. Relevant books, news reports, magazines, periodicals etc. have been consulted. For collecting the data of exchange rate (annual average) of the Indian Rupee
vis-à-vis US Dollar, we consulted Handbook of Statistics on Indian Economy (2007-08). The data of exchange rate were required to make difference between growth rates in dollar and in rupee terms.

In our country foreign trade statistics is reported by Directorate General of Commercial Intelligence and Statistics (DGCI&S) and Reserve Bank of India. DGCI&S publishes commodity-wise foreign trade data while RBI publishes only total exports and imports. Data from these two sources always differs. The major differences are noticed in import statistics. DGCI&S data is custom based data while RBI data is on payment basis.

For analysing the data collected we have divided the period (1991-92 to 2006-07) into sub-periods i.e. pre-WTO (1991-92 to 1995-96) and post-WTO (1995-96 to 2006-07). Having observed the extreme fluctuations prevailed during 2000-01 and 2001-02, we have further classified the data into three sub-periods viz. (1991-92 to 1995-96), (1995-96 to 2001-02) and (2001-02 to 2006-07) for analysing India’s terms of trade with EU. We have considered the data series in terms of rupees and US dollar.

3.3 Analysis

After collecting the data, we start to analyse the data. In order to make our analysis more clear and comprehensive, we sub-divide this part into descriptive analysis and inferential analysis.

3.3.1 Descriptive Analysis

Descriptive analysis is basically related to the main features of a collection of data. Descriptive statistics are distinguished from inferential statistics (or inductive statistics), in that descriptive statistics aim to summarize a data set, rather than use the data to learn about the population that the data are thought to represent. This generally means that descriptive statistics, unlike inferential statistics, are not developed on the basis of probability theory. Even
when a data analysis draws its main conclusions using inferential statistics, descriptive statistics are generally also presented.

Tables are used to make the data easily understandable. We prepare different columns or separate tables for absolute figures of total exports/imports, composition of India’s exports/imports to/from EU, direction of India’s exports/sources of India’s imports, destination of India’s exports to EU/India’s imports from EU members in rupee terms as well as in dollar terms. Share of EU exports/imports in total exports/imports (%), ratio of EU exports/imports to GNP (%) are also prepared in separate columns of tables. Full flagged tables are prepared for composition of India’s exports/imports to/from EU in percentage terms, for direction/sources of India’s exports/imports to/from EU in percent and for India’s exports/imports to/from EU members in percentage figures.

For examining the trends in exports and imports to/from EU, statistical tools like simple average, coefficient of variation, Karl Pearson correlation coefficient, simple and compound growth rate, summary statistics for every table has been prepared. In this summary, we divide the study period into two or three sub-periods. Some of the above statistics are computed as:

### a) Arithmetic Mean

It is also known as simple average computed as;

\[
\text{Arithmetic Mean} = \frac{\sum X_i}{n}
\]

Where:

- \(X\) - values of observation,
- \(n\) - number of observations,
- \(i\) - 1, 2, 3, \ldots, n.
b) Karl Pearson Correlation Coefficient

Simple correlation coefficient was developed by Karl Pearson. Hence, it is also known as Karl Pearson correlation coefficient. We compute the correlation coefficient as;

\[
r_{xm} = \frac{\text{Covariance between } x \text{ & } m}{(\text{Standard Deviation of } x) \times (\text{Standard Deviation of } m)}
\]

Or

\[
r_{xm} = \frac{\frac{1}{n} \sum (X - \bar{X}) (M - \bar{M})}{\sqrt{\frac{1}{n} \sum (X - \bar{X})^2} \times \sqrt{\frac{1}{n} \sum (M - \bar{M})^2}}
\]

Where;

- \( r_{xm} \) - correlation coefficient between exports & imports,
- \( X \) - exports,
- \( M \) - imports,
- \( n \) - number of observations

c) Simple Growth Rate

In order to quick examination of percentage change of exports/imports over previous year, we construct figures. This percentage change is also known as simple growth rate for a year. Symbolically;

\[
\text{Simple Growth Rate} = \frac{\text{Change in exports or imports } Y_1 \text{ to } Y_2}{\text{exports or imports in } Y_1} \times 100
\]

Where;

- \( Y_1 \) - previous year,
- \( Y_2 \) - present year.
d) Exponential Growth Rate

We determine exponential growth rate by using following equation;

\[ X_t = Ae^{gt}u_t \]  \hspace{1cm} (1)

Where;

- \( X \) - exports,
- \( A \) - constant,
- \( g \) - growth rate to be estimated,
- \( t \) - time.

In log form equation (1) is written as;

\[ \ln X_t = \ln A + gt + \ln u_t \]  \hspace{1cm} (2)

We estimate equation (2) using ordinary least squares.

Likewise exponential growth rate for our imports will be estimated as

\[ M_t = Ae^{gt}u_t \]  \hspace{1cm} (3)

Where;

- \( M \) - imports,
- \( A \) - constant,
- \( g \) - growth rate to be estimated,
- \( t \) - time.

In log form equation (3) is written as;

\[ \ln M_t = \ln A + gt + \ln u_t \]  \hspace{1cm} (4)

We estimate equation (4) using ordinary least squares.
3.3.2 Quantitative Analysis

In this head we discuss different statistical tools for quantitative analysis viz. regression technique, coefficient of variation (CV), Fisher’s Ideal Price Index and Terms of trade (TOT).

a) Regression Technique

Various econometric methods can be used to derive estimates of the parameters of economic relationships from statistical observations. We use ordinary least square (OLS) for regression analysis because; simple and fair computation, widely used with fairly and satisfactory results, the mechanics of least squares are simple to understand.

The linear regression model is based on certain assumptions, some of which are as;

1. The error term \( u_i \) is a random real variable whose value may be positive, negative or zero.
2. The mean value of ‘u’ in any particular period is zero.
3. The variance of \( u_i \) is constant in each period.
4. The variable \( u_i \) has a normal distribution.
5. The random terms of different observation (\( u_i, u_j \)) are independent.
6. The ‘u’ is not correlated with the explanatory (independent) variable(s).
7. The explanatory variable(s) are measured without error.
8. The explanatory variables are not perfectly linearly correlated.
9. The macrovariables should be correctly aggregated.
10. The relationship is correctly specified.
After assuming above assumptions we try to examine the impact of the imports of capital goods from EU on the India’s exports of manufactured goods. Here we specify a simple model in the log-form as:

\[ \ln X_t = \alpha + \beta M_t + u_t \]

Where;

- \( \ln \) - natural log,
- \( X \) - exports,
- \( M \) - imports,
- \( u \) - the error term,
- \( t \) - the time,
- \( \alpha \) & \( \beta \) - parameters to be estimated.

We can split the true relation into two parts: a part represented by the line and a part represented by the random term ‘\( u \)’.

\[ \text{[Variation in } X_t \text{]} = \text{[Systematic Variation]} + \text{[Random Variation]} \quad \text{or} \quad \text{[Explained Variation]} + \text{[Unexplained Variation]} \]

Our ordinary least square (OLS) has various weaknesses because of unrealistic assumptions.

- It is not true that variance of \( u_i \) is constant in each period.
- In real world the random terms of different observations are not independent.
- The ‘\( u \)’ is not independent of the explanatory variable(s).
b) Coefficient of Variation (CV)

Coefficient of Variation is a measure of relative dispersion which is the ratio of absolute dispersion to arithmetic mean in percentage terms. We require CV for the comparison of consistency of the observations of two different series.

\[
CV = \frac{\text{Standard Deviation}}{\text{Mean}} \times 100
\]

Where;

\[
\text{Standard Deviation} = \sqrt{\frac{1}{n-1} \sum (X - \bar{X})^2}
\]

\[
\bar{X} \quad \text{sample mean},
\]

\[
n \quad \text{sample size}.
\]

c) Fisher’s Ideal Index

Fisher’s Ideal Index Number has an important role in price index numbers. It was developed by Prof. Irving Fisher after an intensive study of 134 different formulae for construction of index numbers.

The fisher’s Index Number is considered as ‘ideal index’ it uses variable weights, is based on geometric mean and satisfies time reversal as well as factor reversal tests.

We use following formula to compute this index number;

\[
FII = \sqrt{\frac{\sum P_1 Q_0}{\sum P_0 Q_0}} \times \frac{\sum P_1 Q_1}{\sum P_0 Q_1} \times 100
\]

Where;

\[
FII \quad \text{Fisher’s Ideal Index Number},
\]

\[
P_1 \quad \text{price in the current year},
\]
\[ P_0 \] - price in the base year,
\[ Q_1 \] - quantity in the current year,
\[ Q_0 \] - quantity in the base year.

d) Terms of Trade

Terms of trade is the ratio of a commodity’s export price index to its import price index, multiplied by 100. We use Fisher’s Ideal Price Index for computing terms of trade.

\[
Terms of Trade = \frac{\text{export price index}}{\text{import price index}} \times 100
\]

For computing India’s terms of trade with EU, we have taken following ten Commodities viz. cashew, cotton raw including waste, iron & steel, oil meals, pulses, rice, spices, sugar, tea and wheat. The reason behind the collection of a few above items is that the data related to quantity and volume of exports and imports are available for the said commodities only.