CHAPTER 3
RESEARCH METHODOLOGY

3 Research Methodology

The present chapter broadly deals with methodologies used in the study to discuss the process requirement to find answers of research questions stated in the study.

The present chapter focused on the system of Indian Trade classification - Harmonized system (ITC-HS code), different level of aggregation at 4digit and 2digit HS classification level. To calculate simple and trade-weighted average IIT index is used by using the formula to calculate Grubel-Lloyd index for measuring the degree of IIT. The usage of panel data techniques and major sources of data and in the last limitations of the study been also discussed. All these points been mentioned below:

3.1 Sampling Technique (ITC-HS classification)

The present study used secondary data only. The study uses Indian Trade classification - Harmonized system (ITC-HS code). As per this classification, all the products are divided into 21 sections and each section further divided into different chapters at 2 digit and different sub-headings at 4 digit and 6 digit HS classification level. There are total 98 chapters and each chapter is divided into 2/4/6/8 digit classification level. For example: at 2 digit, chapter 85 belongs to an Electrical Machinery and Equipment and Parts thereof; at four digit the chapter is divided into 48 sub-headings like 8501, 8502…..8548; at 6 digit the category 8501 is divided into 13 sub-headings category like 850110 and so on; while 8 digit describes the specific products. This way each product at 8digit has allotted under different category at chapter level.

All the data have been collected at 4 digit HS classification level with exports and imports trade value for 12 years from 2005 to 2016. Out of 98 chapters, study used 7 top traded sectors between ASEAN members and India. The chapters at 2 digit levels are identified as 27, 29, 71, 72, 84, 85, and 87. At 4digit these identified sectors are averaged at 2digit for reporting purpose.

Difference between 4digit and 6digit HS Classification Level

In the international trade studies, the level of aggregation is important to describe in the objective of the study and rationale of using 4 or 6digit HS level. There are studies which have considered lowest level of disaggregation at 2digit or some studies take 8digit disaggregation. The industry is concerned at 4digit or 6digit level normally. The level of disaggregation affects the degree of

IIT; therefore the present study uses 4digit level of disaggregation to understand an industry rather at least aggregated level of 2digit. Therefore, 4digit level summation will give 2digit chapters at broader sense. The study average all the IIT values of 4 digit into 2 digit for reporting purpose.

The data at 4digit HS level collected from World Integrated Trade Solution (WITS) database for a period of 2005 – 2016, i.e. pre agreement as 6 years before agreement signed in 2010 and 6 years after signing AIFTA.

3.2 Measuring Grubel-Lloyd Index

The Grubel Lloyd (GL) index of intra-industry trade is a useful indicator of how much trade is of the Krugman type (two way trade of differentiated varieties). The models which are widely used for measuring IIT index is Herbert Grubel and Peter Lloyd (1975) who provided the definitive empirical study on the importance of intra-industry trade and how to measure it. Research on two-way trade in similar products in the 1960s and the 1970s was mainly focused on the empirical estimation of the phenomenon of intra-industry trade. Thus Grubel and Lloyd (1975) empirically confirmed that intra-industry trade is a real phenomenon and that the levels of intra-industry trade grow faster within the trade between developed countries which are members of custom unions or other regional trading arrangements, than in the trade of the developed countries with other countries. The most widely used method for computing the IIT among these is developed by Grubel and Lloyd (1971).

The most often used method for determining the extent of intra-industry trade was proposed by Grubel and Lloyd (1975). This measure, now known as the Grubel–Lloyd index, is simple to calculate and intuitively appealing. Once a country's export and import value for a particular sector and period are known, it is calculated as:

Intra-industry trade flows are conventionally defined as the two-way exchange of goods within standard industrial classifications. The extent of intra-industry trade is commonly measured by Grubel-Lloyd indexes based on commodity group transactions. Thus, for any particular product class i, an index of the extent of intra-industry trade in the product class i between countries A and B is given by the following ratio:

$$IIT_{\mathrm{i,AB}} = \left[\frac{\{(X_i+M_i)-(X_i-M_i)\}}{X_i+M_i}\right] * 100 \qquad (1)$$

Where, $IIT_{i,AB}$ is the Intra-Industry Trade of commodity classification '*i*' in between the two countries or trading partners *A* and *B*, X_i is the exports of commodity classification '*i*' from country *A* to country *B* and M_i is the imports of commodity classification '*i*' from country *A* to country *B*. This index takes the minimum value of zero when there are no products in the same class that are both imported and exported, and the maximum value of 100 when all trade is intra-industry (in this case Xi is equal to Mi)

However, beside aggregation bias, the traditional G-L index has two problems often cited in the empirical literature. First, the unadjusted G-L index is negatively correlated with a large overall trade imbalance. With national trade balances, the level of IIT in a country will be clearly underestimated. To avoid this problem, Grubel and Lloyd (1975) proposed another method to adjust the index by using the relative size of exports and imports of a particular good within an industry as weights. The second problem of the unadjusted G-L index is that it does not distinguish vertical IIT from horizontal IIT in data although theory suggests determinants of IIT for both types are quite different.

The present study used simple IIT index and trade-weighted average IIT index for understanding the volume and relative share of export and imports of particular good within a chapter.

3.3 Panel Data Analysis

In panel data or longitudinal data, the same cross sectional unit is surveyed over time. Therefore, observations in panel data involve at least two dimensions; a cross-sectional dimension, indicated by subscript *i*, and a time series dimension, indicated by subscript *t*. In short, panel data have space as well as time dimensions, for example data regarding GDP, per capita income and population of different countries (cross section data) arranged chronologically for several years (time series). The advantage of using panel data is that it gives holistic view about the nature, pattern, and determinants of the data under consideration.

Panel data, by blending the inter-individual differences and intra-individual dynamics have several advantages over cross-sectional or time-series data:

- More accurate inference of model parameters. Panel data usually contain more degrees of freedom and more sample variability than cross-sectional data which may be viewed as a panel with T = 1, or time series data which is a panel with N = 1, hence improving the efficiency of econometric estimates (e.g. Hsiao et al., 1995).

- Greater capacity for capturing the complexity of human behavior than a single cross-section or time series data.
- Controlling the impact of omitted variables.
- Simplifying computation and statistical inference. Panel data involve at least two dimensions, a cross-sectional dimension and a time series dimension. Under normal circumstances one would expect that the computation of panel data estimator or inference would be more complicated than cross-sectional or time series data. However, in certain cases, the availability of panel data actually simplifies computation and inference.

There are some disadvantages also:

- The challenge of panel methodology is to control the impact of unobserved heterogeneity also known as Heterogeneity bias – when important factors peculiar to a given individual are left out.

The present study considers panel data analysis for 12 years in order to find out IIT determinants which possibly describe the relation of IIT with independent variables.

The present study used Regression analysis by using Ordinary Least Square (OLS) method for examining the impact of AIFTA in promoting IIT index for 12 years**.** Regression analysis is a statistical process for estimating the relationships among variables. It includes many techniques for modeling and analyzing several variables, when the focus is on the relationship between a dependent variable and one or more independent variables. More specifically, regression analysis helps to understand how the value of the dependent variable (or 'criterion variable') changes when any one of the independent variables is varied, while the other independent variables are held fixed.

In linear regression, the model specification is that the dependent variable, y_i is a linear combination of the parameters (but need not be linear in the *independent variables*). For example, in simple linear regression for modeling n data points there is one independent variable: xi and two parameters, beta 0 and beta 1:

$$Y = \beta 0 + \beta i xi + \varepsilon i \qquad i = 1,\ldots\ldots, n \qquad \ldots (2)$$

The 12 years represents good time period before the AIFTA agreement signed in 2005 - 2010 and after the AIFTA agreement from 2011- 2016. The studies by Veeramani and Varma mainly focused on the agriculture IIT and selected papers of Veeramani consider manufacturing sectors

in Asia. The current study understands the trade quantum, share and pattern at 2 and 4 digit level HS classification of ASEAN7 member countries IIT with India.

To examine the possible determinants of IIT between ASEAN7 and India, we estimate the following formula:

$$IIT_{ijt} = \beta_0 + \beta_1 \ln DGDP_{ijt} + \beta_2 \ln DPCGDP_{ijt} + \beta_3 \ln TO_{ijt} + \beta_4 \ln FDI_{ijt} + \beta_5 \ln Dist_{ij} + \beta_6 AIFTA + \varepsilon_{ijt} \quad (2)$$

$IIT_{ijt} = Intra - industry\ trade\ between\ country\ i\ and\ j\ at\ specific\ time\ period$

$\ln DGDP_{ijt} = \log of\ Differences\ in\ GDP\ between\ country\ i\ and\ j\ at\ specific\ time\ period$

$\ln DPCGDP_{ijt}$

$= \log of\ difference\ in\ per\ capita\ between\ country\ i\ and\ j\ at\ a\ specific\ time\ period$

$\ln TO_{ijt} = \log of\ trade\ openness\ is\ a\ share\ of\ merchandise\ trade\ in\ GDP$

$\ln FDI$

$= \log of\ Foregin\ direct\ investment\ net\ inflows\ between\ country\ i\ and\ j\ at\ a\ specific\ time\ period$

$\ln Dist_{ij} = \log of\ distance\ between\ traidn\ partners$

$AIFTA = dummy\ variable\ of\ AIFTA\ as\ 0\ and\ 1, pre - agreement\ as\ 0\ and\ post\ agreement\ as\ 1$

Firstly the value of IIT has been tabulated for entire 4 digit and then averaged at 2 digit HS classification for reporting purpose by using G-L index for 12 years. Then the simple linear regression analysis is used to see the significance of the impact of AIFTA on IIT index.

Apart from Regression analysis, the present study uses Tobit model due to the nature of dependent variable as IIT who takes the value of 0 and 1. There are various studies which suggest the usage of Tobit model to remove inconsistency in the estimates because regression results could be inconsistent, if dependent variable is between 0 and 1. Therefore, the present study represents regression results of OLS and Tobit in one table but estimated results are approximately same with no much difference.

3.4 Software used for Regression and Tobit Regression Analysis

The present study uses STATA software version 2014 for Regression and Tobit estimation.

3.5 Major Sources of Data

The study assembled the relevant data from various sources. The specific data sources used in the present study are:

- Publications of Directorate general of commercial intelligence and statistics (DGCI&S) which provide disaggregated data on India's foreign trade.
- Reserve bank of India provides data of important open macroeconomic variables.
- UNCOMTRADE – United Nations commodity trade database has annual and monthly trade database since 1962.
- WITS – World integrated trade solution provides trade values and quantities for products on various nomenclatures; find tariff rates for products in different markets based on various product classifications; compare tariffs across markets; analyze protection levels for countries and products over time; compare scenarios of changes to applied or bound tariffs; or simulate economic impacts of various market access conditions.
- ASEAN website for ASEAN activities and trade statistics.
- World Bank for independent variable of IIT determinants like GDP, PCI, FDI and Trade openness.
- Distance data is calculated by using CEPII database which calculated distance from registered cities to cities in other country.

3.6 Research Hypothesis

Hypothesis 1 – There is a significant impact of ASEAN-India free trade agreement in promoting IIT index.

Hypothesis 2 – There is a shift and diversification in the pattern of trade after AIFTA at 4 digit HS level of classification.

Determinants of IIT Hypothesis

Hypothesis 1: The smaller the difference of GDP, higher the IIT index.

Hypothesis 2: The difference in per capita income between trading partners decreases, IIT index increases.

Hypothesis 3: The presence of Foreign Direct Investment increases IIT.

Hypothesis 4: The trade openness promotes higher IIT

Hypothesis 5: The IIT is higher when closer the countries are geographically

Hypothesis 6: The IIT is higher when countries have free trade agreements

3.7 Limitations of the Study

- The present study is based on the overall IIT rather than disentangling IIT between VIIT and HIIT.
- Though the AIFTA agreement has been signed in 2009 and came in force in 1st January 2010 and entire agreement will be completed by 2021, it's little early to understand the AIFTA impact. But still this study will contribute trade policy makers to check changing volume, share and composition of trade.
- The study only considers selected identified sector on the basis of top traded value of export and imports accompanied by calculating IIT at 4digit HS level. There were many sub-headings available at 4digit but not a part of top exports and imports. The study could not study those sectors that are not in the top ten sectors with high average IIT at 4digit.
- Due to data unavailability of countries of ASEAN like data for Cambodia, Myanmar, Lao PDR and Brunei Darussalam for all the years were not available. Therefore the study could not capture these countries observation in IIT index.