Chapter 4

Research methodology

In the past, the majority of economic growth theory considered capital and labor to be two primitive factors for economic growth. At that time period, the main sources of capital accumulation were lonely domestic resources. But recently, economists across the board have agreed with the opinion that the process of economic growth is an extremely complex phenomenon it depends on many variables such as capital accumulation (both physical and human), International trade, price condition, political situation, income distribution and even more on geographical factors. Thus the overall growth of countries can be generated not only by increasing the amount of labour and capital within the economy, but also expanding exports to wider markets. KindleBerger (1962) defines trade as a leading sector when exports rise would lead to an incentive for the establishment and expansion of other peripheral activities.

4.1 Selection of Variables

The present study employs data on some selected macroeconomic variables like GDP (Gross domestic production), EXP (Exports of goods and services), GFCF (Gross fixed capital formation), EII (Exports instability index), and DV (Dummy variable).GDP at factor cost is used as a measure of economic growth. The study used GDP at constant price because constant series are use to measure the true growth and constant series are not influenced by the effects of inflation. The study used Gross fixed capital formation as a proxy for investment. The variables like GDP, GFCF, EXP are in logarithm form. Besides this exports variable is measured by real exports earnings, there are obtained adjusting the nominal exports values by an exports price index. A unit value index provides information on the trends in imports and exports unit values that are weighted with prices and quantities of the current reference period. It is affected not only by changes in the prices included in the values, but also through the structure and quality of goods and services. Therefore the present study utilizes exports unit value index because if we say that our exports gradually increased in different periods than it may be possible that exports prices increased instead of quantities of goods. Similarly, if exports earnings increased due to

raises of quantities instead of prices of exports commodities. So in this situation we usethe export unit value index to know the real cause of increased or decreased exports earnings by adjusting the nominal exports values to export price index. The study highlighted real exports earnings index in Appendix A.

To analyze the impact of exports instability on economic growth the study usedexports instability index. All previous empirical studies have used a cross country alone, though they differ in the construction of the exports instability index. For example Macbean (1966) measured instability as the average annual percentage deviations in the dollar value of exports from a five year moving average of exports value. Whereas, Kenen and Voivadas (1972) employ a first order autoregressive model for proceeds, with the standard error of the exports equation being the measure of instability. The instability index of Glezakor (1973) is the arithmetic mean of the absolute values of the yearly changes in a time series corrected for a linear time trend. In Inspection of the export receipts data however indicate that export receipts are stable in some period and volatile in other periods. To contrast existing studies we use an export instability index that follows Basu and Macbean (1999), Tariq and Ghirmay and Kaushik (2008) to measure exports instability. Thus, the study measured exports instability index by utilizing following regression.

$$\text{Log (EXP)} = \alpha + \alpha T + \mu_t$$

Exp= exports, αT denotes a time trend and μ_t = error term

This above equation estimated expected exports earnings by the least square method and exports instability index measured as squared deviations from the estimated exponential time trend. In short EII is square of (Real exports earnings – Estimated Exports earnings).EII is measured in absolute term.

4.2 Data Description:

The study is based on secondary data. It utilizes variables like GDP, GFCF, EXP, EII, DV. Data is collected from RBI Annual data sources (Handbook of statistics on Indian Economy).GDP, EXP, GFCF collected by table 3(a). Further, unit value index of exports also collected from RBI

site in table number 137(Index numbers and terms of foreign trade .The data set is annual and covers 1970-71 to 2011-12 period .

4.3 Method of Analysis

The study employed following methods to the role of export instability and economic growth in India.

Unit root test

It is necessary to adopt unit root tests to ensure whether a stationary Co integration relationship existsbetween all variables in both short run as well as long run. In short, is a series is stationary its mean, variance and auto covariance (at various lags) remain the same. On the other hand non stationary time series will have a time varying mean or a time varying variance or both. Therefore, estimating the long run relationship without identifying the stationary behavior, this may be a spurious regression. The stationary point is the unit root stochastic process that we discussed in the following equation.

$$\Delta Yt = (Yt-Yt-1) = \mu t$$

$$(-1 \leq p \geq 1)$$

Where t is the time or trend variable and μt is a white noise error term. In each case if the null hypothesis is that $\delta = 0$ that is, there is a unit root or we can say the time series is stationary whereas alternative hypothesis is that δ is less than zero it is $\delta \leq 0$ that is the time series is stationary. Therefore, the results will have no economic meaning if that are estimated the relationship without identify the stationary of data. Unit root tests are performed to test the stationary of the series. The present study employs the Augmented Dickey-Fuller (ADF) test and Phillips-Perron (PP) test to check the unit root of time-series monthly data. These tests are performed to the level variables as well as to their first difference in logarithms term of the series for intercept and trend & intercept model.

Augmented Dickey-Fuller (ADF) Test

Dickey and fuller have developed a test known as the argument dickey fuller (ADF) test. This test conducted by arguments the preceding three equations by adding the lagged values of the dependent variable ΔYt. ADF testis the modified version of Dickey-Fuller (DF) test to determine whether there is a unit root in macroeconomic variables and stock indicesused in the study. The ADF test controls for higher-order correlation by adding lagged difference terms of the dependent variable to the right-hand side of the regression(Damodar N. Gujarati). The ADF test here consists following regression equation. The present study also adopts an ADF test to check stationary among variables. ADF test is adopted to check the level and their first difference of the series for two models: first is intercept and second is trend & intercept model. The unit root test has following two equations for intercept and trend & intercepts models.

Intercept Model:

$$\Delta Y_t = \beta_1 + \delta Y_{t-I} + \sum_{i=1}^{m} \alpha_I \Delta Y_{t-1} + \varepsilon_t \qquad (1)$$

Trend and Intercept model

$$\Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-I} + \sum_{i=1}^{m} \alpha \Delta Y_{t-1} + \varepsilon_t (2)$$

Where

ΔY_t is the first difference of the series Y_t

$\alpha_i, \beta_1, \beta_2$ are parameters to be estimated;

t is the time or trend variable;

ε_t is a white noise term

The ADF tests the null hypothesis (H_0) against the alternative (H_1) hypothesis;

H_0: Each variable has a unit root, $\delta = 0$

H_1: Each variable does not have a unit root, $\delta \neq 0$

Phillips-Perron (PP) Test

Phillips and person have developed more comprehensive theory of unit root test non stationarity. The tests are similar to ADF test, but they incorporate an automatic correction to DF procedure to allow for auto correlated residuals. In Phillips-perron test use non parametric statistical methods to take care of the serial correlation in the error terms without adding lagged difference terms. The test regression for PP test is the AR (1) process:

$$\Delta Y_{t-1} = \alpha_0 + \beta Y_{t-1} + \varepsilon_t \qquad (3)$$

While ADF test corrects for higher or serial correlation by adding lagged differenced termed on the right hand side, the PP test makes correction to the t statistic of the coefficient from AR (1) regression to account for the serial correlation in ε_t.[1]

H_0:$\beta = 0$

H_1:$\beta > 0$The time series model requires determining the optimal lag length. Akaika Information Criterion (AIC) and Schwarz Information Criterion (SIC) are used in order to determine the

[1] D. Asterrou,and Palgrave Macmillan, (2006), Applied Econometrics.

optimal lag length. AIC method imposes penalty for adding large number of regressors to model[2]. It is defined as:

$$AIC = e^{2k/n}\sum\hat{u}_i^2/n = e^{2k/n}\ RSS/n \qquad (4)$$

Where *k* is the number of regressors including the intercept and n is the number of observations. It is written for mathematical convenience as follow:

$$Ln\ AIC = (2k/n) + ln\ (RSS/n) \qquad (5)$$

Where, ln AIC is the natural log of AIC and 2*k*/n is penalty factor. N is number of observation, RSS is residual sum square.The SIC criteria are employed as under:

$$Ln(SIC) = (k/n)Ln(n) + Ln\ (RSS/n) \qquad (6)$$

The optimum leg length is determined where the AIC/SIC bears lowest values.

Co-integration Test

A number of methods for testing co- integration have been proposed in the literature. But the present study adopts Johanson co-integration method to examine the co-integration relationship between all variables. By adopting this method, we can explore that how well these all variables are co-integrated to each others. The study used this method to avoid the spurious regression situation. As Granger notes a test for co-integration can be thought of as a pre test to avoid spurious regression situation. Therefore at first stage, the study checks the integration order of the series. After that, it employs Johansen co-integration method to investigate the relationship between exports instability and economic growth. Infect, in a two variable model, there can be only one co-integrating vector. But when there are more than two variables in a model, the number of co-integrating vectors can be more than one. In fact, for *n* number of variables there can be up to n-1 co-integrating vectors. This problem cannot be resolved by the Engle-Granger single equation approach. Since we have five variables in our model, Johansen approach for

[2]Damoda N. Gujarati and Sangeetha,(2007), Basic Econometrics; p-548

multiple equations in adopted here. Considering n variables, all of which can be endogenous, a Vector Auto Regressive model with higher order. Autoregressive process can be written as:

$$X_t = A_1X_{t-1} + A_2X_{t-2} + \ldots\ldots\ldots\ldots\ldots + A_pX_{t-p} + e_t \qquad (7)$$

Where

$$X_t = (n\times 1) \text{ vector } (X_{1t}, X_{2t}, \ldots\ldots\ldots\ldots X_{nt})$$

e_t = an independently and identically distributed n dimensional vector with zero mean and variance matrix Σ_ε. Equation (1) can be reformulated in a vector error correlation model (VECM) as follows:

$$\Delta X_t = \Pi X_{t-1} + \sum_{i=1}^{p-1} \Pi_i \Delta X_{t-1} + \varepsilon_t \qquad (8)$$

$$\text{Where } \Pi = -(I - \sum_{i=1}^{p-1} A_i) \text{ and } \Pi_i = -\sum_{j=i+1}^{p-1} A_j$$

The important point to note in equation (2) is the rank of the matrix Π, the rank of Π is equal to the number of independent co-integrating vectors. Clearly, it rank of (Π) =0, the matrix is null and equation (2) is the usual VAR model in first differences. If Π is of rank n, the vector process is stationary. Intermediate class, if rank (Π) = 1, there is a single co-integration vector and the expression Πx_{t-1} is the error correction term. For other cases in which $1 <$ rank (Π) $< n$, there are multiple co-integrating vectors. Johansen (1988) and Johansen and Juselius (1990) suggest two tests for determining the number co-integrating vectors. In practice, only estimates of Π and its characteristic roots can be obtained. The tests for the number of characteristic roots that are insignificantly different from unity can be conducted using following two test statistics:

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^{n} ln(1-\lambda_i) \qquad (9)$$

And

$$\lambda_{max}(r, r+1) = -T\ ln(1-\lambda_{r+1}) \qquad (10)$$

where, λ_i= the estimated values of the characteristic roots (Eigen values) obtained from the estimated Π matrix.

T = the number of observations

The first statistic tests the null hypothesis that the number of distinct co-integrating vectors is less than or equal to r against the alternative hypothesis that co-integrating vectors is greater than r.The second statistic tests the null hypothesis that the number of co-integrating vectors is r against the alternative of r+1 co-integrating vectors.

Error Correction model

The error correction mechanism first used by Sargan and later popularized by Engle and Granger corrects for disequilibrium. An important theorem, known as the Granger representation theorem states that if two variable x and y are co-integrated then the relationship between the two can be expressed as ECM method. Further, one identifying the co-integration behavior among the specified variables, the short-run dynamics is investigated using the Error Correction Model (ECM).The error correction model result indicates the speed of adjustment back to long-run equilibrium after a short-run shock.TheECM_{t-1}, past error term will explore feedback relationship among the variables. It will shows long run relationship between GDP and other variables like FDI, DI and OP. While the parameters likeψ_i ,ϕ_i, λ_I andδ_i will explore short run influence of independent variables on GDP.