Chapter 4

METHODOLOGY

In the economic growth theory, capital and labour are considered to be two primitive factors for economic growth. Capital can be accounted from domestic as well as foreign source. In the past, majority of economies survived in the closed system. At that time, the main source of capital accumulation was lonely domestic resources. But in recent past, the world wide economies have opened the system. In this process technology transfer has been subject matter of concern. The productivity efficiency of FDI may differ from domestic investment. Various empirical literatures argued that foreign capital plays a significant role in economic growth of a country. This can contributes to economic growth through various channels such technology spillover, increase productivity and crowding in domestic investment (Balasubranyam et al., 1996; Blomstrom and Kokko, 1998 and Kumar and Pradhan,2005).

Apart from FDI, trade openness also affects the economic growth of a country. It was argued that the degree of trade openness makes the relationship of FDI and economic growth more robust. The present study also considers openness along with FDI and DI as determinants of economic growth.

4.1 Selection of Variables

The real Gross Domestic Product (GDP) is taken as proxy of economic growth. GDP is measure of all currently produce final goods and services in an economy.Foreign Direct Investment (FDI)is the category of international investment that reflects the objective of obtaining a lasting interest by a residential entity in one economy is an enterprise residential in another economy. This included equity capital, reinvestment earning and other capitals. Domestic investment is measured by excluding the GDP deflatored FDI from Gross Fixed Capital Formation (GFCF). Trade openness (OP) is quantified with exportsplus importsas percentage of nominal GDP.It shows the degree of competitiveness of an economy at international level.

In brief, study utilizes real GDP, domestic investment (DI), foreign direct investment (FDI) and trade openness (OP) variables to identify the relationship between FDI and economic growth.

4.2 Data Sources

The study is based on secondary data. It utilizes variables like GDP, FDI, DI and Openness. Data is collected from Handbook of Statistics on Indian Economy 2009-10 and Annual Reports (various issues), publication of Reserve Bank of India;National Accounts of Statistic (various issues) publication of Central Statistical Organization (CSO); Department of Industrial Policy and Promotion (DIPP), published by Ministry of Commerce and Industry. Some information from international source also included asWorld Development Indicators publication ofWorld Bank.

This study has utilized two set of time series data to examine the relationship between FDI, DI and openness with economic growth. First is with yearly frequency for the period of 1980 to 2009. The next set is based on quarterly data for the period of 1999 to 2010. Yearly observations of GDP, FDI inflow, DI and Openness are collected from World Development Indicators published by World Bank, are in dollar term. Whilequarterly observations are in rupee termin 1999 base year. FDI is included equity capital, reinvestment of earnings, and other long term and short-term capital. Again it has been converted into real value by using 1999 GDP deflator. DI is obtained by subtracting FDI from Gross Fixed Capital Formation (GFCF) to avoid double counting. Export and imports share on GDP was used as a proxy for openness.Except openness, all variables are taken into real terms.

4.3 Method of Analysis

The study employed following methods to the role of FDI in economic growth.

4.3.1 Unit Root Tests

Cointegration model is used to find the relationship between FDI and economic growth. The estimation of the model regresses to check the stationary behavior of the series. A stationary series is characterized by a time invariant mean and variance. Estimating the long run relationship without identify the stationary behavior,this may be a spurious regression.To check the stationary

of the series unit root test is performed, for this purpose ADF and PP tests have been utilized. These tests are applied to the level form and first difference of the series for two models; intercept and intercept & trend. The ADF test is the extension of Ducky-Fuller test (DF) test to take care of possible serial correlation by adding the lagged difference term of endogenous variable which is included. The Phillips – Perrontest is conducted to provide more robust result for unit root test of the series. The stationary of the series are checked with the help of following equations.

- Intercept and no trend model:

$$\Delta Y_t = \alpha_0 + \Omega Y_{t-i} + \sum_{i=1}^{k} \beta i \Delta Y_{t-i} + \varepsilon_i \qquad (1)$$

- Intercept and trend model:

$$\Delta Y_t = \alpha_0 + \alpha_1 T + \Omega Y_{t-i} + \sum_{i=1}^{k} \beta i \Delta Y_{t-i} + \varepsilon_i \qquad (2)$$

Where

ΔY_t,is the first difference of the series y_t;

α, Ω and β_i are parameter to be estimated;

T is trend component;

ε_i is a stochastic disturbance term.

The parameter, Ω is used to check the stationary behavior. The statistically significance of the coefficient Y_{t-1} implies that series do not have unit root. It means the series is stationary. On the other hand, statistically insignificance of the coefficient indicates the non stationary behavior.

The distribution theory supporting Dickey-Fuller test is based on the assumption that error terms are statistically independent and having constant variance. Therefore, PP test has been developed which is less restrictive nature of the error process.

- Constant and no trend model:

$$\Delta Y_{t-1} = \alpha_0 + \beta_1 Y_{t-i} + \varepsilon_i (3)$$

- Constant and trend model:

$$\Delta Y_{t-1} = \alpha_0 + \alpha_1 T + \beta_1 Y_{t-1} + \varepsilon_i (4)$$

Where,

$\Delta Y_{t-1}$is the first difference of the series y_{t-1};

α_0,α_1 and β_1 are parameter to be estimated;

T is trend component;

ε_i is a stochastic disturbance term.

The null hypothesis for presence of unit root are $\alpha_1 = 0$and $\beta_1 = 0$.

The time series model requires to determine the optimal lag length. For the purpose Akaika Information Criterion (AIC) and Schwarz Information Criterion(SIC) are used. These methods impose a penalty for including increasingly large number of regressors.[1] The model can be explained as

The AIC criterion is given by

$$\text{Log AIC} = (2k/n) + \text{Log } (RSS/n) \qquad (5)$$

Where Ln AIC is natural Log of AIC, and K is number of parameter, n is number of observation. RSS is residual sum Square.

The SIC criteria is employed as under;

$$\text{Log SIC} = (k/n) \text{ Log} + \text{Iog } (RSS/n) \qquad (6)$$

The optimum lag length is determined where the AIC / SIC bear the lowest values.

4.3.2 Co-integration Test

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 financial development and economic growth.

It is well documented that most economic variables are non-stationary in their levels (integrated of order 1) but stationary, I(0), in their first difference. Engle and Granger (1987) introduced the concept of co-integration in which economic variables may reach a long-run equilibrium that depicts a stable relationship.

[1]Damodar Gujarati and Sangita, Basic Econometric,. p548.

In present study we are using four variables such as GDP, FDI, DI and OP. The time series variables GDP, FDI, DI and OP are said to be co-integrated of order d, b where $d \geq b \geq 0$, if (i) all the four series are integrated of order d, (ii) there exists a linear combination of these variables, say α_1 GDP+α_2 FDI+α_3 DI+α_4 OP which is integrated of order d-b.

Johansen's test enables estimating and testing for the presence of multiple co-integration relationships, *r,* in a single-step procedure. The numbers of co-integrated equations are identified with the help of trace and max statistic developed by Johansen.The statistics are formulated as:

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^{g} \log(1-\lambda_i) \qquad (7)$$

$$\lambda_{\max}(r, r+1) = -T \log(1-\lambda_{r+1}) \qquad (8)$$

Where:r is the number of cointegrating vectors under null hypothesis

$\lambda_r$is the estimated value of r[th]characteristic root(Eigen value) obtained from estimated matrixΠ.

T is number of usable observations

When the appropriate values of *r* are clear these statistics are simply referred to as the λ_{trace} and $\lambda_{\max}$.

The first statistic tests the null hypothesis that the number of distinct cointegrating vector is less than or equal to *r* against a general alternative. From the previous discussion, it should be clear that λ_{trace} and $\lambda_{\max}$ equal to zero when all λ_i= 0. The further the estimated characteristic roots are from zero, the more negative is ln (1- λ_i) and larger is the λ_{trace} statistic. The second statistic tests the null that the number of cointegrating vector is r against the alternative of*r+1 coint*egrating vectors. Again, if the estimated value of the characteristic root is close to zero, $\lambda_{\max}$ will be small.[2]

4.3.3 Error Correction Models

[2]Walter.Enders., (2004)*Applied Econometric Time Series*, p 353.

One identifying the co-integration behaviour among the specified variables, the short-run dynamics is investigated using the Error Correction Model (ECM).,cointIn general, an ECM derived from the Johansen test can be expressed as follows:

$$\Delta \text{LnGDP}_i = \beta_0 + \sum_{i=1}^{p} \psi_i \Delta LnGDP_{t-i} + \sum_{i=1}^{p} \phi_i \Delta LnFDI_{t-i} +$$

$$\sum_{i=1}^{p} \lambda_i \Delta LnDI_{t-i} + \sum_{i=1}^{p} \delta_i \Delta OP_{t-i} + \alpha \text{ECM}_{t-1} + U_t \qquad (9)$$

Where

ECM_{t-1} = the past error term

LnGDP_t=logarithm of gross domestic product in year t;

LnFDIt = logarithm of foreign direct investment inflows in year t;

LnDI_t= logarithm of domestic investment in year t;

OP = trade openness of Indian economy in year t;

$\beta_0, \psi_i, \phi_i, \lambda_i$ and δ_i are the parameters

The error correction model result indicates the speed of adjustment back to long-run equilibrium after a short-run shock.The ECM_{t-1},pasterror 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 like $\psi_i, \phi_i, \lambda_i$ and δ_i will explore short run influence of independent variables on GDP.