CHAPTER 3
MODEL SPECIFICATION, HYPOTHESES AND
METHODOLOGY

Methods and materials are, at best, mere instruments to comprehend and interpret a problem, and not end in themselves. There operative value is related, on the one hand, to the problem and on the other hand to the alternative tools, that would be useful in the inferences and analyses. No social or economic problem can be explained adequately with the help of a single tool or techniques. One has to be adjustable, imaginative and careful in choosing the right method. Thus, the chapter is structured as follows: In section 3.1 Nature and sources of data have been presented. Conceptual framework and variables selected for this study has been described in section 3.2. The final section provides specification of the model which includes multiple regression approach for the evaluation of the macroeconomic indicators as described in section 3.3.

3.1 Nature and Sources of Data

The present study is based upon the time series secondary data collected from various published sources. The required data set for the selected variables of BRICS countries has been obtained from UNCTAD, ‘World Development Indicators (WDI), except for Industrial Production index, Investment in infrastructure and Exchange rate. Data set of industrial production index, investment in infrastructure and exchange
rate are obtained from International Monetary Fund (IMF) and The Federal Reserve Board Statistics (FRBS Releases and Historical data).

3.1.1 Period of Analysis:

To estimate the impact of macroeconomic variables on FDI and causality between FDI and economic growth, the study broadly covers period of 35 years from 1975 – 2009 (given in annexure 1 to 5) for the five fast developing countries namely Brazil, Russia (the data set is available from 1992 onwards), India, China and South Africa (BRICS countries). Time period taken for study is long enough to see the long term impact of macroeconomic indicators on FDI inflow. In this period most of the economic reforms initiate in countries under study.

3.2 Conceptual Framework and Variables

In this section we discuss those variables which have been chosen for our study. FDI inflow as a percentage of GDP chosen as the dependent variable in our study and the independent variables expected to determine FDI flows are carefully selected, based on the literature surveyed in the last chapter and availability of dataset for the selected period.

We have selected only few variables out of many variable as per literature surveyed (chapter 2) which have maximum influence on FDI inflow. Some of the variables are ignored due to unavailability of the data. List of selected variable is as follows;
3.2.1 Market Size (measured by GDP)

The main objective of attracting FDI inflows in emerging countries is to tap the domestic market, and thus market size does matter for domestic market oriented FDI. Market size is generally measured by GDP, per capita income or size of the middle class. Thus, an economy with a large market size (along with other factors) should attract more FDI. Market size is important for FDI as it provides potential for local sales, greater profitability of local sales to export sales and relatively diverse resources, which makes local sourcing more feasible.

3.2.2 Openness ((Import + Export)/GDP)

Openness of an economy measures the degree to which an economy is open to foreign trade and indicates the economic linkages with the rest of the World. Investors generally want big markets and like to invest in countries which have regional trade integration, and also in countries where there are greater investment provisions in their trade agreements. The larger the degree of openness, lower the degree of restrictions imposed by the host location on international trade, thus lower the cost of doing business.

3.2.3 Industry Production (percent of GDP)

Industrial production is a measure of output of the industrial sector of the economy. The industrial sector includes manufacturing, mining, and utilities. Foreign trade enables the productivity increase as well as
maintaining (technology import) and spreading the technologies and increases the rate of economic growth.

3.2.4 Workers' Remittances and Compensation (net workers' remittances and compensation)

Workers' remittances and compensation of employees comprise current transfers by migrant workers and wages and salaries earned by non-resident workers. Remittances are classified as current private transfers from migrant workers residents in the host country for more than a year, irrespective of their immigration status, to recipients in their country of origin. Migrants' transfers are defined as the net worth of migrants who are expected to remain in the host country for more than one year that is transferred from one country to another at the time of migration. Compensation of employees is the income of migrants who have lived in the host country for less than a year.

3.2.5 Inflation (average consumer price change percentage)

The rate of inflation (ILF) acts as a proxy for the level of economic stability, considering that one of the classic symptoms of loss of fiscal or monetary control is unbridled inflation. Considering that investors prefer to invest in more stable economies, those reflect a lesser degree of uncertainty, it is reasonable to expect that inflation would have a negative effect on direct investment.
3.2.6 Gross Fix Capital Formation (percent of GDP)

Gross Fixed Capital Formation (GFCF) is the measure of total investment for each country and includes both private and public sector investment and excludes changes in stocks. Improvements in the investment climate help to attract higher FDI inflows. It translates into higher gross fixed capital formation (GFCF) which in turn leads to greater economic growth.

3.2.7 Investment in Infrastructure (domestic investment percent of GDP)

Investment in infrastructure (INS) is an important determinant of FDI inflows. A country which has opportunity to attract FDI flows will stimulate that country to equip with good infrastructure facilities. The better the infrastructure, the more profitable FDI, therefore ceteris paribus, we would expect to see FDI follow increases in public domestic investment. Another plausible argument is that private domestic investors have more accurate information about the local business climate than do foreign investors. When information is incomplete, domestic investment acts as a signal about the state of the economy to foreign investors. This is an important component of GDP because it provides an indicator of the future productive capacity of the economy. Data Source: International Monetary Fund (2010).
3.2.8 Exchange Rate (real effective exchange rate index)

The strength of a currency (Exchange rate) is used as proxy for the purchasing power of the investing firm. Devaluation of a currency would result in reduced exchange rate risk. As a currency depreciates, the purchasing power of the investors in foreign currency terms is enhanced, thus we expect a significant relationship between the currency value and FDI inflows. The currency value can be proxied by the real exchange rate, real effective exchange rate (REER) and nominal effective exchange rate (NEER).

3.3 Specification of the Models

3.3.1 Identification of Determinants of FDI Inflow in BRICS Countries

This study carried out to identify the factors influence FDI inflow. Method of Ordinary Least Squares (OLS) is used to examine the relationship of FDI inflows and its determinants (Carkovic and Levine, 2002) of the BRICS countries.

The empirical methodology is motivated by the literature surveyed, but it is modified to accommodate the objective at hand. The choice of independent variables is indicated both by data availability and objective of the study. In the present study we propose an estimation model as follows, where the selected variables are expected to determine the FDI inflows:
\[ FDI_{it} = \alpha + \beta_{i1} MKTS_{it} + \beta_{i2} OPEN_{it} + \beta_{i3} IP_{it} + \beta_{i4} ILF_{it} + \beta_{i5} WRC_{it} + \beta_{i6} GFCF_{it} + \beta_{i7} INS_{it} + \beta_{i8} REER_{it} + \epsilon_{it} \]

Where

- \( FDI_{it} \) = Foreign direct investment as percent of GDP in country \( i \) at time \( t \)
- \( MKTS_{it} \) = Market size approximated by gross domestic product at constant Prices (2000 prices) in country \( i \) at time \( t \)
- \( OPEN_{it} \) = Measure of openness of the economy calculated as the sum of exports and imports as a share of GDP in country \( i \) at time \( t \)
- Openness is calculated as:
  \[ \text{Openness} = \frac{(\text{Import} + \text{Export})}{\text{GDP}} \]
- \( IP_{it} \) = Industrial production as percent of GDP for country \( i \) at time \( t \)
- \( ILF_{it} \) = Inflation rate as average consumer price change percentage for country \( i \) at time \( t \)
- \( WRC_{it} \) = Net workers' remittances and compensation of employees for country \( i \) at time \( t \)
- \( GFCF_{it} \) = Gross fixed capital formation as percent of GDP in country \( i \) at time \( t \)
- \( INS_{it} \) = Investment in infrastructure as a percent of GDP in country \( i \) at time \( t \)
- \( REER_{it} \) = Real effective exchange rate for country \( i \) at time \( t \)

In this model before running a regression we tested the stationarity of entire set of dependent and independent variables under study through
unit root test. We found that variables follow random walk and are not stationary. Therefore to avoid the risk of non-stationary in regression, we took first-difference all the variables. The above model is estimated using Ordinary Least Squares method after checking for the validity of the standard assumptions of the classical linear model. For this purpose we propose to test for multicollinearity, heteroskedasticity and autocorrelation and run the subsequent regressions only after ensuring that standard assumptions are not being violated.

3.3.1.1 Multicollinearity:

The presence of large number of variables leads to the possibility of multicollinearity. The OLS estimates obtained in the presence of multicollinearity may still be best linear unbiased estimates (Gujrati), which makes multicollinearity a far less serious problem than other violations of the linear model. The presence of multicollinearity can be detected either by high value of partial correlation coefficients between the regressors or by a combination of high value of $R^2$ and low t-values.

3.3.1.2 Heteroskedasticity:

Heteroskedasticity is a more serious violation of the assumptions of the classical linear model than multicollinearity and its presence would result in OLS estimators that are unbiased but not efficient. Heteroskedasticity can be detected by using variance ratio test. The variance ratio test is defined as the ratio of the highest to the lowest variance of the states in the sample and follows F-distribution. In case of
unequal variance this ratio exceeds a critical value and indicates the presence of heteroskedasticity following which we functionally transform the dependent variable and run the OLS regression with transformed values.

3.3.1.3 Autocorrelation

Durbin–Watson $h$ statistic is used to ascertain the assumption about the error terms being uncorrelated. The test statistic is given as

$$h = r \sqrt{n/1 - n \text{var}(b_1)}$$

where $r = (1 - d/2)$, $d$ is the conventional Durbin–Watson Statistic, $n$ is the sample size and $\text{var}(b_1)$ is the estimated sampling variance of the lagged dependent variable term. The decision rule is to reject the null hypothesis of 'no first order serial correlation' if $h$ is greater than 1.96 or less than -1.96. A value of $h$ greater than 1.96 indicates positive first order autocorrelation while a value less than -1.96 indicates negative correlation. Estimates in the presence of autocorrelation are linear-unbiased but inefficient, as with heteroskedasticity. In the event we detect the presence of autocorrelation, we transform the dependent variable using the first differences and run the regression on new data.

3.3.2 To Evaluate the Impact of FDI on Economic Growth

In order to test for direct causality between FDI and economic growth, we perform a Granger causality test using equations (i) and (ii):

$$GDP_t = \gamma + \sum_{i=1}^{k} \alpha_i \cdot GDP_{t-i} + \sum_{i=1}^{k} \beta_i \cdot FDI_{t-i} + \mu_t$$ (i)

$$GDP_{t-1} = \delta + \sum_{j=1}^{l} \gamma_j \cdot GDP_{t-j} + \sum_{j=1}^{l} \omega_j \cdot FDI_{t-j} + \nu_t$$ (ii)
\[ FDI_t = \phi + \sum_{i=1}^{k} \delta_i GDP_{t-i} + \sum_{i=1}^{k} \lambda_i FDI_{t-i} + \eta_t \]  \hspace{1cm} (ii)

where \( GDP_t \) and \( FDI_t \) are stationary time series sequences, \( \gamma \) and \( \phi \) are the respective intercepts, \( \mu_t \) and \( \eta_t \) are white noise error terms, and \( k \) is the maximum lag length used in each time series. The optimum lag length is identified using Hsiao’s (1981) sequential procedure, which is based on Granger’s definition of causality and Akaike’s (1969, 1970) minimum final prediction error criterion. If in equation (1) \( \sum_{i=1}^{k} \beta_i \) is significantly different from zero, then we conclude that FDI Granger causes GDP. Separately, if \( \sum_{i=1}^{k} \delta_i \) in equation (ii) is significantly different from zero, then we conclude that GDP Granger causes FDI. Granger causality in both directions is, of course, a possibility.

3.3.3 Research Hypothesis:

What has driven FDI to the emerging markets? How the largest and rapidly growing emerging markets have attracted FDI and growth? The aim of the research is to observe congenial business climate for the FDI to take place in an emerging market and to find out impact of different economic indicators on FDI inflows into a particular country. The tests of hypothesis are concerned with determining whether the findings lend support to some hypothesized causal relationship between the dependent and explanatory variables. The null hypotheses contend that there is no
such relationship while the alternative hypothesis postulates the existence of such relationship.

The literature review thus indicates, that the statistical hypothesis can be derived to find out the impact of market size, openness, industry production, inflation rate, net workers' remittances and compensation, gross fixed capital formation, real investment and real effective exchange rate, on inflow of foreign direct investment in a host country.

The study has following hypotheses:

H1: Larger market size of the host country attracts more FDI.

H2: More liberal policies and trade facilities presents opportunity for FDI to come to the hosting country.

H3: Higher industry production attracts more FDI to the host country.

H4: Stable inflation condition attracts FDI to the host country.

H5: Investment in infrastructure facility of the host country provides great platform for investment and leads to greater FDI inflow.

H6: Lower labour cost in the host country pulls FDI to the country.

H7: Real effective exchange rate has a significant impact on FDI inflow to the host country.

H8: High Gross capital formation shows the potential of the country for spending and thus has a significant impact on FDI inflow.

H9: There is significant impact of foreign direct investment on economic growth of BRICS countries.