CHAPTER 3 RESEARCH METHODOLOGY

The conduct of the study and analysis made therein is directly pretentious by the methodology of research used for data collection, tabulation, summarization, analysis and presentation. The literature of statistics and modern statistical packages, in the contemporary scenario, are the main contributors to the analysis and presentation of the constructed results. This chapter discusses the methodology used in the present study and also deals with the discussion of the sample countries, data collection, selection of the variables and statistical tools used.

3.1 Objectives of the Study

1. To develop an index for measuring and forecasting the financial stability in Emerging Market Economies.
   a. To compute the z-scores of the data of the indicators, in order to normalize them for making an index.
   b. To develop the sub-indices of the financial stability index.
   c. To examine the causal relationship between FSI and FD, FV, and FS
   d. To propose a ‘FD-FV-FS’ Model.

2. To analyze the implications of the capital flows, exchange rate, GDP and stock prices.
   a. To examine the causal relationship between FSI and capital flows, exchange rate, GDP and Stock Prices in Asian Emerging Economies.
   b. To examine the causal relationship between FD and capital flows, exchange rate, GDP and Stock Prices in Asian Emerging Economies.
   c. To examine the causal relationship between FV and capital flows, exchange rate, GDP and Stock Prices in Asian Emerging Economies.
   d. To examine the causal relationship between FS and capital flows, exchange rate, GDP and Stock Prices in Asian Emerging Economies.
   e. To examine the causal the relationship among capital flows, exchange rate, GDP and stock prices in Asian EMEs.
3.2 Hypotheses of the study

In order to establish and evaluate the above objectives, the author has used different hypotheses. The overall objective of the study is to provide a measure of financial stability in Emerging Market Economies. The hypotheses have been set to evaluate the measure so framed. Also, the hypotheses have used from time to time to test the validity of the models used, which means in order to test the assumptions of the statistical measure, hypotheses have been used. These are enumerated as below:

3.2.1 FSI and FD, FV, FS

H$_{01}$: There is no impact of FD, FV and FS on FSI in Asian Emerging Economies

H$_{11}$: There is an impact of FD, FV and FS on FSI in Asian Emerging Economies

3.2.2 Financial Development Index and MC, BD, BM, PVT, INT, HH

H$_{02}$: There is no impact of MC, BD, BM, PVT, INT, HH on FD in Asian Emerging Economies

H$_{12}$: There is an impact of MC, BD, BM, PVT, INT, HH on FD in Asian Emerging Economies

3.2.3 FV and INF, GB, CAD, EXT, RES, REER, SHT, LTD

H$_{03}$ - There is no impact of INF, GB, CAD, EXT, RES, REER, SHT, LTD on FV in EMEs in Asia

H$_{13}$ - There is an impact of INF, GB, CAD, EXT, RES, REER, SHT, LTD on FV in EMEs in Asia

3.2.4 FS and NPL, CA, CRAR, LR, ROA, ROE, H, SR, BR

H$_{04}$ - There is no impact of NPL, CA, CRAR, LR, ROA, ROE, H, SR, BR on FS in EMEs in Asia

H$_{14}$ - There is an impact of NPL, CA, CRAR, LR, ROA, ROE, H, SR, BR on FS in EMEs in Asia
3.2.5 FSI and Capital Flows, Exchange Rate, Stock Prices and GDP

H₀⁵ - There is no impact of Capital Flows, Exchange Rate, Stock Prices, and GDP on Financial Stability Index in EMEs in Asia.

H₁₅ - There is an impact of Capital Flows, Exchange Rate, Stock Prices, and GDP on Financial Stability Index in EMEs in Asia.

3.2.6 FD and Capital Flows, Exchange Rate, Stock Prices and GDP

H₀⁶ - There is no impact of Capital Flows, Exchange Rate, Stock Prices, and GDP on Financial Development Index in EMEs in Asia.

H₁₆ - There is an impact of Capital Flows, Exchange Rate, Stock Prices, and GDP on Financial Development Index in EMEs in Asia.

3.2.7 FV and Capital Flows, Exchange Rate, Stock Prices and GDP

H₀⁷ - There is no impact of Capital Flows, Exchange Rate, Stock Prices, and GDP on Financial Vulnerability Index in EMEs in Asia.

H₁₇ - There is an impact of Capital Flows, Exchange Rate, Stock Prices, and GDP on Financial Vulnerability Index in EMEs in Asia.

3.2.8 FS and Capital Flows, Exchange Rate, Stock Prices and GDP

H₀⁸ - There is no impact of Capital Flows, Exchange Rate, Stock Prices, and GDP on Financial Soundness Index in EMEs in Asia.

H₁₈ - There is an impact of Capital Flows, Exchange Rate, Stock Prices, and GDP on Financial Soundness Index in EMEs in Asia.

3.3 About the study

The study was descriptive and causal in nature. It is based on formulating and estimating the proposed model ‘FD-FV-FS model’ in the study. This model gives the measure of the financial stability of the economy. It is based on cyclical-monetarist view, of which cyclical view
proposed by Kindleberg (1978) and Minsky (1977) and monetarist view of financial stability by Freidman and Schwartz (1963). The detail analysis has been given in Chapter 1 of the study.

Due to the growing involvement in the global environment, Emerging Market Economies of Asia was the population of the present research. Getting more specific, the sample size of the present study was the ten Asian Emerging Economies, namely, China, India, Indonesia, Korea, Malaysia, Philippines, Saudi Arabia, Singapore, Thailand and Vietnam. This sample size and sample countries was decided on the basis of their increasing integration and share in the global economic growth. These economies of Asia have shown consistent better performances in terms of trade, protection against risks, than other emerging economies in Asia and rest of the world.

The model was framed and analyzed by taking the data for sixteen years, ranging from 2000-2015. The time frame again was decided on the purposive sampling basis. 2000 year was the major year for most of the Asian Emerging economies, as they just faced the one of the biggest turmoil in 1997-98. Further, this year was the beginning of the revolutions in some economies of Asia like Vietnam (as stock market was launched in this year). A major revolution was the change of the exchange rate regime from fixed to floating by most of the Tiger Economies (IMF, 2000).

Individual country was the sampling element and Non Probability Purposive sampling method was used for the study. Face Validity of the model was checked.

3.3.1 FD-FV-FS Model

Table 1 shows the indicators included to estimate the proposed FD-FV-FS model. It lists the various parameters which serve as determinants to sub-indices in the main model. These have been indicated in the reports provided by IMF.

The researcher identified the indicators of the study, on the basis of reports of IMF. Further the indicators were supported by theoretical framework, which led the foundation of the model proposed.
Table 1: FD-FV-FS Model

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Component</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market Capitalization to GDP</td>
<td>Financial Development Index (FD)</td>
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<tr>
<td>Bank Deposits to GDP</td>
<td></td>
</tr>
<tr>
<td>Broad Money to GDP</td>
<td></td>
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<tr>
<td>Private Sector Credit to GDP</td>
<td></td>
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<tr>
<td>Interest Rate Spread</td>
<td></td>
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<tr>
<td>Herfindahl Hirschman Index</td>
<td></td>
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<tr>
<td>Inflation Rate</td>
<td></td>
</tr>
<tr>
<td>Current Account Deficit to GDP</td>
<td>Financial Vulnerability Index (FV)</td>
</tr>
<tr>
<td>General Government Budget</td>
<td></td>
</tr>
<tr>
<td>Surplus/Deficit to GDP</td>
<td></td>
</tr>
<tr>
<td>REER</td>
<td></td>
</tr>
<tr>
<td>External Debt to GDP</td>
<td></td>
</tr>
<tr>
<td>Short Term Debt to Reserves</td>
<td></td>
</tr>
<tr>
<td>Reserves to External Debt</td>
<td></td>
</tr>
<tr>
<td>Loans to Deposits</td>
<td></td>
</tr>
<tr>
<td>Non-performing Loans to Total Loans</td>
<td>Financial Soundness Index (FS)</td>
</tr>
<tr>
<td>Capital to Assets</td>
<td></td>
</tr>
<tr>
<td>Capital to Risk Adjusted Ratio</td>
<td></td>
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<tr>
<td>Liquidity Ratio</td>
<td></td>
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<tr>
<td>Return on Assets</td>
<td></td>
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<tr>
<td>Return on Equity</td>
<td></td>
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<tr>
<td>Household Debt to GDP</td>
<td></td>
</tr>
<tr>
<td>Stock Market Turnover Ratio</td>
<td></td>
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<tr>
<td>Bond Market Turnover Ratio</td>
<td></td>
</tr>
</tbody>
</table>

3.4 Tools used for data collection and computation

Data was collected from the secondary sources. These included the reports published by IMF, World Bank and Asian Development Bank. IMF has provided the parameters which indicate the financial soundness of the nations. MS-Excel was used to compute composite ratios as elaborated below:

The data of components of FD was computed from the reports of the Central Banks of sample countries. The data of market capitalization was computed from Stock Market of the sample countries. Further, the data of Herfindahl-Hirschman Index was collected from World Bank. In order to calculate the composite indicators with GDP, GDP at current prices was taken for all the countries. Vietnam stock market started in 2000; therefore, the data of market capitalization is from 2003-2015.
The data of components of FV, namely, INF, GB, CAD, EXT, RES, REER, SHT, LTD, was computed from the figures in the annual reports released by Central Banks and Statistics Department. Inflation Rate was taken from the World Bank website. GB was computed from the figures in the Statistics reports of the Central Banks of the countries. CAD data was again taken from the World Bank (The differences in the sources of data were ignored, as both the sources gave the results). EXT was computed by taking external debt from the BOP of the economy and dividing it GDP at current prices. RES is the ratio of international reserves to external debt. This ratio was computed by taking international reserves from BOP and dividing it by external debt. REER was taken from the website of the Central Banks. SHT is the ratio of short term debt to reserves. External Short Term debt is taken to compute the composite ratio. In Saudi Arabia, the data for external debt to GDP was calculated from 2004. In fact, Saudi Arabia, being a Muslim country believes on no deposit interest rates. They have large deposits which help them not to depend on external debt (Central Bank Report). Even the data for short term debt to reserves was not there in case of Saudi Arabia and Singapore LTD is loans to deposit ratio. Loans comprised of the total loans of the central bank and total deposits of the central bank.

The data of components of FS are NPL, CA, CRAR, LR, ROA, ROE, H, SR, and BR was computed from the reports of Central Bank. The data of this FS was ensured to be from one source, as these are computed in different ways by different sources. Therefore, the present study focused on the central banks reports. NPL is the ratio of Non-Performing Loans to Total Loans. CA is capital to asset ratio. CRAR is Capital to Risk Adjusted Ratio. LR is the liquidity ratio, covering liquid liabilities of the central banks. ROA and ROE were given by the central bank reports. H is the Household debt to GDP ratio. The data for this ratio is available mostly from 2003, as the data of household debt emerged from 2003. SR is the stock turnover ratio was calculated by the stock turnover from the stock exchanges. BR is the bond turnover ratio. It was also available from the website of ADB. The data for this indicator was available for a few years.

The data of Capital Flows was taken from BOP issued by International Financial Statistics, IMF database. The financial side of the BOP was taken as Capital Flows. The data of the stock prices was the average of the monthly stock prices at the major stock indices of the sample countries. These were Shanghai Stock Exchange; Bombay Stock Exchange; Jakarta Stock Exchange; KOSPI; Bursa Malaysia; Philippines Stock Exchange; Tadawul (Saudi Stock Exchange);
Singapore Exchange; Securities Exchange of Thailand; and Hanoi Stock Exchange. These stock prices were converted into dollar values with the exchange rate at a particular point of time. The exchange rates are yearly rates with respect to Dollar, provided by the Central Banks of the respective countries. While estimating the relationships, GDP at constant prices was taken which was sourced from the statistics department of the ministries which provided the data.

While computing the ratios, it was kept in mind that the unit value is same, in terms of currency also, in order to avoid misleading results.

Furthermore, in order to avoid the problems of Heteroskedasticity in the data, the data was transformed to first order. Log values were also computed for the data, using EVIEW 6.

3.5 Tools used for Data Analysis

3.5.1 Computation of Z-scores

The literature provided the understanding that in order to develop an index of varied and diverse indicators, one must follow the process of normalization (May and Finch, 2009). It is a statistical method which eliminates the discrepancy in the unbalanced and missing data (Illing and Liu, 2003). It can be computed as follows [5]:

\[ Z = \frac{x - \mu}{\sigma} \]  

Equation 5

3.5.2 Irving Fisher’s Ideal Index

The present study is an attempt to develop a comprehensive and forecasting tool for measuring financial stability of the nation. Furthermore, the literature provided the components which can measure domestic environment, international environment and banking stability. Therefore, an index was framed using Irving Fisher Ideal Index method. This is the geometric mean of Laaspyre’s and Paasche’s Index Price Indices. Both of these measures become important as they consider the weighted aggregate indices. This is so because, while computing the average for the index some values are combated with higher values, giving an average of the values, which may not serve to be the best method. In order to avoid the balancing effect, the present study has used weighted average method, where weights are assigned to each item in the index. This gives more accurate results.
Furthermore, in order to grab the effects of the base year and current with weights, the combination of Laaspyre’s and Paasche’s method is used. Laaspyre’s index eliminated the difficulty of determining new quantities for each year. This can be computed as follows [6]:

\[
I = \frac{\sum p_1 q_0}{\sum p_0 q_0} \times 100 \quad \text{---Equation 6}
\]

The measure of Paasche provided an edge over the Laaspyre’s method. It included the measures of quantity of current year rather than the base year. It can be computed as follows [7]:

\[
I = \frac{\sum p_1 q_1}{\sum p_0 q_1} \times 100 \quad \text{---Equation 7}
\]

Irving Fisher provided an index, where he combined the indices measures of Laaspyre and Paasche, in order to balance the effects of both the indices. He took the geometric mean of these measures, which can be seen eq. [8],

\[
I = \left( \frac{\sum p_1 q_0}{\sum p_0 q_0} + \frac{\sum p_1 q_1}{\sum p_0 q_1} \right)^{\frac{1}{2}} \times 100 \quad \text{---Equation 8}
\]

The results can be interpreted in the way, that, if base year is 100, it signifies that values more than 100 are outperforming the market and there can be the risk of trigger. If the values are less than 100, that means markets are trying to cope with the environment in order to attain the financial stability. Too low values signify the sudden shock in financial market and institutions (Guru, 2016).

### 3.5.3 Unit Root Analysis

Unit Root Analysis in panel data is similar to that of a single series. There are five panel unit root estimations in EVIEWS. The present started by classifying the unit root tests on the basis of whether there are restrictions on the autoregressive process across cross-sections or series. Consider a following AR(1) process for panel data:

\[
Y_{it} = p_{it}Y_{i,t-1} + X_{it}\delta_i + \varepsilon_{it} \quad \text{---Equation 9}
\]

where \(i = 1, 2, \ldots, N\) cross-section units or series, that are observed over periods \(t = 1, 2, \ldots, T_i\).
The $X_{it}$ represent the exogenous variables in the model, including any fixed effects or individual trends, $\rho_i$ are the autoregressive (AR) coefficients, and the errors $\epsilon_{it}$ are assumed to be mutually independent idiosyncratic disturbance. If $|\rho_j| < 1$, $y_i$ is said to be weakly (trend-) stationary. On the other hand, if $|\rho_j| = 1$ then $y_i$ contains a unit root.

### 3.5.4 The Toda and Yamamoto Approach

The approach uses Granger causality theorem which includes estimation of VAR models. It shows that if a pair of I(1) series are co-integrated there must be a unidirectional causality in either way. Further if the series are not I(1) or are integrated of different orders, no test for a long run relationship is usually carried out (Toda, 1995). The following equation [10] and [11] explains the Granger Causality in the present study:

$$Y_{i,t} = a_{i,t} + a_{1,1} Y_{i,t-1} + \ldots + a_{1,i} Y_{i,t-1} + \beta_{1,1} X_{i,t-1} + \ldots + \beta_1 \quad \text{---Equation 10}$$

$$X_{i,t} = a_{0,t} + a_{1,1} X_{i,t-1} + \ldots + a_{1,i} X_{i,t-1} + \beta_{1,1} Y_{i,t-1} + \ldots + \beta_1 \quad \text{---Equation 11}$$

The different forms of panel causality test differ on the assumptions made about the homogeneity of the coefficients across cross-sections.

EViews offers two of the simplest approaches to causality testing in panels. The first is to treat the panel data as one large stacked set of data, and then perform the Granger Causality test in the standard way, with the exception of not letting data from one cross-section enter the lagged values of data from the next cross-section. This method assumes that all coefficients are same across all cross-sections eq. [12] and [13], i.e.:

$$a_{0,t} = a_{0,j}, a_{1,i} = a_{1,j}, \ldots, a_{1,i} = a_{1,j}, \delta_{i,t} \quad \text{---Equation 12}$$

$$\beta_{1,t} = \beta_{1,j} \beta_{t,i} = \beta_{ij} \delta_{i,t} \quad \text{---Equation 13}$$

### 3.5.5 Panel Regression Model

Seminal works on panel regression model have been given by Wallace and Hussain (1969), Balestra and Nerlove (1966). This method is used to analyze the data collected with various cross sections at different periods of time. With such panel data, the most commonly computed
models are Fixed Effect and Random Effect Model. The present study used EVIEWS 6 to estimate these models.

3.5.5.1 Fixed Effect Model:

It is used in case of the data, in which values remain same over the period of time. The basic fixed effect equation [14] is-

\[ Y_{i,t} = \alpha_i + X_{i,t}\beta + \epsilon_{i,t} \] \hspace{1cm} \text{Equation 14}

In the eq. [9] \( Y \) is the dependent variable at \( i \) with different cross sections and \( t \) with different time periods, \( \alpha_i \) the intercept picks up the fixed effects that differ among individuals but is constant over time, \( \beta \) is the vector of coefficients on explanatory variables. Further, these measurements can be analysed using Ordinary Least Square, when N is small.

Furthermore, Blundell and Smith (1989) provided that one should transform the data to the least square dummy variable method when N is too large. In the present study, the author has used ten cross sections which is a large number hence the data was transformed to least square dummy variable. For this, time average is taken as shown in eq. [15]

\[ \tilde{y}_i = \alpha_i + \bar{x}_i\beta + \epsilon_i \] \hspace{1cm} \text{Equation 15}

The further step, is to take the deviation out of mean [16],

\[ y_{i,t} - \tilde{y}_i = (x_{i,t} - \bar{x}_i)\beta + (\epsilon_{i,t} - \tilde{\epsilon}_i) \] \hspace{1cm} \text{Equation 16}

The fixed effect least square dummy variable of \( \beta \) is [17],

\[ \beta_{FE} = \left( \sum_i^N \sum_t^T (x_{i,t} - \bar{x}_i)(x_{i,t} - \bar{x}_i) \right)^{-1} \sum_i^N \sum_t^T (x_{i,t} - \bar{x}_i)(y_{i,t} - \bar{y}_t) \] \hspace{1cm} \text{Equation 17}

\[ \alpha_i = \tilde{y}_i - \bar{x}_i\beta_{FE} \] \hspace{1cm} \text{Equation 18}

The estimators in equation [16] and [17] are unbiased, consistent and efficient with corresponding covariance matrix given by:

\[ \text{cov} \beta_{FE} = \sigma^2_{\epsilon} \left( \sum_i^N \sum_t^T (x_{i,t} - \bar{x}_i)(x_{i,t} - \bar{x}_i) \right)^{-1} \] \hspace{1cm} \text{Equation 19}

Here, \( \sigma^2_{\epsilon} = \frac{1}{N(T-1)} \sum_i^N \sum_t^T (y_{i,t} - \alpha_i - x_{i,t}\beta_{FE}) \)

Then,

\[ y_i = i\alpha_i + \bar{x}_i\beta + \epsilon_i \] \hspace{1cm} \text{Equation 20}
3.5.5.2 Random Effect Model

Random effect models are better for analyzing the factors of growth as [21],

\[ y_{i,t} = \mu + x_{i,t}\beta + \alpha_i + \epsilon_{i,t} \]  

---

Where, \( \alpha_i \sim IID (0, \sigma_{\alpha}^2) \) are individual specific random errors and \( \epsilon_{i,t} \sim IID (0, \sigma_{\epsilon}^2) \) are remaining errors.

\[ \alpha_i l_T + \epsilon_i \]  

---

Equation 22

Where, \( l_T = (1, 1, \ldots, 1) \)

3.5.5.3 Hausman Specification Test

Hausman (1978) devised a test for the orthogonality of the common effects (\( \alpha_i \)) and the regressors. The Hausman Test was used to identify the better model of panel regression. It helps in taking decision from Fixed Effect Model and Random Effect Model. It uses following hypotheses:

\( H_0 = \) Random Effect Model is appropriate

\( H_1 = \) Fixed Effect Model is appropriate

3.5.5.4 Wald Coefficient Test

As fixed effect model can be estimated in number of ways, another way is to include dummy variables, as discussed above. It will use the following hypotheses:

\( H_0 = \) Pooled Regression Model, All dummy variables will be zero.

\( H_1 = \) Fixed Effect Model

Further, Wald Test can be used to check that all the dummy variables are zero.

3.5.5.5 Normality of the residuals

The residuals of the model so formed were tested with the normality statistics using Jarque Bera values, Skewness and Kurtosis.

Further, the graphical analysis provided the stationary of the residuals. Unit Root Analysis was also done in order to check that the residuals are stationary and homoskedastic.