1. INTRODUCTION

This chapter provides an overview of the Indian economy for the post liberalization period. It demonstrates the need and the significance of the study, sets up research objectives, and defines the broad hypothesis. It provides research methodology, data sources, summary of empirical findings, plan and limitations of the study.

1.1 Introduction

Liberalization and globalization are the twin forces that have transformed the Indian economy in the last two decades. Changes are rapid and visible. They have touched almost all the sectors of our economy, in particular the Indian Capital market and Indian industry. The Indian capital market plays a significant role in the growth of the financial sector. A robust stock market can promote economic growth by bringing in domestic as well as foreign investments. The growth of the economy depends upon multiple elements, such as fundamental macroeconomic factors, investment climate, performance of industry sectors and global business environment. An understanding of the macroeconomic factors that influence the movement of stock prices and the role of sector indices, that represent a variety of industries in economic growth, is essential for investors as well as policy makers.

India had shown phenomenal resilience during the global financial crisis of 2007-09 and was a partner in the global recovery process along with other BRIC countries. The findings of this study will help researchers and policy makers understand how, during the post liberalization period including financial crisis, macroeconomic indicators act and sector specific interlinkages gain importance.

The study examines the response of different industrial sectors to the liberalization measures that have been taken, and the role of the relevant macroeconomic variables that influence the Indian stock market. It investigates the long-term and short-term relationships and the influence of selected macroeconomic indicators on the Indian
stocks during the post liberalization period. It also examines the influence of inflows and outflows of Foreign Institutional Investments (FIIs) on the Indian equity market and their role in integration with the US equity market. It studies the impact of structural breaks on the relationships and the behavior of FIIs and identified variables. It attempts to explore the long-run and short-run relationships between major sectoral indices that represent a variety of Indian industries using Vector Autoregressive (VAR) models. It explains the unique behavior of major sectoral indices and the Sensex return in the different timeframes created due to structural breaks.

Several studies have been conducted on the relationships between macroeconomic variables and stock returns for developed economies but, till date, hardly anyone has comprehensively examined the influence of macroeconomic variables on Indian stock returns. In this study, macroeconomic variables have been selected on the basis of their current economic relevance and not merely on the basis of literature review, as done in most of the other studies. This study uses a more robust and reliable methodology to predict stock market return. The research analysis in this thesis uses the VAR model and enables us to identify the relationship and causality between the Sensex and each of the variables and interlinkages between sector indices. The identified Vector Error Correction model (VECM) is further refined by segregating endogenous and exogenous variables in order to understand the relationships between macroeconomic variables and the Sensex return, with precision. The fact that this has never been done in any Indian research till date, makes this study very interesting indeed.

This is the first study that has attempted to understand the interplay of 11 sector indices comprehensively. It provides insights into the responses of sector specific indices of the Indian capital market in the integrated and globalised environment. It uses a variety of VAR models to study the behavioral patterns of sector indices in the sub time frames created due to structural breaks. It attempts to determine the predominant driver index which integrates and helps explain the variations in indices of other sectors.
According to the Economic Survey, 2011-12,¹ “At the level of national policy even minor improvements can have mega impacts on well beings of the people. This simply underlines the need for more fundamental research in India. Policy related research can be context sensitive and it is imperative that India strengthens its capacity in this.” This study is an attempt to move in the direction indicated in these lines; its findings being significant for researchers, policy makers and investors. It leads to clarity about the relationships between the macroeconomic variables and stock market movements. It also helps develop an understanding of the significantly increasing role of sector specific investment strategies during the post liberalization period. The emerging policies will give direction to investors and assist them in regaining confidence in the Indian equity market. The framework of this study can also be used to conduct similar studies for other emerging economies.

When governments need to introduce policy changes to stimulate the economy, they look for research studies that give pointers to what appears feasible in the prevailing macroeconomic environment. This thesis attempts to identify the leading indicators that affect the prices of equities in the stock exchanges in India. In this thesis, an attempt has been made to understand the industry’s response to the tectonic shift from a near-autarkic economy to one that is gradually integrating with the rest of the world.

1.2 Need and Significance of Study

Owing to trade liberalization in India, since 1991, and gradual globalization measures taken by the government, the Indian economy has witnessed phenomenal changes. This has led to progressively increasing GDP growth supported by more robust macroeconomic fundamentals. The rapid growth and potential for further growth attracted the attention of Foreign Institutional Investors (FIIs), who invested heavily in Indian equities, adding to the foreign exchange reserves. However, since the global slowdown in 2008 and recession in many North-Atlantic countries that are major export destinations for Indian products, the Indian economy has been affected by the challenging global economic environment. The current account deficit worsened from

2.3% of GDP, in 2008-09, to a high of 4.2%,\textsuperscript{2} in 2011-12. Europe continues to face sovereign debt crises in some of the Euro-zone countries such as Portugal, Italy, Greece and Spain (PIGS), with some other countries also under stress. The delay in resolving this crisis is adding to volatility in the equities market and adversely impacting financial markets not only in Europe but also in the US and in Emerging Economies such as India. The Indian economy, which had grown for two consecutive years by 8.4%,\textsuperscript{3} in 2009-10 and 2010-11, grew by only 6.5%\textsuperscript{4} in 2011-12, and RBI has indicated a further decline for 2012-13.

During 1990-91 to 2011-12, the structure of the Indian economy changed significantly. The size of the economy (at constant 2004-05 prices) grew from $300 billion to $1,162 billion. While all sectors of the economy grew in absolute terms, their relative shares in GDP altered significantly. The share of agriculture reduced from 29.6% to 13.9%, industry’s share grew almost pari passu with GDP, as its share changed marginally from 27.7% to 27%, while the share of Services increased from 42.7% to 59% during this period.

This change in the share of firms as compared to farms was facilitated by a growing equities culture. Equity financing of firms showed a phenomenal increase with market capitalization of the Sensex increasing from $7.75 billion in 1990-91 to $569.88 billion in 2011-12.\textsuperscript{5} However, since 2008, the equities culture has taken a beating. Market capitalization crashed in 2008-09 across the world and in India Sensex dropped from 21,078 on 8 January 2008 to 8,160 on 9 March 2009. Bill Gross, founder and co-chief investment officer of PIMCO, the world’s largest bond fund management company, begins his August 2012 commentary by stating, “The cult of equity is dying.” Equities financing propelled India into the trillion dollar economy group and needs to be revived to sustain future growth. For this to happen, a more robust and reliable methodology needs to be developed to predict stock market returns. This thesis attempts to provide such a methodology.

\textsuperscript{2} RBI First –Quarter Review of Monetary Policy 2012-13 (April-March), July 31st, 2012.
\textsuperscript{3}Indian Economic Survey 2011-12, (GDP at factor cost 2004 -05)
\textsuperscript{4} CMIE, July 2012 Survey.
\textsuperscript{5} Prowess database, CMIE.
Macroeconomic Variables and Their Relevance for the Study

**Sensex** The Indian stock markets have of late witnessed a great deal of participation not only from Indian investors but also from global investors. This is primarily because India has now been identified as one of the most important emerging economies in the world. The Indian government has also played a supportive role in this area, by introducing a number of measures, which have aided the development of the Indian capital markets.

The Sensitive Index (Sensex) of the Bombay Stock Exchange (BSE), which has 30 large cap, actively traded companies, is the bellwether of equities prices in India. It is influenced by a host of macroeconomic variables. In this study, we have considered twelve variables:

**IIP** Stock market returns are based on expectations regarding the performance of the listed companies. The Index of Industrial Production (IIP) is a monthly index of the output of industry. Its rate of change gives a fair indication of the expected financial performance of the industrial sector. It is thus one of the most important variables in determining stock market returns. Industrial growth measured by IIP reached a peak of 15.5% in 2007-08, which coincided with the peak in Sensex. Due to global slowdown, IIP touched a low of 2.5% in 2008-2009; again coinciding with the trough in the Sensex. It gradually increased to 5.3% and 8.2% in 2009-10 and 2010-11, respectively, and again fell significantly to 5.3% in 2011-12. IIP has further contracted to 1.8% in the first quarter of 2012-13 due the slump in the manufacturing sector.

**Foreign Exchange Reserves** The level of foreign exchange reserves is indicative of a country’s ability to service its foreign currency payment obligations. They also help stability in the exchange rate, providing a reliable environment to exporters and importers. India currently has one of the largest foreign exchange reserves. This provides foreign investors the comfort of knowing that they can repatriate their investment whenever they want. This also ensures that the credit rating agencies, such
as S&P, do not down-grade or put on watch a country’s credit rating. The foreign exchange reserves were merely $ 5.8 billion in March 1991; they have since risen to $279.1 billion in March 2010 and further to $ 304.8 billion in March 2011. They have declined by a small extent to $296.7 billion in March 2012.

**Export & Import** Growth in exports reflects the global competitiveness of Indian producers. Their export earnings add to the forex reserves and India’s ability to pay for its imports. India’s share in world trade has crossed 1.5% due to globalization and the impact of trade liberalization measures. Both exports and imports have shown substantial growth of 37.3% and 26.8% in 2010-11 over 2009-10. The balance of trade has reduced from –9.7% in 2008-09 to –8.7% in 2009-10 and further down to –7.8% in 2010-11. Indian exports have been under tremendous pressure due to China and recession in the US, Euro-zone, and Japan. The contraction in global demand is the prime reason for the recent decline in exports. Exports dipped by 1.7% to $75.2 billion in April-June quarter of 2012-13 from $76.5 billion in the same period for 2011-12. The sluggish movement of exports has had an effect on the Sensex.

Imports were $115.26 billion in April-June 2012-13, showing a negative growth of 6.1% and were $122.74 billion in Q1 of 2011-12. In Q1 of 2012-13, though oil and non-oil imports have decreased, exports have also decreased leading to a higher trade deficit.

As a consequence of the WTO regime and liberalization of the trade policy, there has been an overall reduction in import duties from a peak of 300% in 1991 to an average of 13.1% in 2012. The overall tariff reduction resulted in increased availability of modern machines, inputs and technology at cheaper rates. This has resulted in an improvement in quality of manufactured products and processes leading to rapid integration with global markets.

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7 World tariff profile 2012, WTO,
/www.wto.org/english/res_e/publications_e/world_tariff_profiles12_e.htm,
http://stat.wto.org/TariffProfiles/IN_e.htm
**FII** Foreign Institutional Investors (FIIs) are savvy investors who look at investment opportunities across the globe and appraise their relative profitability. Domestic investment climate, to a great extent, determines attractiveness of an economy to foreign investors. Foreign investments in proportion to the total capital flows rose from 1.2% in 1990-91 to around 62.19% in 2009-2010. There has been upsurge in foreign investment inflows, both direct and portfolio, which totaled around $50.36 billion in 2009-10. This declined to $39.65 billion due to a slow-down in Foreign Direct Investment (FDI) inflows in 2011-12. The FIIs inflows marked a significant turnaround from $9.84 billion (–) in 2008-2009 to $30.25 billion in 2009-10 and moved upto $32.23 billion in 2010-2011, reflecting the growth in domestic and world asset markets.

**S&P 500** International capital flows have their own dynamics; they flow towards countries with low inflation and a modest fiscal deficit. They are also influenced by the movement of stock markets in the home country of the FII (reflected by S&P 500 for the US). In 2008-09, there was a very substantial withdrawal of FII investments from Emerging Economies, including India, to shore-up the balance-sheets of the FII’s principals in the home countries of recession hit US and Europe. Equity capital flows to the developing economies were subdued in 2011 in comparison to 2010, as a consequence of the uncertainty surrounding Euro-zone countries and its fall-out in the rest of the world. There was a marked increase in preference for gold and bonds.

**Exchange Rate** FIIs constitute a large proportion of the investment in Indian equities of large and mid-cap companies. As their investments are also substantial, a decision by them to buy or sell a particular stock can move the market price substantially. FIIs seek to maximize their returns converted into foreign currency. Thus, if the $/Rs exchange rate strengthens, they get fewer dollars for their rupee earnings. This makes investment in India unattractive. A strengthening rupee, on the other hand, would make investments more attractive.

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8 Economic outlook for 2011-12, Economic Advisory Council to the Prime Minister.
Post liberalization, India acquired a flexible market determined exchange-rate regime. Exchange rate has been highly volatile in 2011-12. Rupee/$ rate depreciated by 13.85% from Rs 44.97 in March 2011 to Rs 51.2 in March 2012 and further to Rs 56.3 by end of June 2012. The depreciation of the Rupee is primarily due to supply-demand imbalance in the domestic foreign exchange market due to slowdown of FIIs, strengthening of $ in international market, increasing current account deficit, and rising inflation.

WPI and inflation The Wholesale Price Index (WPI) is the headline measure of inflation in India. Inflation remained the major source of concern for growth. One of the principle roles of the Reserve Bank of India (RBI) is inflation control and one of its main policy instruments for this is controlling of interest rates. High inflation leads to RBI enforcing high interest rates to control aggregate demand. While this increases consumer prices, it also affects the cost of raising finance for investment, leading to a cut-back or deferment of investment. This immediately impacts the capital goods industry, housing and real estate, and infrastructure projects and their related service providers. This decline in demand and high interest rates, leads to a slowdown in economic activity impacting stock market returns.

High interest rates have another effect on investment activity. Banks offer higher interest rates on fixed deposits (FD). As FDs are risk-free they are preferred in an uncertain equities environment. Thus, firms find it increasingly difficult to finance their investment plans from both bank loans and equities. Thus, movements in WPI give an advance warning of possible action by RBI.

WPI, which was 1% in September 2009, ballooned to 11.0% in April 2010, remained above 9% during April-November 2011, and it subsequently moderated to 6.9% by the end of March 2012. The Quarterly Macroeconomic Review by the RBI for April-June 2012-13 indicated sticky inflation of around 7% due to rising government spending and input costs, high food prices, and shortfall in monsoon. RBI has taken several measures to control inflation, but has not cut interest rates as it believes that it

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9 Public Debt Management, Quarterly report April-June 2012, Department of Economic Affairs, MOF.
cannot boost economic activity without prudent governance. It, however, increased liquidity by reducing the statutory liquidity ratio (SLR) by 100 basis point (=1%) to 23%.

**Oil**  India is an energy deficient country and imports about 80 per cent of its crude oil requirement. The price of oil coupled with the depreciating exchange rate, threatens to increase costs of Indian industry with adverse effect on its competitiveness. “Global energy prices continue to pose a risk to growth and inflation due to geo-political factors and global macro economic situation,” observed the then Finance Minister, Pranab Mukherjee. According to the International Energy Agency (IEA), world crude demand has increased from 83.6 million barrels per day (mbd) in 2005 to a projected 90.0 mbd in 2012, an increase of 6.4 mbd over the seven years. The main contributors to this increase in net oil demand are China (60%), West Asia and North Africa (42%) and India (19%). The increase in demand from China and India is linked to their pace of economic expansion. It is unlikely that the demand for oil will slow down. Crude oil price also surged recently: the price of Brent crude rose from $111 per barrel in January 2012 to $ 120 per barrel by mid April 2012, an increase of 8.1%.

**Gold**  India has been a major importer of gold for jewelry. The volatility in equities markets globally and the rising demand for gold as a safe investment is also catching on in India. There has been a boom in the demand for gold exchange traded funds (ETF). As the issuer company of gold ETFs needs to have gold as security for the ETFs it issues, it will import gold. Consequently, the import of gold has also been on the rise owing to this factor. It was $ 30 billion in 2009-10, $ 33 billion in 2010-11 and $ 58 billion in 2011-12. In an uncertain market and high inflation, people found gold a better investment option and as a hedge against inflation.

**M3**  Adequate liquidity in the money market is essential for smooth business activity. RBI has increased liquidity by reducing SLR. It has also stated in the April-June policy that it will resort to Open Market Operations (OMO) as warranted by the future market situation. Monetary deepening (ratio of average M3 to GDP) increased
from 42.6% in 1990-91 to 78.4% in 2010-11. This indicates spread of banking services and development of financial sector.\textsuperscript{10} Money supply (M3) growth was 17% in the beginning of 2011-12, indicating a strong growth in time deposits which moderated to 13% by March 2012; lower than RBI’s projection of 15.5%, indicating tightness in primary liquidity as well as lower credit demand.

The fiscal deficit remained high at 5.9% in the revised estimate for 2011-12 and is targeted at 5.1% for 2012-13. Sharp deceleration of GDP growth in particular for the manufacturing sector and increasing commodity prices may lead to slippage in the fiscal deficit resulting in high inflation and a continued high interest rate regime.

While there is no doubt that the above factors influence the Sensex, this knowledge is not enough to inform policy action. It is necessary to determine the extent to which each of these variables affects it. The extent of the relationship of each variable with the Sensex can then help prioritize policy interventions to achieve the desired objectives. The research analysis in this thesis, using the VAR model, enables us to identify the relationship and causality between the Sensex and each of the variables. It is believed that this is a more robust model than most others developed till now.

Many studies were done on the relationships between macroeconomic variables and stock returns for developed economies such as the US, Japan and major European countries, but limited research were carried out on examining the impact of macroeconomic variables on Indian stock returns till now. These studies are restricted in terms of scope, as they have considered a few macroeconomic variables and have performed analysis for a shorter time period. No study for the Indian stock market has been conducted about the role of its sector specific indices using VAR models for different sub-periods created by structural breaks. The findings of a comprehensive analysis have significant implications. It is useful for policy makers and investors. It improves clarity about the relationships between macroeconomic variables and stock

\textsuperscript{10} Indian Economic Survey 2011-12, pp. 93.
market movements. And, it develops an understanding of the significantly increasing role of sector specific investment strategies during the post liberalization period.

The study has included macroeconomic variables selected on the basis of their current economic relevance discussed above and extensive literature review. The study employs the Johansen method of co-integration to determine suitable VECM. This model is further refined by identifying exogenous variables using rational restrictions, which has not been done by any Indian researcher earlier. This will help in having a better understanding about the long-run and short-run relationships between the Sensex and identified macroeconomic variables of the emerging Indian economy. It employs Impulse Response Function and Variance Decomposition analysis for knowing the relative importance of a variable by knowing the percentage of variation in one variable being explained by the other.

The study also examines influence of FII inflows and outflows on the Sensex return and its role in integration with the US economy. The study is motivated due to lack of research based on high frequency daily data which has been divided into sub-periods due to structural breaks. It uses, for the first time, different VAR models comprising of suitable endogenous variables to clearly understand the emerging statistical and economic relationships, and causation between them. The emerging policies will help to give direction to the investors and assist to regain confidence in the Indian equity market.

Another new achievement of the study is in understanding the importance of usage of sector indices of industry. The study provides insight for sector specific investment strategy and suitable policy formulation in the significantly reforming and liberalizing Indian economy. The study attempts, for the first time, to comprehensively understand the interplay of 11 sector indices and their behavior patterns in the sub time frames created due to the structural breaks by using independent VAR models. It has also, for the first time, used the generalized impulse response function (GIRF) to investigate the pattern of flow of information in the sector indices. The study successfully
identifies the market driving sector index. It focuses on the policy implications by studying the significance of different sectors.

1.3 Research Objective

The study explores the response of different industry sectors due to liberalization measures and influence of a large set of macroeconomic variables on the Indian stock market by employing multiple VAR models. The study will help to understand policy implications on the outcomes and provide a framework to conduct future research.

The objective of the first phase of study is to identify robust VAR models explaining the influence of the relevant macroeconomic variables on the Sensex and their relationship on the basis of monthly data for the post liberalization period from March 1995 to December 2009. It will also attempt to identify the existence of the long-run and short-run relationships between these variables and determine market efficiency of the Indian stock market. Further, it will determine the causality relationships between the macroeconomic variables and the precise contribution of each variable in the inter-linkages to explain fluctuations in stock price returns.

The objective of the second phase is to determine the influence of FIIs on the Sensex return for high frequency daily data from 1/1/1999 to 31/12/2010 and its role in integration with US equity market. To identify different VAR models comprising of the Sensex and S&P 500, inflows and outflows of FIIs, Net FIIs and exchange rate, which explain the relationships between these variables. Further, it studies the impact of structural breaks on the relationships and behavior of the identified variables.

The objective of the third phase of the study is to determine the existence of both short-term and long-run relationships between BSE’s major sectoral indices and Sensex for the daily data from 23/8/2004 to 31/12/2010 using VAR models. To identify different VAR models which may explain unique behavior of major sectoral indices and Sensex return during different time frames created due to structural breaks. To determine the predominant driver index for all sub-periods which is
integrates and explains the variations of other sector indices and to find secondary sector driving indices leading others in the different sub-periods.

1.4 Research Hypothesis

A set of different hypotheses have been developed during the sequential data analysis process for each section of the study and suitable inferences have been drawn at various levels. These hypotheses are based on recent research work conducted. The hypotheses for the three phases of the study are given below. These three hypotheses will have several sub-hypothesis, which are tested for all phases.

**Phase 1**

**H$_{0P1}$:** There exists a robust VAR model to explain the long-run and short-run relationships and causality between the macro economic variables and Sensex return.

**H$_{1P1}$:** There is no robust VAR model to explain the relationships between the macro economic variables and Sensex. There is neither a long-run nor short-run relationship or causality between the identified macroeconomic variables and Sensex return.

**Phase 2**

**H$_{0P2}$:** The inflows and outflows of FIIs have influence on the Sensex return. Different VAR models comprising of Sensex returns, purchase and sales of FIIs and net FIIs inflows, Exchange rate and S&P 500 explain the interrelationships and causality between them in the sub-periods created by the structural breaks. The US market influences FIIs inflows or outflows, or both.

**H$_{1P2}$:** The inflows and outflows of FIIs do not have influence on the Sensex return. There do not exist interrelationships and causality between Sensex returns, purchase and sales of FIIs and net FIIs inflows, exchange rate and S&P 500 using VAR analysis for the sub-periods created by the structural breaks. The US market neither influences FIIs inflows or outflows, or both.
Phase 3

$H_{0P3}$: Different VAR models can explain the short and long-run relationships and causality between the major sectoral indices and the Sensex return for the four time frames created by the structural breaks. There exists a dominant sector index for all sub-periods and key driving indices leading other indices in the different sub-periods.

$H_{1P3}$: There does not exist short-run or long-run or causality relationships between the major sectoral indices and Sensex returns for any of the four sub-periods created by the structural breaks. There is neither a dominant sector index for all sub-periods nor any key sector driving indices leading others for different sub-periods.

1.5 Research Methodology

*Sims (1980)* in his landmark contribution developed VAR models as an empirical tool with an objective to conduct macroeconomic study. These models have been widely used by the researchers for all kinds of empirical macroeconomic studies, for interpreting time series, forecasting and for policy analysis. VAR became an indispensable tool for applied research alongside structural macro econometrics developed by *Thomas Sargent*. The Noble Prize in 2011 was awarded to *Sims and Sargent* for their seminal contributions to find methods and applications in explaining the interplay between monetary policy, fiscal policy and economic activity (§3.10.2).

Deregulation of financial markets enhanced interest in the study of monetary policy using VAR models by foreign researchers in the last two decades. Secondly, the role of analysis by VAR models increased due to a gradual focus on transparent policy rules and fixing monetary targets by most of the emerging economies, including the Indian economy. It makes the study of monetary policy employing VAR methodology interesting and relevant. This empirical study also uses VAR models for econometric time series analysis.

The research methodology starts with collecting secondary data on macroeconomic variables on the basis of their current relevance and literature review. It is followed by
quantitative analysis of the data using both descriptive and inferential statistics. Subsequently, econometric analysis is conducted. The process of data analysis is explained below in brief:

The descriptive statistics of the secondary data helps to understand hidden patterns of the macroeconomic time series. The graphical representation of the time series of each macroeconomic variable reveals uniqueness of their behavior. The properties of macroeconomic time series, their log transformed and first difference series are quantified by the measure of central tendency, dispersion, skewness and kurtosis. Correlation matrixes of all variables including their transformation are determined. The correlation coefficients thus calculated, indicate strength of relationships between these variables. In order to test normality of the distribution of variables, Jarque-Bera (JB) is calculated. It helps to infer about the departure of the time series from the Gaussian distribution. The Variance Inflation Factor (VIF) greater than 10 and high value of $R^2$ indicates multi-collinearity problem of the independent macroeconomic variables. The multiple regression models of variables may reveal high degree of fitness but this will lead to spurious regression due to existence of unit root. If the standard regression techniques are applied to non-stationary data, the regression may appear to be good with significant coefficient estimates and high $R^2$ but its inference would be meaningless. The standard assumptions of asymptotic analysis in such case will be invalid; as t-ratio and F-statistics will not follow the t-distribution and F distribution, respectively. Thus, testing for stationarity of the time series is the first step of the econometric analysis.

The econometric methodology used in the study comprises of the following analytical steps which are briefly summarized. The first step is test for stationarity of the time series. Chow test has been used to test for structural breaks in the time series. A variety of unit root tests are employed for confirming stationarity of the time series of macroeconomic variables and their log transformed series. If the time series are non-stationary, then the order of integration is determined. The first difference of the log transformed series should be $I(0)$ which is a necessary condition for cointegration. The order of integration will help to investigate the long-term relationship. The
second step is to test for the long-run relationship by confirming cointegration using the VAR analysis by Johansen (1988) and Johansen-Juselius (JJ) (1990) technique for VECM.

The Granger Representation Theorem (1983) provides a suitable link between the co-integrating technique and error correction model which states that if there exists a dynamic linear model with stationary disturbances and the data is I(1), the variables must be co-integrated of order (1,1). In case there is no cointegration or long-run relationship between the variables, the third step to follow is to examine Granger Causality (1969, 1988) between endogenous variables.

The VECM also identifies the magnitude and length of information being transmitted by an impulse triggered in a series to other connected in the multivariate system. These two factors are known as Variance Decomposition (VD) and Impulse Response Function (IRF), respectively. Thus the fourth step is to use Variance Decomposition Analysis (VDC), Impulse Response Function (IRF) and Generalized Impulse Response Function (GIFR). The Variance decomposition separates variation in the endogenous variables into component shocks to VAR and it provides relative importance of every random innovation. The IRF manifests effect of a random shock (unpredicted) which happens through one of the innovations on the current and future variable value. The IRF quantifies duration of the effect of innovations in one variable to itself and to other variables. The study also uses GIFR that is insensitive to the ordering of the variables in the VAR.

This framework of research methodology will help to examine the long-run and short-run relationships and interlinkages between stock price return, macroeconomic variables and sector indices.

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1.6  Source of Data

The study uses secondary data taken from different reliable databases for empirical analysis. The time series monthly data from March 1995 to December 2009 has been taken for the identified macroeconomic variables for the 1st phase of the study [Table 4.3.1]. The source of data are: four databases of the Centre for Monitoring Economy (CMIE) – namely Prowess, Economic Intelligence Service (EIS), Business Beacon, Industry Analysis Service (IAS); and the other data sources are the Hand Book of Statistics on Indian Economy, RBI, Director General of Commercial Intelligence and Statistics (DGCI&S), www.yahoofinance.com and www.lbma.org.uk.

For the 2nd phase to study, the influence of FIIs on Sensex and integration with US equity market, daily data from January 1999 to December 2010 has been taken from the Business Beacon, www.bseindia.com and www.uk.finance.yahoo.com [Table 4.3.2].

In the 3rd phase, econometric analysis of eleven sector indices has been conducted using the daily data from 23/08/2004 to 31/12/2010 taken from www.beseindia.com and the CMIE database, Prowess.

1.7  Empirical Findings

During the first phase of the study, it is seen by using different unit root test that the log transform of time series of 10 macroeconomic variables are I(1). Their first difference is I(0). The Johansen cointegrating trace and maximum eigen value tests confirmed the existence of three long-run relationships between the Sensex and the identified macroeconomic variables. This implies that the Indian stock market is informationally inefficient and these variables may be used to predict stock price movements. The VECM indicates existence of both short-run and long-term relationships between the Sensex and 10 macroeconomic variables namely S&P 500, inflation, IIP, exchange rate, M3, imports, exports, foreign exchange reserves and gold price. Thus, Sensex was found not a leading indicator, though it could have been if timely information were available for efficient price discovery. Further, the
macroeconomic variables interact with each other to bring the system in equilibrium in the long-run with different speeds.

Many interesting results obtained from VECM analysis for the first phase of the study are summarized below:

The increase in IIP is expected to be positively related to the stock price. But the relationship was found to be negative. The opposite relationship between the two raises questions about the reliability of usage of IIP. There are multiple reasons for observed opposite relationship: usage of non-representative IIP series (base year 1993-94), employing out-dated weights, data used relates to dormant companies and speculative nature of the market. (Refer §3.10.1). Further, due to inflationary pressure, the input cost of manufacturing will increase, which results in reducing margins and, thus, lowering IIP. This will bring down the Sensex.

The hypothesized positive relationship between the Sensex return and exchange rate was found to be true. Sensex increases as the Indian Rupee depreciates against the US $. This indicates that as the exchange rate depreciates, Indian exports become globally competitive. This leads to increase in the foreign exchange reserves resulting in strengthening the Sensex.

The exchange rate was found to have long-run negative relation with IIP. Increased domestic output results in exploring new international markets leading to growth of exports. This will bring in more foreign exchange resulting in a gradual appreciation of Rs with respect to $.

It is found that decrease in the money supply increases stock price. Inflation is positively related to money supply. Thus, increase in the money supply will enhance discount rates through inflationary expectations. This will eventually decrease the stock price. Thus, increase in money supply and rising inflation will not help to strengthen the Indian stock market.
Positive relation between imports and Sensex was observed. As import increases, the trade deficit increases; this depreciates the Rupee in comparison to the $. Indian exports become cheaper in the international market. The export oriented and IT companies benefit and their stock prices go up, which triggers the Sensex to rise. Further, increase of Capital Goods (CG) import helps to bring in latest technology and improves manufacturing processes for producing international quality products. This will have a positive impact on Sensex movement. Hence, imports are beneficial for export oriented companies or companies using Export Promotion Capital Goods (EPCG) scheme. Thus, overall, essential imports for manufacturing are beneficial for the domestic industry as it increases productivity and efficiency.

The exchange rate and exports were observed to have opposite signs. The exchange rate depreciation will help to stimulate exports and restrict imports, while exchange rate appreciation will be detrimental to the exports and encourages imports.

The relation between the stock market return and foreign exchange reserves was found to be positive. Thus, increase in the foreign exchange reserves and simultaneously controlling inflation develops confidence of both domestic as well as foreign investors pushing the Sensex upwards.

It was found that gold price and Sensex have a long-run and positive relationship. Gold works as an effective hedge during volatility in markets. Further, the gold price has spiked over the period irrespective of occasional downwards movement Sensex for short period.

The binding restrictions on the original VECM improve the model. The refined model indicates that the exchange rate, M3, imports, exports, foreign exchange reserves and gold price are weakly exogenous and other variables are endogenous. The first cointegrating vector manifested that the growth in IIP causes growth of the Sensex. Thus, manufacturing activity is responsible for the movement of Sensex in the long-run. The economic growth, which is partially represented by IIP, causes movement in
share prices and not otherwise, implying that the share price index is not the leading indicator of the growth of economy.

The VDA indicated that the Sensex return is largely dependent on itself. The US equity market contemporaneously influences the Indian capital market. Sensex return is also influenced by the money supply and exchange rate.

The IRF of Sensex showed that growth of industrial production has a positive impact on the growth of the stock price index. Growth of exports and growth of Sensex are positively related. Rising inflation and depreciating Rupee has a negative impact on the growth of our economy.

The Granger causality/block exogeneity test indicates that for a shorter duration, in 19 cases, one may forecast present value of the other variable using the past value of the variables. Thus, the market is informationally inefficient and provides opportunity for short-term policy formulation. The IIP, exchange rate and money supply are the key variables as they have short-term relationships with Sensex return. It was also observed by the analysis that the joint impact of controlling inflation, money supply and depreciation of exchange rate will result in the improvement of the foreign exchange reserves and trade balance, which will bring sustained growth of our economy.

Thus, in the first phase of study a robust VECM model helped in precisely explaining existence of the long-run, short-run and causality relationships between the macroeconomic variables and Sensex return. It has also improved the understanding between the interlinkages between macroeconomic variables and related policy formulation suitable in the current economic scenario.

The study in its second phase examined the influence of FIIs on the Indian equity market and its role in integration with the US equity market. Despite global recessionary conditions, both purchase and sales by FIIs have steadily increased. The
inflows of FIIs substantially picked up pace during the last five years but there has been a significant down trend of investment inflows recently.

The period of study from January 1999 to December 2010 has been partitioned into smaller time frames due to existence of structural breaks. The daily data for the sub-period from 1/3/1999 to 31/7/2003 was analyzed by using four VAR models for determining existence of short-term and long-run relationships, and for ascertaining causality between FIIs, Sensex and key variables.

The VAR I model comprises of two endogenous variables – FIIs inflows and Sensex return. It was found that FIIs inflows depend upon its past values rather than on the Sensex returns. It appears that foreign investors do not take decisions on the basis of Sensex returns. Thus, investors are more concerned about FII policies and attractiveness of the Indian market. The confidence of the investors may be reposed in the Indian market by softening controversial General Anti Avoidance Rules (GAAR) and retrospective taxation issues.

Further, the growth of Sensex return is mostly due to itself and it marginally depends on inflows of FIIs. The generalized innovation analysis indicated that innovation in the Sensex return affected itself, but marginally influenced FIIs inflows. Innovation in FIIs inflow has a positive impact ahead on both FIIs inflows and Sensex return. Bi-directional causality exists between the growth of Sensex return and growth of FIIs inflows. Thus, the government’s prime focus should be maintaining stability of FIIs inflows.

VAR II model considers two additional variables – S&P 500 and change in exchange rate. For this modified model, it is seen that in the short-term the foreign investors also monitored past movement of Sensex. Further, there is no conclusive evidence of a relationship between FIIs inflows and change in the exchange rate. It is observed that the growth of Sensex return causes change in the exchange rate. Further, stock market returns in the short-term are neither caused by short-term the changes in the inflows of FIIs nor by the changes in the exchange rate. It was observed that S&P 500
has no role in the growth of FII inflow, and changes in FII inflows do not induce change in the exchange rate. Thus, the key focus area is the domestic investment policy reforms rather than influence of developments in the US equity market.

VAR III model is estimated for endogenous variables – NETFII & Sensex return. It was observed that bi-directional causality existed between Sensex return and net FIIs. This means that the market information efficiency hypothesis may be rejected for Sensex return and net FIIs.

VAR IV model considers growth of Sensex, growth of FII outflows, change in the exchange rate and growth of S&P 500. It was observed that FII outflows can be forecast by the change in the exchange rate which is influenced by change in Sensex return. Further, the variation in Sensex return has persistent influence on the change in exchange rate. The granger causality indicated that FII outflows largely depend on themselves as well as on the stability of the exchange rate. The Rupee depreciation will enhance speed of outflow of FIIs in the short duration. Therefore, stability of exchange rate is essential to curb outflow of FIIs.

Hence, overall, FII inflows and outflows are significantly influenced by the returns in the domestic equity market. The exchange rate has no effect on the inflows of FIIs; however, the outflows are influenced by the change in the exchange rate. Sensex returns bring a change in the exchange rates. Change in exchange rate affects the outflow of FIIs. The US equity market has no influence on FII’s inflows but has a marginal influencing role on its outflows.

Thus, attractive investment climate, FII policy reforms and stability of exchange rate is essential for increasing inflows of FIIs. The study provided insights to move towards a liberalized FII’s policy framework for regaining foreign investors’ confidence in the Indian equity market.

The study in the third phase uses VAR models to examine short-run and long-run relationships between 11 major sectoral indices of BSE for the daily data from
23/8/2004 to 31/12/2010. It determines how movements of sector indices contribute to the variation in the Sensex returns. It also traces interlinkages between the sectoral indices. The daily data is divided into four sub-periods due to structural breaks. An independent VAR model analysis for the four sub periods was performed. This analysis provided a better insight for diversification and investment strategies for different sectors.

No long-run relationship was observed for the first three sub periods. This fact provides possibility of existence of profitable investment opportunities for portfolio diversification in the long-run. However, during the post subprime crisis, long-term relationships between sector indices were found. This indicates minimal benefits from diversifying investments into different sectors in the long-run.

During all the four sub-periods, limited short-run relationships between sector indices were observed. Banking index played a predominant influencing and integrating role in driving the other indices in all phases. The other major drivers are Metal (1st), Power and Realty (2nd), Metal, CG (3rd) and Metal and Realty (4th sub-period). FMCG Index is the least integrated in 1st and 2nd sub-periods giving the best opportunity for diversification of investments.

Bankex is the predominant driver for integration and information spillover for all sub periods. Bankex is integrated with most of the sectoral indices which were found to be highly interdependent on it. The shocks transmitted by it are quick and strong, triggering higher volatility in most sectors. Hence, during the recessionary period, the financial problems of one sector may be passed on to the interlinked sectors which are integrated with Bankex. Thus, the study reveals and validates importance of Indian Banking sector.

For the 1st sub-period from 23/08/2004 to 8/7/2007, the VAR model comprised of Bankex, IT, Oil & Gas, FMCG, Auto, CG, Metal & Health care indices. It was found that Bankex, Metal and CG indices are the significant drivers. These sector indices may potentially be employed in predicting short-term movements of other sector
indices such as Oil & Gas, FMCG and Auto. There is a scope for deriving benefits from portfolio diversification in the short-run. Volatility in Bankex and Metals during the recessionary conditions may bring volatility of higher magnitude in Oil & Gas, FMCG and Auto indices. The Metal sector, in particular, created maximum volatility in itself and higher return in all other indices. Fast Moving Consumer Goods (FMCG) is the least integrated amongst all sector indices. It provides profitable opportunities for portfolio diversification advantages. It was observed by the GIFR that CG is highly integrated; no diversification benefit may be achieved from this index. A sudden fall in the CG returns will adversely influence many other sectors. Capital Goods industry numbers have shown fluctuations due to a poor investment climate, which gets reflected in the performance of the IIP. Thus, the focus should be to review and reform policies for Banking, Metal and the CG sector.

In the 2nd sub period, from 9/07/2007 to 15/01/2008, Power and Realty indices were introduced due to their growing importance. The VAR model for this sub period comprised of Bankex, Oil & Gas, FMCG, CG, Power and Realty index. No long-run relationship between the six sectoral indices was observed. This implies that in the long-run investors may benefit from diversifying their investments into different sectors. Existence of short-run unidirectional granger causality from Bankex to Capital Goods, Power and Realty was seen. It was also observed by the GIFR and Variance Decomposition Analysis (VDC) that during the 2nd phase, Bankex played a predominant influencing and integrating role in the Indian capital market for the short-run. It generated volatility and provided insight for the price discovery of other sector indices. Oil & Gas index followed it. FMCG is the least integrated and in the short-run it has potential for investment diversification. Power & Realty both appeared to be highly integrated with other sectors and are the possible sectors for policy reforms.

The sub-prime crisis period from 6/01/08 to 9/03/09 had a downward trend of all sector indices, registering negative returns. Infrastructure was most affected and FMCG showed maximum volatility. The VAR model comprised of Bankex, IT, Oil & Gas, FMCG, Auto, CG and Metal. No long-run equilibrium was found. During the recessionary period, FMCG stocks moved downwards with Bankex, Oil & Gas and
Auto. Both VDC analysis and GIRF indicated that even during the recessionary period, Bankex played a predominant integrating role with other sector indices. Thus, downtrends in the banking sector bring down other sector indices. It validates that sound Banking policies have contributed in protecting our economy up to some extent during global recessionary conditions. Thus, future recessionary trends may be controlled by regulatory reforms in the Banking sector. Other sectors which created volatility during this period are: CG, Metal and Oil & Gas. Hence, in the short-run, policy relating to Banking, CG, Metal and Oil & Gas would have control downtrends of other indices in a similar economic scenario.

During the post recessionary period, from 4/09/2009 to 31/12/2010, the sectoral indices and Sensex started showing an upward trend. Consumer Durable and Oil & Gas registered highest returns and highest volatility of returns, respectively. Relative low volatility was observed for Healthcare and Auto sector.

The **Johansen and Juselius (1990)** multivariate cointegration analysis confirmed the existence of two co-integrating vectors. This implies long-term relationship between sector indices. The significant implication of this finding is that the different sectors of the Indian capital market are influenced by the economic fundamentals which tend to bring these sectoral indices together in the long-run. This validates connection between the phase 1 and phase 2 of the study with the phase 3. Further, the investors with long holding periods may get only moderate advantage from diversification strategy. The GIRF and VDC analysis indicated that Bankex is integrated with major sector indices and had created high volatility in the other sector indices. Highest order of volatility happened in Reality and Metal index, which got contemporaneously transmitted to all sector indices.

Thus, a robust banking policy plays an important role in the growth in the period of recovery. This may also help in controlling unexpected losses of other major sectors during recessionary periods. Further, relevant policy for Metal and Realty sector would protect average returns of the other sectors during recessionary period.
Thus, the findings validate growing importance of the sector indices as it will help in suitable investment strategies for different economic conditions.

The empirical findings of the study may be valid for the other emerging markets and may provide insights for policy formulation and investment diversification strategies by focusing on the sector indices.

1.8 Plan of the Study

The dissertation is divided into seven chapters including the present.

Chapter I introduces the topic, need and significance of the study, research objectives, hypothesis, research methodology, source of data, empirical findings, research plan and limitations.

Chapter II contains literature review for both Indian as well as international research, reviews objective and hypothesis, provides literature reviews for the three phases of the study, and for variable selection and identifies specific research gaps.

Chapter III relates to the conceptual framework, outlines research questions, key assumptions, objectives and hypothesis, provides brief inputs to readers about variables, sectors and related policies, and suggests strategy to address the research gaps.

Chapter IV focus on research methodology, research design, data source, period of study and theoretical frame work providing concepts and theory to conduct sequentially statistical and econometrics analysis for decision making.

Chapter V gives detailed data analysis for the first two phases of the empirical research and presents analysis of results. The data analysis starts with interpretation of descriptive statistics, test stationarity of time series, checks for co-integration, develops VAR and VECM, and analyzes Granger causality as well as uses impulse response function and VDC to understand the relationship between the variables.
Chapter VI contains data analysis, interpretation and results for phase 3 of the study. The data analysis using VAR models for different sub periods have been done comprehensively focusing on behavior and relationships between sectoral indices.

Chapter VII provides conclusions of the study and implications of the results for policy formulation. It summarizes the empirical findings and identifies few potential areas for further research.

1.9 Limitations of the Study

The study is based on the assumption that the time series of the macroeconomic variables is sensitive to capture information relating to the changes in the business and economic environment. The first limitation relates to availability of data. The study for the first phase focuses on the influence of macroeconomic variables on Sensex post liberalization period from 1991. As the complete data for all identified macroeconomic variables from 1991 to 1994 is not available, the study was conducted using the secondary data which is available from 1st January 1995 to 31st December 2009.

The IIP (1993-94; base year) captures manufacturing activities is one of the variables of study. The monthly data for IIP (1993-94; base year) is only available. The old base year’s IIP series has compounded problems which have been discussed in §3.10.1. Since that data for IIP for the new base year (2004-05) is not available, the analysis has been conducted using monthly data for the old IIP series.

The second limitation relates to the usage of methodology. The study has not considered a few variables for further study which are stationary at levels since the methodology for co-integration for different level of stationarity of variables has not been applied. This problem could have been overcome by employing Toda and Yamamoto (1995) methodology for estimating augmented VAR for integrated time series of arbitrary order. Alternatively, Autoregressive Distributed Lag (ARDL) model could have been used.
VAR models are theoretical in nature, using little information from financial and economic theory. It is difficult to choose correct lag length for VAR model as different methods come out with varied lag lengths. In case of unrestricted VAR having large number of variables with many lags, the degree of freedom gets substantially reduced, leading to loss of efficiency and inclusion of irrelevant meaningless variables. Further, the ordering of variables is significantly important for impulse and VDC. This problem is overcome by the usage of generalized impulse response function.

The third limitation is about scope of the study. This could have been widened by considering influence of specific macroeconomic variables driving key sector indices. The study has only considered the influence of S&P 500 on the Indian capital market. The combined influence of other integrated capital markets, represented by FTSE 100, NIKKEI, SSE composite index and MSCI emerging market index, could have revealed a better insight of interlinkages of economies using panel data cointegration analysis.