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"IMPACT OF MACRO-ECONOMICS VARIABLES WITH RESPECT TO SENSEX"

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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 inter linkages 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 globalized 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. "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%, 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%, in 2009-10 and 2010-11, grew by only 6.5%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 paripassu

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.

1.3 Objectives of the Study

To find out the relationship between long-run and short-run identified macroeconomic variables and Sensex.

1.4 Macroeconomic Variables and Their Relevance for the Study

1.4.1 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.

1.4.2 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.

1.4.3 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 2011-12.6 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.

1.4.4 FII Foreign Institutional Investors (FIIs): They 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 2009-2010.8 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.

1.4.5 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 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%.

1.4.6 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.

2.1 LITERATURE REVIEW

The review of the literature provides a cross section of representative sample of studies done for both global markets and domestic Indian stock market. Many of these studies have initiated new modeling techniques, expanded theoretical concepts, explored new hypothesis, and focused on different economies depending on their objectives. The literature review has been done in the three phases. The study deals with the relationships between macroeconomic variables and stock market returns.

There have been numerous studies on the impact of macroeconomic variables on stock price for developed economies. The objective is to identify and include macroeconomic variables in the suitable robust model, and to determine the relationship of variables which contribute to price movements of Indian stocks in the long-run as well as the short-run. The significant contribution is of Chen, Roll and Ross (1986) who concluded that stock returns are exposed to systematic economic news and are priced in accordance with their exposure. The paper also provided a basis that a long-term relationship exists between stock prices and relevant macroeconomic variables. They used seven macro variables' data series – industrial production, risk premium, inflation, and term structure of interest rate, market return, oil prices and consumption. It was assumed that these variables are serially uncorrelated. It was observed that industrial production, spread between long and short interest rates, expected and unexpected inflation, and the spread between high and low grade bonds, are sources of risk and are significantly priced. They found that oil price risk is not separately rewarded in the stock market. Fama (1970, 1990, and 1991) studied the relationship between fundamental economic activities and stock market return. Fama (1991) suggests that stock prices reflect earnings, dividends and interest rate expectations as well as information about future economic activity. Stock returns affect the wealth of investors which in turn influences the level of consumption and investment. Geske and Roll (1983) concluded that the US long-term interest rates show a significantly negative influence on share prices. Hamo (1988) has done a similar study on the Japanese stock market by APT and found that changes in inflation, unexpected changes in the risk premium, and term structure of interest rates, significantly affects stocks. He observed that changes in monthly production is weekly priced and unexpected changes in the exchange rate as well as changes in oil prices are not priced in the Japanese stock market. Schwert (1981, 1990) showed that growth of industrial production is a significant factor for long-run stock return. Brown and Otsuki (1990) found that money supply, production index, crude oil price, exchange rate and call money rates are associated with a significant risk premium in pricing Japanese equities.

The relationship between the set of macroeconomic variables and stock price is done extensively for developed markets but limited studies have been conducted for emerging markets particularly for India. Research studies have been done for the different countries on the basis of varied sets of significant macroeconomic variables using different methodologies. Some are summarized below:

Rad A (2011) used the unrestricted VAR model to examine the relationships between Tehran Stock Exchange (TSE) price index and three macro-economic variables – Consumer Price Index

(CPI), free market exchange rate and liquidity (M2) on the monthly data for a period from 2001 to 2007. The impulse response analysis indicated that the response of TSE price index to shocks in the three macro-economic variables is weak. The generalized forecast error variance decomposition reveals that the contribution of macroeconomic variables in fluctuations of TSE price index is around 12%.

Asaolu T &Ogunuyiwa (2011) examined the impact of macroeconomic variables on Average Share Price (ASP) for the Nigerian stock market. The monthly data from 1986 to 2007 was taken for six macroeconomic variables – external debt, exchange rate, foreign capital flow, investments, industrial output and inflation rate. The Average Share Price for 25 quoted companies from Insurance, Manufacturing, Banking, Services and Real estate were taken representing dependent variables where as others as exogenous variables. Granger causality test, co integration and Error Correction Method (ECM) were employed and results revealed existence of weak relationship between ASP and macroeconomic variables. A long-run relationship was found between ASP and macroeconomic variables. The findings indicated that ASP is not a leading indicator of macroeconomic performance in Nigeria

Baek IM & Jun J (2011) tests for existence of financial contagion using a method which allows an incubation period before contagion takes effect. Contagion is an increase in cross-market linkages following shocks. Using daily data on the total return index for selected Asian countries in 1997 to 1998, strong evidence for existence of financial contagion was found during the Asian crisis. The evidence remains robust even when global and regional factors as well as heteroscedasticity and serial correlation are explicitly controlled. A significant upward shift in the linkage between the stock returns of Thailand and other Asian countries was found.

Hosseini M, Ahmad Z & Lai Y (2011) examined relationships between stock market indices of China and India and four macroeconomic variables, crude oil price (COP), money supply (M2), industrial production (IP) and inflation rate for the period between 1999 to 2009. They used Johansen-Juselius (1990) multivariate cointegration and VEC model technique which indicated that both countries have short as well as long-run relationships between macroeconomic variables and market index of individual countries. The results for both economies are different. In the long-run the impact of increase in crude oil price and money supply for China is positive, whereas, for India, it is negative. The influence of industrial production for China is negative. The effect of inflation for both stock indices is positive. In the short-run, crude oil price has contemporaneous effect for India but negative and insignificant for China. The immediate effect of inflation on current Chinese stock index (SSE) is positive and significant. However, for India it is negative but insignificant. This analysis will help investors to enhance their knowledge for both short-term and long-term investment strategies for both countries.

Ahmet B (2010) analyzed the effects of macroeconomic variables on the Turkish stock exchange market by consumer price index, money market interest rate, gold price, industrial production index, oil price, foreign exchange return, and money supply, and the main Turkish stock market index (Istanbul Stock exchange, ISE-100) for monthly data from January 2003 to March 2010. A Multiple regression model was designed to test relationships between macroeconomic variables

and ISE-100. It was found that interest rate, industrial production index, oil price, and foreign exchange rates have a negative impact on ISE-100 Index returns. Inflation and gold price do not have any significant influence on ISE-100 returns.

Von Lach, Krakau (2010) employed application of linear, non-linear and long-run Granger causality tests in order to examine causal links between the main Polish market price index (WIG) of the Warsaw stock exchange and four macroeconomic variables, namely the value of sold industrial production, unemployment rate, interest rate, and rate of inflation by using monthly data from January 1998 to June 2008. All macroeconomic variables were found to have a long-run causal influence on the performance of the stock market. The linear causality analysis strongly supports the hypothesis that the Polish stock market is informationally inefficient with respect to the value of sold industrial production and interest rate. Further test results provided grounds for claiming that the stock market has already incorporated all past information on the unemployment and inflation rate as no linear causal influence was found for these. They found bidirectional linear causal relationship between the stock market index and sold industrial production and a strong evidence of linear and nonlinear Granger causality from changes in the interest rate to fluctuations in the stock market index.

Bilquees, Mukhtar& Malik (2010) focused on investigating the impact of exchange rate volatility on exports of India, Pakistan and Sri Lanka using VECM technique for yearly data for a long period 1960 to 2007.Their findings indicated the presence of a unique cointegrating vector linking real exports, relative exports prices, foreign economic activity and exchange rate in the long-run. It was also observed that real exchange rate volatility exerts a significant effect in both the short and long-run. Improvement in the terms of trade represented by the decline in the real exchange rate and real foreign income exerts positive effect on export activities. Maintaining a stable competitive real exchange rate will enhance exports in the three countries.

HasanA&Javed M (2009) examined the both short-run and long-run relationships between macroeconomic variables and equity market returns using monthly data for a period from 6/1998 to 6/2008 by using the VAR frame work. The variables considered are industrial production index, consumer price index, money supply, exchange rate, foreign portfolio investments, Treasury bill rates and oil price. It was found that a long-run relationship exists among macroeconomic factors and the equity market. Unidirectional Granger causality was found from consumer price index, exchange rate, money supply and interest rate to equity market. There was no Granger causality among industrial production, foreign portfolio investment and equity market return. VDC analysis indicates that the monetary variables bring volatility in the equity market.

Pilinkus D (2009) analyzed the relationship between 40 macroeconomic variables (!) and the Lithuanian stock market index (OMXV). The objective is to investigate whether stock prices may serve as a leading indicator for macroeconomic variables in the Lithuanian economy or a group of macroeconomic variables may serve as a leading indicator for stock returns. Granger causality tests have been employed to estimate the relationship between the OMXV index and 40 macroeconomic variables depicting the health of Lithuanian economy. It was found that some

macroeconomic variables (GDP deflator, net exports, foreign direct investment) lead OMXV, whereas, macroeconomic variables (GDP, material investment, construction volume index) are led by the OMXV index and macroeconomic indices (money supply, payment balance) and the stock market returns Granger-cause each other. The study establishes existence of a relationship between stock market returns and most of macroeconomic variables.

Humpe and Macmillan(2009) applied cointegration analysis on stock prices in the US and Japan and found that US stock prices are influenced positively by industrial production and are negatively related to both the consumer price index and long-term interest rates.

Adam, Anokye M, Tweneboah& George (2008) examined the impact of macroeconomic variables, namely, inward foreign direct investments, treasury bill rate, consumer price index, average crude oil prices on Ghana stock prices using cointegration test and VECMs. They established co-integration between macroeconomic variables and stock prices in Ghana indicating a long-run relationship. The lagged values of interest rate inflation have significant influence on the stock market. The inward foreign direct investments, oil prices and exchange rate show weak influence on price changes. The stock index is not informational efficient with respect to interest rate, inflation, inward FDI, exchange rate and world oil price.

Adam, A M &Tweneboah G (2008) employed multivariate cointegration and error correction model to examine the impact of Foreign Direct Investment (FDI) on the stock market development in Ghana. The study indicated that there exists a long-term relationship between FDI, nominal exchange rate and stock market development in Ghana. They found that a shock to FDI significantly influenced development of the stock market in Ghana resulting in sector specific policy implications.

Ratanapakorn and Sharma (2007) investigated long term and short-term relationship between the US stock price index (S & P 500) and six macro-economic variables namely industrial production index, narrow money supply (M1), treasury bill rate, government bond rate, inflation rate, Yen /$ exchange rate and observed that the stock prices negatively relate to the long-term interest rates and every macroeconomic variable causes stock prices in the long run but not in the short-run.

Chachart S, Valadkhani A and Harvie C (2007) examined the impact of fifteen stock market indices and five macroeconomic variables – Consumer Price Index, Exchange rate, Interest rate (on money), Money supply (M2) and Oil price on the Thai stock market for the pre and post 1997 period on the basis of monthly data from 1988:1 to 2004:12 using a GARCH-M model. It was found that the Singapore stock market influenced Thai stock market for both the pre and post 1997 period. Indonesian and Malaysian stock market were significantly related to the Thai stock market during pre-1997, whereas, Korean and Philippines played predominant role for variation in the Thai stock market during post 1997. Thus, the Thai market was largely influenced by regional neighboring countries and non-regional markets had insignificant role. This explains why the financial crisis of 1997 remained a regional crisis.

Christopher G, Minsoo L, Hua Y & Jun Z (2006) examined the relationship between New Zealand Stock Index and a set of seven macroeconomic variables – Inflation Rate (CPI), Exchange Rate (EX), Gross Domestic Product (GDP), Money Supply (M1),Short-term Interest Rate (SR) and Domestic Retail Oil Price (ROIL) from 1990 to 2003 using cointegration test. They have employed Johansen Maximum Likelihood and Granger-causality test to determine whether the New Zealand stock Index is a leading indicator for macroeconomic variables. It also examines the short run dynamic linkages between NZSE-40 and macroeconomic variables using innovative accounting analysis. It was seen that in general NZSE-40 is consistently determined by interest rate, money supply and real GDP, and no evidence was found that NZSE-40 is a leading indicator for the changes in the macroeconomic variables.

Erdem, Arslan and Erdem (2005) examined volatility spillover from inflation, exchange rate, M1 money supply and industrial production to Istanbul Stock Exchange's stock price indices including IMKB 100, financial, industrial and services indices using monthly data. EGARCH model captured significant unidirectional spillovers from inflation, interest rate to all stock price indices. There are negative volatility spillovers from inflation to stock price indices except the Service Index and positive spillover from interest rate to stock price indices except Service Index (Negative spillovers). Spillovers from M1 money supply to the financial index and from exchange rate to both IMKB 100 and industrial indices were observed. There is no volatility spillover from industrial production to any index.

Chaudhuri K & Smiles S (2004) used multivariate cointegration methodology to investigate long-run relationship between real stock price and measures of aggregate real activity which includes real GDP, real private consumption, real money and real price of oil for Australian market. Using quarterly data from 1960:1 to 1984:4, they established existence of a long-run relationship between real stock price and real activity. The error correction technique indicated that the real stock prices are related to the changes in the real economic variables. It was further found that the stock market variations in the US and New Zealand markets significantly affects Australian stock return movements.

Dritsaki and Dritsaki (2004) studied the long-run relationship between the Greek stock market index and macroeconomic variables industrial production, inflation and interest rate and found a significant causal relationship between these and stock prices.

Wongbangpo and Sharma (2002) studied interdependence between the stock markets and fundamental macroeconomic factors for the five South East Asian countries – Indonesia, Malaysia, Philippines, Singapore and Thailand – on the basis of monthly data for GNP, consumer price index, money supply, interest rate and exchange rate for these countries. The results indicates that high inflation in Indonesia and Philippines influences the long-run negative relation between stock prices and money supply, whereas, the money growth in Malaysia, Singapore and Thailand imparts positive effect on their stock markets. The exchange rate is positively related to the stock prices in Indonesia, Malaysia and Philippines and negatively related for Singapore and Thailand.

3.1 RESEARCH INTRODUCTION

This chapter provides a framework for research design, data and period of study, data source, theoretical framework and process to conduct the study. It also focuses on the basic concepts and related statistical and econometric methodologies used. Secondary data, including monthly and high frequency daily data, has been obtained from different reliable sources which are used in a comprehensive manner to conduct conclusive research. Descriptive and Inferential statistics and different econometric techniques are employed in a scientific manner for data analysis. Its interpretation is done for rational decision making and for identifying evolving policy issues.

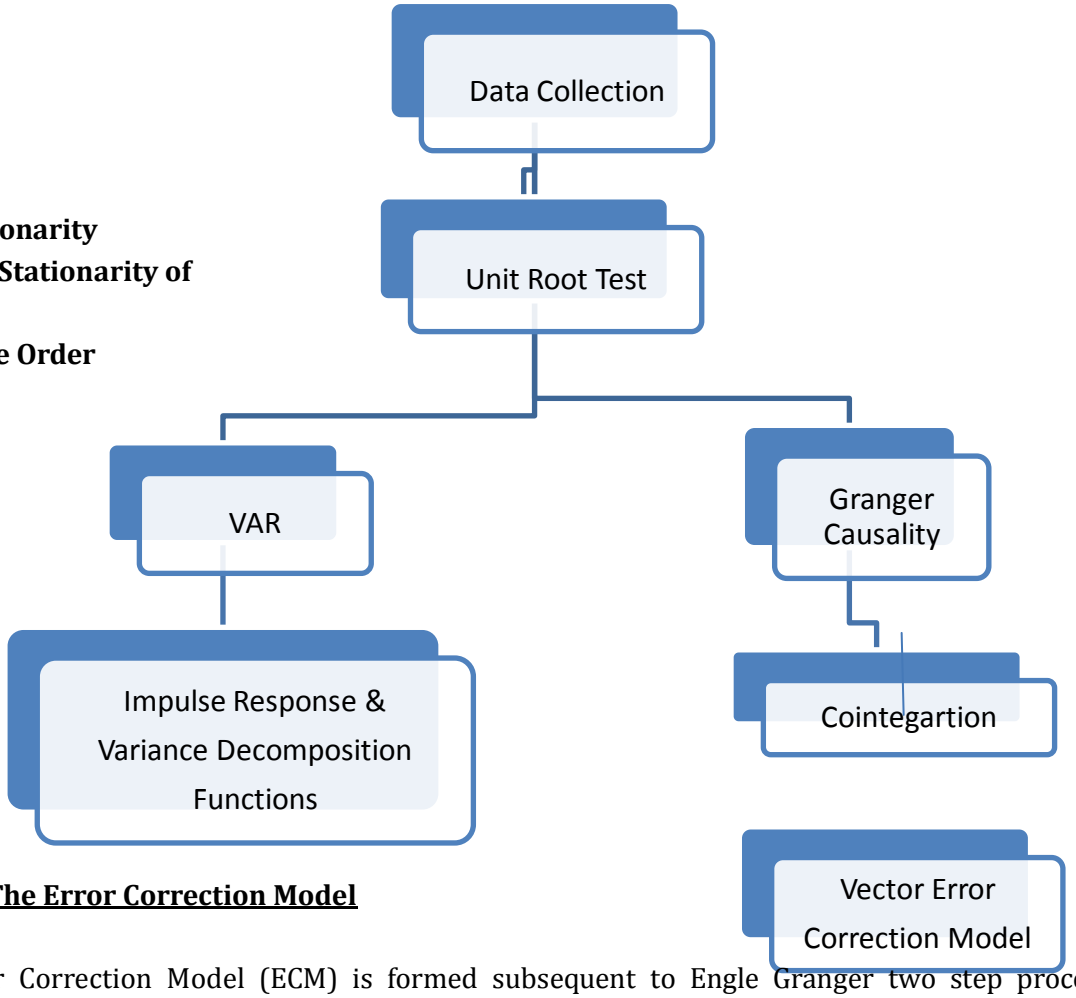
3.2 Research Objective

The study explores 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.

3.3 Research Design

Extensive exploratory research has been conducted by reviewing the literature so as to identify relevant macroeconomic variables and suitable methodologies used for conducting the study. Monthly data for the post liberalization period, from October 2015 to March 2016, is employed to identify a robust VAR model for studying the impact of macroeconomic variables on Sensex. The focus of the study is on the post liberalization period of Indian economy, since 1991, during which many significant economic reform measures were taken, which have gradually affected the Indian stock market. The time series data used to the identified variables: Bombay Stock Exchange (BSE) Sensex), Inflation(WPI), Index of Industrial Production (IIP), Imports(IMPO), Exports(EXPO), FII, Foreign Exchange Reserves (FER),and Gold Price (GP). The sample monthly data for the selected variables ranging from October 2015 to March 2016 (6 months) from different reliable sources have been employed.

3.4 Flow chart for VAR & Error Correction Model



3.5 The Error Correction Model

Error Correction Model (ECM) is formed subsequent to Engle Granger two step processes. Assuming that the original time series is non stationary, the existence of co-integration is tested. If there is no co integration then there is no need of ECM, in such case the first difference model can be formed. If the variables are cointegrated, then formation of Error Correction Model may be suitable.

The proposed model for the study estimates relationship between Sensex, WPI, IIP, Inflation, IMPO, EXPO, FII, FER and GP

Which is represented by:
Z= (Sensex, WPI, IIP, Inflation, IMPO, EXPO, FII, FER, GP)' where Z is a 9x1 vector of variables.

Stationarity is important for the purposeful data analysis; if the time series is nonstationary then the results of classical regression analysis will not be valid. OLS regression procedure of non-stationary series is meaningless and such phenomenon is known as spurious or nonsense regression.If the time series is non-stationary, then it is possible to have a high $R^2$and very high value of t–ratios, even though the series are unrelated. The standard assumptions for asymptotic analysis will not hold good after running regression. The t-ratio will not follow t-distribution and F-statistics will not follow F-distribution.

3.6 Source of Data

The study uses secondary data taken from different reliable databases for empirical analysis. The time series monthly data from October 2015 to March 2016 has been taken for the identified macroeconomic variables for the 1st phase of the studyThe 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 ofStatistics on Indian Economy, RBI, Director General of Commercial Intelligence andStatistics (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 USequity market, daily data from October 2015 to March 2016 has been taken fromthe Business Beacon, www.bseindia.com and www.uk.finance.yahoo.In the 3rd phase, econometric analysis of eleven sector indices has been conductedusing the daily data from October 2015 to March 2016 taken from www.beseindia.comand the CMIE database, Prowess.

4.1 DATA INTERPRETATION

	EXPORT	FCR	FII	GOLD	IIP	IMPORT	INFLATION	SENSEX	WPI
Mean	2353179.	23289.15	4248.223	26853.48	14384.50	993026.9	0.060946	25420.84	152.3967
Median	1996475.	23222.10	3928.490	26449.50	14634.50	1016092.	0.063200	25590.65	136.6500
Maximum	11164943	23909.50	13086.79	30002.00	14975.90	1476624.	0.067200	27470.81	359.0000
Minimum	527223.0	22758.00	540.7700	24882.00	12968.80	143829.0	0.055300	22951.83	97.00000
Std. Dev.	1257217.	303.5366	1871.268	1599.995	643.5520	237867.9	0.004024	982.2018	47.46552
Skewness	2.978127	0.214282	2.060188	0.593106	(1.540162)	(1.059187)	0.095209	(0.391005)	1.950922
Kurtosis	16.78827	2.200677	9.893235	1.883891	3.913527	5.044057	1.760269	3.043779	7.988903
Jarque-Bera	1710.749	6.237942	489.0808	20.11706	78.28218	65.71470	11.93004	4.652033	304.1943
Probability	0.000000	0.044203	0.000000	0.000043	0.000000	0.000000	0.002567	0.097684	0.000000
Sum	4.28E+08	4238626.	773176.7	4887333.	2617979.	1.81E+08	11.09220	4626592.	27736.20
Sum Sq. Dev.	2.86E+14	16676335	6.34E+08	4.63E+08	74962808	1.02E+13	0.002930	1.75E+08	407788.5
Observations	182	182	182	182	182	182	182	182	182

	EXPORT	FCR	FII	GOLD	IIP	IMPORT	INFLATION	SENSEX	WPI
EXPORT	1.000000	0.156018	0.168351	0.116573	(0.030319)	(0.136823)	0.005025	0.749112	0.003960
FCR	0.156018	1.000000	0.030528	0.662555	(0.605200)	0.282657	(0.716200)	0.789599	(0.135767)
FII	0.168351	0.030528	1.000000	0.109305	0.101765	(0.210786)	0.144792	0.774642	0.161124
GOLD	0.116573	0.662555	0.109305	1.000000	(0.512404)	0.331436	0.792081	(0.772081)	(0.020640)
IIP	(0.030319)	(0.605200)	0.101765	(0.512404)	1.000000	(0.350492)	0.541708	0.780844	(0.165401)
IMPORT	(0.136823)	0.282657	(0.210786)	0.331436	(0.350492)	1.000000	(0.458107)	(0.759834)	0.091633
INFLATION	0.005025	(0.716200)	0.144792	0.792081	0.541708	(0.458107)	1.000000	(0.813221)	0.095037
SENSEX	0.749112	0.789599	0.774642	(0.772081)	0.780844	(0.759834)	(0.813221)	1.000000	0.773608
WPI	0.003960	(0.135767)	0.161124	(0.020640)	(0.165401)	0.091633	0.095037	0.773608	1.000000

4.2 Correlation Analysis

Correlation measures the strength of relationship between the two random variables. The correlation matrix of 8 macroeconomic variables indicates that there is a high degree of correlation between the following variables. Sensex is positively and strongly associated with Export, FCR, FII IIP & WPI. The dependent variable, Sensex is negatively and strongly associated with Gold price, Import and Inflation higher degree of correlation means there may be multicollinearity exist between the random variables. In this study VIF (Variance Index Factor) is less than 10, which mean that there is no multicollinearity exist between the random variables.

4.3 Multiple Regression Model

Dependent Variable: Sensex
Included observations: 180

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4501.477	4313.105	1.043674	0.2982
WPI	-3.044226	30.31836	-0.10041	0.9201
Import	-0.000164	0.001435	-0.11444	0.909
Export	-0.012594	0.003268	-3.8532	0.0002
Iip	42.64197	9.44278	4.515828	0
Inflation	-17.79607	103.9658	-0.17117	0.8643
Gold	0.168585	0.045755	3.684517	0.0003
FII	0.007701	0.001663	4.631094	0
FCR	0.00056	0.000244	2.293614	0.0231
R-squared	0.948156	F-statistic		333.8025
Adjusted R-squared	0.936989	Prob(F-statistic)		0
S.E. of regression	938.3871	Durbin-Watson stat		0.790435
Sum squared reside	146000000			

Table provides spurious multiple regression of Sensex on 8 explanatory variables. The multiple regression equation is:

Sensex= 4501.4769 - 3.0442*WPI-0.0002*Import- 0.01259*Export + 42.6419*IIP-17.7961*Inflation +0.1685*GP+ 0.0077*FII+ 0.0006*FER

4.3.1 Interpretation

The inferences drawn from the multiple regression analysis are:

1. The goodness of fit measure R2= 0.948156. It implies that 94.8% variation of the dependent variable Sensex is explained by the combined variation of 8 independent macroeconomic variables. Adjusted R2=0.936989implies high goodness of fit. The high value of R2 measures goodness of fit but it also indicates unnecessary inclusion of a few explanatory variables and multicollinearity problem.
2. The other measure of goodness of fit is F-statistics (=333.8025). It reflects joint explanatory power of 8 independent variables. The p-value=0.0000< .05, therefore, reject H0:β1=β2=β3……=β13=0 (no joint explanatory power); H1: βi ≠βj; for at least one i

≠ j at 5% level of significance. Thus, significant explanatory power for goodness of fit is explained by F- statistics.

3. Durbin Watson Statistics d is 0.790435 < R2 = 0.963156, this means existence of auto correlation and apparently the regression is spurious.(R2>d, according to Granger &Newbold is a good rule of thumb that estimated regression is spurious)

4.4 Normality of Error Terms

The distribution of error terms is marginally positively skewed with kurtosis slightly more than 3, implying distribution of errors is almost normal. Further, the JB statistics is 5.283385 which is less than the tabulated value of $\chi 2$ at 5% is 5.991.Therefore, do not reject null hypothesis that errors are distributed normally.

4.5 Econometric Data Analysis

A time series is strictly stationary if the distribution of its values remains the same as time progresses. Stationarity of time series could be tested by graphical analysis, correlogram test and unit root tests.

4.6 Correlogram

The correlogram indicates that the series is non-stationary and it also shows presence of significant auto correlation both positive as well as negative as many values of τ falls outside the 95% confidence interval (–0.14609, + 0.14609) (since T = 180, critical value=0.14609). This is further confirmed by Ljung-Box statistics (Q*) which tests the null hypothesis, Ho: No auto correlation against H1: There exists auto correlation. The null hypothesis is rejected at α=5%, as the p-values for all lag lengths for Q* statistics is 0.000 is less than 0.5). Thus, all autocorrelation coefficients are significantly different for zero at α=5%. This clearly indicates need for specification of the current model. However, stationarity needs to be tested by different unit root test.

4.7 Durbin-Watson Statistics (1950)

The value of Durbin-Watson statistics, d = 0.7904; refer to Savin and White (1977) table for a model which includes intercept, DL ≈1.600 for k=13, α=0.05(=1.550 for n =150 and DL=1.632 for n=200 at α=0.05).As d<DL, and, thus, reject null hypothesis indicating existence of positive auto-correlation.

4.8 Test for Stationarity

4.8.1 Augmented Dickey Fuller (ADF) Test:

The ADF follows same asymptotic distribution as of DF statistics. Thus, it will be appropriate to use MacKinnon critical values. The Table provides standard critical values for ADF and PP test. The ADF test confirms non-stationarity of time series at level assuming constant trend (except

for FII) at α =5% and using SIC. Whereas, for the model with constant without trend; it indicates that all-time series are non-stationary except for the Term Structure and FII at 5% level of significance. However at 10% Term Structure is also non-stationary.

4.8.2 Test for Cointegration:

Granger (1981) introduced concept of cointegration which was extended and improved by Engel and Granger (1987). An economic time series may be unstationary but its suitable linear combination may remove common trend. This makes the resulting new series to be stationary which imply that the time series are cointegrated. Two different streams of cointegration tests were developed: Engel and Granger (1987) test based on residuals of regression equation of I (1) variables and Cointegration Regression Durbin-Watson (CRDW) Test. Test developed by Johansen (1988, 1991) and Johansen and Juselius (1990) are based on VAR models focusing on system of equations.in this study the second one is used.

Johansen &Juselius (1990) provided a systematic test to examine the cointegrating rank indicating number of long-run relationships amongst macroeconomic variables by way of setting multivariate framework at an optimum lag length. According to Brook &Tsolacos(2003), 'Schwartz's criterion is well known for parsimonious models that it chooses, while Akaike's criterion can be very profligate and has tendency to select the largest model that is consistent with the data'. First step is to estimate VAR system for different lag length

4.9 Granger Test of Casuality

Lags: 2			
Null Hypothesis:	**Obs**	**F-Statistic**	**Prob.**
FCR does not Granger Cause EXPORT	180	0.44729	0.6401
EXPORT does not Granger Cause FCR		0.67336	0.5113
FII does not Granger Cause EXPORT	180	7.13490	0.0611
EXPORT does not Granger Cause FII		6.02820	0.0029
GOLD does not Granger Cause EXPORT	180	1.52583	0.2203
EXPORT does not Granger Cause GOLD		0.47409	0.6232
IIP does not Granger Cause EXPORT	180	2.12196	0.1229
EXPORT does not Granger Cause IIP		0.43991	0.6448
IMPORT does not Granger Cause EXPORT	180	0.72369	0.4864
EXPORT does not Granger Cause IMPORT		0.03399	0.9666
INFLATION does not Granger Cause EXPORT	180	0.00206	0.9979
EXPORT does not Granger Cause INFLATION		0.06421	0.9378
SENSEX does not Granger Cause EXPORT	180	0.19628	0.8220
EXPORT does not Granger Cause SENSEX		0.43886	0.6455

WPI does not Granger Cause EXPORT	180	1.09074	0.3382
EXPORT does not Granger Cause WPI		0.50191	0.6062
FII does not Granger Cause FCR	180	0.45387	0.6359
FCR does not Granger Cause FII		2.03336	0.1340
GOLD does not Granger Cause FCR	180	1.46580	0.2337
FCR does not Granger Cause GOLD		0.82285	0.4409
IIP does not Granger Cause FCR	180	2.92191	0.0565
FCR does not Granger Cause IIP		0.18423	0.8319
IMPORT does not Granger Cause FCR	180	0.30421	0.7381
FCR does not Granger Cause IMPORT		2.62557	0.0752
INFLATION does not Granger Cause FCR	180	1.24353	0.2909
FCR does not Granger Cause INFLATION		0.29244	0.7468
SENSEX does not Granger Cause FCR	180	0.58170	0.5600
FCR does not Granger Cause SENSEX		0.59409	0.5532
WPI does not Granger Cause FCR	180	1.91213	0.1508
FCR does not Granger Cause WPI		1.22893	0.2951
GOLD does not Granger Cause FII	180	1.43516	0.2409
FII does not Granger Cause GOLD		1.85235	0.1599
IIP does not Granger Cause FII	180	0.20156	0.8176
FII does not Granger Cause IIP		0.17416	0.8403
IMPORT does not Granger Cause FII	180	0.02580	0.9745
FII does not Granger Cause IMPORT		1.48844	0.2286
INFLATION does not Granger Cause FII	180	0.76721	0.4659
FII does not Granger Cause INFLATION		2.29944	0.1033
SENSEX does not Granger Cause FII	180	1.08082	0.3416
FII does not Granger Cause SENSEX		0.39610	0.6735
WPI does not Granger Cause FII	180	0.68220	0.5068
FII does not Granger Cause WPI		1.81352	0.1661
IIP does not Granger Cause GOLD	180	2.35683	0.0977
GOLD does not Granger Cause IIP		0.05404	0.9474
IMPORT does not Granger Cause GOLD	180	3.44280	0.2342
GOLD does not Granger Cause IMPORT		2.73197	0.0679

INFLATION does not Granger Cause GOLD	180	9.65639	0.3001
GOLD does not Granger Cause INFLATION		0.81964	0.4423
SENSEX does not Granger Cause GOLD	180	2.33906	0.0994
GOLD does not Granger Cause SENSEX		2.03193	0.1342
WPI does not Granger Cause GOLD	180	2.22238	0.1114
GOLD does not Granger Cause WPI		0.21821	0.8042
IMPORT does not Granger Cause IIP	180	0.76225	0.4682
IIP does not Granger Cause IMPORT		3.71337	0.0263
INFLATION does not Granger Cause IIP	180	0.29918	0.7418
IIP does not Granger Cause INFLATION		15.4734	0.6543
SENSEX does not Granger Cause IIP	180	0.54215	0.5825
IIP does not Granger Cause SENSEX		0.07007	0.9324
WPI does not Granger Cause IIP	180	0.01066	0.9894
IIP does not Granger Cause WPI		0.80063	0.4507
INFLATION does not Granger Cause IMPORT	180	5.56977	0.0445
IMPORT does not Granger Cause INFLATION		1.43662	0.2405
SENSEX does not Granger Cause IMPORT	180	1.23480	0.2934
IMPORT does not Granger Cause SENSEX		0.21385	0.8077
WPI does not Granger Cause IMPORT	180	1.08927	0.3387
IMPORT does not Granger Cause WPI		0.77259	0.4634
SENSEX does not Granger Cause INFLATION	180	3.23487	0.0717
INFLATION does not Granger Cause SENSEX		0.44581	0.6410
WPI does not Granger Cause INFLATION	180	0.05986	0.9419
INFLATION does not Granger Cause WPI		1.50634	0.2246
WPI does not Granger Cause SENSEX	180	0.08263	0.9207
SENSEX does not Granger Cause WPI		1.11024	0.3318

Engel and Granger (1987) and Granger (1986) employed cointegration techniques for studying long-run equilibrium between the variables. Lee (1992) employed a pioneering approach to study the relationship between share prices and macroeconomic variables. The VAR model technique foregoes many a priori spurious structural restrictions and has the ability to work with unrestricted dynamic representation of data. Thus it overcomes many limitations and is useful to study the pattern of interrelationships amongst the variables included in the model. In the above table it is found that all the above p value is greater than 0.05. Hence the Null hypothesis is accepted. It means that all the variables are independent of each other.

4.10 Selection of Model

Selection of a suitable model amongst the two models is done to decide whether an intercept or trend, or both may be included in the cointegrating relationship. Table gives the summary of the Trace and Max Eigen value statistics obtained by the Johansen's procedure for different models based on the distinct set of assumptions. It manifests a mixed picture of existence of number of cointegrating vectors. However, the positive outcome of this analysis is that it ensures that the series will be co integrated with at least 2 cointegrating vectors. The cointegration of several variables indicates existence of long-term relationship between trends of variables. The Error Correction Model (ECM) will be the most suitable in comparison to a model comprising of the first difference of the macroeconomic variables. The ECM will capture both long- and short-term relationship between the time series

Table relates to the model selection process for identification of most the representative model. Moving through Table for Model 1, row by row, First time, H0 is not rejected at 5% when the numbers of cointegrating equations are 3. This happens as the trace statistics is117.8199< critical value = 115.6154.This is also confirmed by the maximum Eigen value test statistics max = 49.45216< critical value = 46.23142; when the number of cointegrating vectors is 23. Thus, both trace test and maximum Eigen value test confirm existence of 2 long-run or co integrating relationships between Sensex and other macroeconomic variables in the multivariate model.

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.333865	244.0803	197.3709	0.0000
At most 1 *	0.264402	172.1716	159.5297	0.0085
At most 2*	0.199800	117.8199	115.6154	0.0135
At most 3	0.163792	78.36773	95.75366	0.4207
At most 4	0.098070	46.70640	69.81889	0.7719
At most 5	0.065920	28.43680	47.85613	0.7944
At most 6	0.045294	16.36658	29.79707	0.6863
At most 7	0.043041	8.162291	15.49471	0.4482
At most 8	0.002117	0.375176	3.841466	0.5402

Trace test indicates 2 cointegratingeqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.333865	71.90862	58.43354	0.0015
At most 1 *	0.264402	54.35174	52.36261	0.0309
At most 2	0.199800	49.45216	46.23142	0.0414
At most 3	0.163792	31.66134	40.07757	0.3219
At most 4	0.098070	18.26959	33.87687	0.8637
At most 5	0.065920	12.07022	27.58434	0.9298
At most 6	0.045294	8.204288	21.13162	0.8908
At most 7	0.043041	7.787115	14.26460	0.4008
At most 8	0.002117	0.375176	3.841466	0.5402

Max-eigenvalue test indicates 2 cointegratingeqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

From the above we can conclude that:

H0A: There is a long-run and short-run relationship between identified macroeconomic variables and Sensex.

H1A: There is neither a long-run nor short-run relationship between identified macroeconomic variables and Sensex.

The null hypothesis is accepted as there are both long-run and short-run relationships between the Sensex and the 8 identified macroeconomic variables namely: WPI, inflation, IIP, exchange rate, imports, exports, foreign exchange reserves and gold price. This is also confirmed by the Johansen cointegration test. This implies that the Indian stock market is informationally inefficient. These variables may be used to predict stock movements. One reason for inefficiency could be availability of limited information or lack of modernization of processes employed in information technology. Second reason is absence of timely coordination to connect with the market for information relating to fundamental.

H0B: There is a robust VAR model to explain the relationship between macroeconomic variables.

H1B: There is no robust VAR model to explain the relationship between macroeconomic variables.

It is seen that there exists a VECM comprising of 8 macro-economic variables & Sensex which explains long-run and short-run relationships between them. The VECM is also useful for detecting Granger Causality when variables are cointegrated. The VECM tests the hypothesis that past changes in the independent macro-economic variables and error correction term is not a cause of current changes of the dependent variable. This implies to test the assumption that coefficient of lagged macroeconomic variable and that of error correction terms are jointly zero. Thus, the macro economic variables interact with each other to bring equilibrium in the system. The VECM also demonstrates casual relationships between the identified macroeconomic variables including Sensex. The Sensex is not a leading indicator and identified variables jointly bring back the system to long-term equilibrium.

5.1 FINDING

1. The growth of industrial production has positive impact on the growth of stock price index.
2. Growth of exports and Sensex are positively related.
3. Rising inflation has negative impact on the growth of Sensex.
4. Inflation has always a negative impact on Sensex.
5. IIP always has a positive impact on Sensex.
6. One of the null hypotheses which have been tested is:
   H0: Growth of imports does not Granger cause growth of inflation
   H1: Growth of imports Granger causes growth of inflation.
   As **0.0445<0.05, reject H0 at 5%.**This implies that the growth of imports Granger causes growth of inflation or growth of inflation may be expressed by the past values of growth of imports.

5.2 SUGGESTION

The study provides comprehensive insights about relationships between the stock market return and relevant macroeconomic variables. It further highlights the usage of 8 sector indices in understanding interlinkages between sector indices and their long run-short run and causality relationships using the VAR model. The study contributes in finding out much needed policy implications. Based upon our findings, it appears that there remains immense scope for further research in this interesting area. The study may include other important macroeconomic variables not considered here. It will be of interest to know whether the results hold for other emerging markets using the same framework. A comparative study on the similar lines using panel cointegration may be conducted for BRIC economies by including oil price as one of the variables.

Bootstrapping (MacKinnon J, 2006) and Monte Carlo methods using simulated data may be employed for testing structural change with unknown break points, assess properties of distribution and estimating model. Artificial Neural Network (ANN) is an alternative framework which is widely used for modeling stock price and forecasting due to its ability to model non-linear process with a few prior assumptions about the process. ANN methodology may be used to study industry response to trade liberalization measures by using multiple macroeconomic variables and a set of selected sector indices. ANN may help to discover new relationships between the variables.

5.3 CONCLUSION

This study analyzed both the short- and long-run relationship between the Sensex and 8 macroeconomic variables during the period from October 2015 to March 2016. The cointegration analysis provides an appropriate framework to test for equilibrium in the multivariate environment and it also examines co-movements of variables. This study has used Johansen's (1991) VECM to investigate whether long-run relationship exists between Sensex and the 8 macroeconomic variables. The general hypothesis about the existence of both long-run and short-run relationship between these identified variables was established. It was found that there are two identifiable and distinguishable cointegrating vectors in VECM indicating long-run equilibrium. It was observed that the relation between Sensex and exchange rate and foreign exchange reserves is positive. This indicates when the exchange rate depreciates, Indian exports become competitive in international market and foreign exchange reserves increase, consequently strengthening the Sensex. The relation between Sensex and inflation is negative, implying that as the money supply increases, it enhances inflation resulting in a fall of Sensex. IIP has positive impact on Sensex. Surprisingly, the relationship between gold price and Sensex is negative.

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