A Study of the Effect of Macroeconomic Variables on Stock Market: Indian Perspective

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Project Report

A Study of the effect of Macroeconomic Variables on Stock Market: Indian Perspective

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By

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DECLARATION

This is to certify that the material embodied in this project report entitled is based on our original research work. Our indebtedness to other works, studies and publications have been duly acknowledge at the relevant places. This project work has not been submitted in part or in full for any other diploma or degree in this or any other university.

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INTRODUCTION

Indian capital market has undergone tremendous changes since 1991, when the government has adopted liberalization and globalization polices. As a result, there is a growing importance of the stock market from aggregate economy point of view. Nowadays stock market have become a key driver of modern market based economy and is one of the major sources of raising resources for Indian corporate, thereby enabling financial development and economic growth. In fact, Indian stock market is one the emerging market in the world.

The smoothing development process in Indian stock markets continues to be breath taking. Form 3,739.69 points on March 31st 1999, with in nine years; Bombay Stock Exchange (BSE) Sensitivity Index (SENSEX) had reached to 21,000 level points in January, 2008. But this impact doesn't last long as it was affected by the recent global financial crisis of 2008-09 and emerging euro-crisis. Now SENSEX is around 18,000 points. In the context of this effect in Indian Stock Market, the critical question is whether the decades old development or recent degradation in the markets are in any way influenced by the domestic and international macroeconomic fundamentals. Agrawalla (2006) stated that rising indices in the stock markets cannot be taken to be a leading indicator of the revival of the economy in India and vice-versa. However, Shah and Thomas (1997) supported the idea that stock prices are a minor which reflect the real economy. Similarly results were found in Kanakaraj et al. (2008). There are several other studies regarding the interaction of share market returns and the macroeconomic variables and all studies provide different conclusion related to their test and methodology.

Result of this study help in exploring whether the movement of Bombay Stock Exchanges indices is the result of some selected macroeconomic variables or it is one of the causes of movement in those variables of the Indian economy. The study consider macroeconomic variables as Index of Industrial production (IIP), Consumer price Index (CPI), Call Money Rate (CMR), Dollar Price (DP), Foreign Institutional Investment (FII), Crude Oil Prices (CO), Gold Price (GP) and Bombay Stock Exchanges indices in the form of SENSEX, BSE- Metals, Auto, Capital Goods, Fast Moving Consumer Goods and Consumer Durables by using monthly data that span from April, 2005 to March, 2012. More specifically, in the study we use ADF test, Correlation and Regression analysis and Granger Casually test to see the effect of macroeconomic variables on Bombay Stock Exchange Indices and vice versa (by using granger causality test). The results would be very useful for the policy markers, traders, investors, and other concerned along with the future researchers.

The rest of the study is organized as follow. Module 1 is a survey of the existing literature including empirical results on the nature of casual relationship between macroeconomic variables and stock prices is conducted. Module 2 is presents the data descriptions and variables undertaken for the study. Module 3 presents research methodology to be employed for investigation and analysis purposes. Module 4 reports the empirical results and discussions of descriptive statistics, ADF test, Correlation and Regression analysis and Granger Casually test which are followed by conclusion.

LITERATURE REVIEW

Relationship between Stock markets movement and Macroeconomic Variables.

In the past decades, many industry researchers, financial analysts and practitioners have attempted to predict the relationship between stock markets movement and macroeconomic variables. They have conducted empirical studies to examine the effect of stock price on macroeconomic variables or vice-versa or relationship between the two and the results of all those studies have provided different conclusions according to the combination of variables, methodologies and tests used. Here, we have discussed some previous research works/papers and their empirical conclusions that are related to our sector analysis.

Fama (1981, 1982) and many other research studies like Fama and Schwert (1977), Gallagher and Taylor (2002), Geske and Roll (1983) empirically find that stock returns are negatively affected by both expected and unexpected inflation. Marshall (1992) also finds that negative effect of inflation on stock return is generated by real economic fluctuations, by monetary fluctuations or changes in both real and monetary variables.

Darat and Mukherjee (1987) applied a Vector Auto Regression (VAR) model and found that a significant causal relationship exists between stock returns and selected macroeconomic variables of China, India, Brazil and Russia which are emerging economies of the world using oil price, exchange rate, and moving average lags values as explanatory variables employed MA (Moving Average) method with OLS (Ordinary Least Square) and found insignificant results which postulate inefficiency in market. Finally they concluded that in emerging economies the domestic factors influence more than external factors, i.e., exchange rate and oil prices.

Bahmani and Sohrabian (1992) studied the causal relationship between U.S. stock market (S&P 500 index) and effective exchange rate of dollar in the short period of time. Their theory established bidirectional causality between the two for the time period taken. However, co-integration analysis failed to identify any long run relationship between the two variables.

Mukherjee and Naka (1995) applied Johansen's (1998) VECM to analyze the relationship between the Japanese Stock Market and exchange rate, inflation rate, money supply, real economic activity, long-term government bond rate, and call money rate. They concluded that a co-integrating relation indeed existed and that stock prices contributed to this relation. Maysami and Koh (2000) examined such relationships in Singapore. They found that inflation money supply growth, changes in short- and long-term interest rate and variations in exchange rate formed a co-integrating relation with changes in Singapore's stock market levels.

Abdalla and Murinde (1997) investigated the intersections between exchange rates and stock prices in the emerging financial markets of India, Korea, Pakistan and the Philippines. They found that results show unidirectional granger causality from exchange rates to stock prices in all the sample countries, except the Philippines, where they found that the stock price lead the exchange rate.

Mookerjee and Yu (1997) studied the Singapore stock market pricing mechanism by investigating whether there were long-term relationships between macroeconomic variables and

stock market pricing. They found that three out of four macroeconomic variables were cointegrated with stock market prices. Using bi-variate cointegration and causality tests, they noted significant interactions between M2 money supply and foreign exchange reserves and stock prices for the case of Singapore.

Kwon and Shin (1999) applied Engle-Granger cointegration and the Granger causality tests from the VECM and found that the Korean stock market was cointegrated with a set of macroeconomic variables. However, using the Granger-causality test on macroeconomic variables and the Korean stock index, the authors found that the Korean stock index was not a leading indicator for economic variables.

Ibrahim (1999) also investigated the dynamic interactions between the KLSE Composite Index, and seven macroeconomic variables (CPI, industrial production index, money supply M1 and M2, foreign reserves, credit aggregates and exchange rate) and concluded that Malaysian stock market was informationally inefficient. Chong and Koh's (2003) results were similar and showed that stock prices, economic activities, real interest rates and real money balances in Malaysia were linked in the long run both in the pre- and post capital control sub periods.

Pethe and Karnik (2000), using Indian data for April, 1992 to December, 1997, attempted to find the way in which stock price indices were affected by and had affected other crucial macroeconomic variables in India. But, this study had run causality tests in an error correction framework on non-cointegrated variables, which is inappropriate and not econometrically sound and correct. The study reported weak causality running from IIP to share price indices (i.e., Sensex and S&P CNX Nifty) but not the other way round. In other words, it holds the view that the state of economy had affected stock prices.

Naka, Mukherjee and Tufte (2001) analyzed long-term equilibrium relationships among selected macroeconomic variables and the BSE Sensex. The study used data for the period 1960 to 1995 and macroeconomic variables; namely, the Industrial production index, the consumer price index, a narrow measure of money supply, and the money market rate in the Bombay interbank market. The study employed a VECM to avoid potential misspecification biases that might result from the use of a more conventional VAR modeling technique. The study found that the five variables were cointegrated and there exists three long-term equilibrium relationships among these variables. The results of the study also suggested that domestic inflation was the most severe deterrent to Indian stock markets performance, and domestic output growth as its predominant driving force.

Bhattacharya and Mukherjee (2002) investigated the nature of the causal relationship between BSE Sensitive Index and the five macroeconomic aggregates in India (i.e., IIP, money supply, national income, interest rate and inflation rate) using monthly data for the period 1992- 93 to 2000. By applying the techniques of unit–root tests, co-integration and the long–run Granger non–causality test recently proposed by Toda and Yamamoto (1995), their major findings suggested that there was no causal linkage between stock prices and money supply, national income and interest rate while IIP lead the stock price, and there was two- way causation between stock price and inflation rate.

Gan, Lee, Yong and Zhang (2006) have examined the macroeconomics variables and stock market interaction: New Zealand Evidence. Their studied had a set of seven macroeconomic variables and used co-integration tests, johansen maximum likelihood and granger-causality tests. In addition, their paper also investigated the short run dynamic linkages between NZSE40 and macroeconomic variables using innovation accounting analyses. In general analysis it was found that the NZSE40 is consistently determined by the interest rate, money supply and real GDP but there is no evidence that the New Zealand Stock Index is a leading indicator for changes in macroeconomic variables.

Chen (2008) investigated whether macroeconomic variables can predict recessions in the stock market. Series such as interest rate spreads inflation rates, money stocks, aggregate output, and unemployment rates are evaluated individually. Empirical evidence from monthly data on the Standard and Poor's S&P 500 price index suggests that among the macroeconomic variables that are considered, yield curve spreads and inflation rates are the most useful predictors of recessions in the U.S. stock market according to in-sample and out-of sample forecasting performance.

Ahmed (2008) studied and found the nature of the causal relationships between stock prices (i.e., Nifty and Sensex) and the key macroeconomic variables (i.e., IIP, FDI, exports, money supply, exchange rate, interest rate) representing real and financial sectors of India. Using quarterly data, Johansen`s approach of co-integration and Toda and Yamamoto (1995) Granger causality test have been applied to explore the long-run relationships while BVAR modeling for variance decomposition and impulse response functions has been applied to examine short run relationships. The study indicates that stock prices in India lead economic activity except movement in interest rate which seems to lead the stock prices. The study indicates that Indian stock market seems to be driven not only by actual performance but also by expected potential performances. The study reveals that the movement of stock prices is not only the outcome of behaviour of key macro economic variables but it is also one of the causes of movement in other macro dimension in the economy.

Kumar (2008) established and validate the long-term relationship of stock prices with exchange rate and inflation in Indian context. There were numerous studies on the relationship of stock indices with macroeconomic variables. This gave a strong subjective background to test the existence of any such relationship in India. The research primarily dealt with an empirical method by combining different statistical techniques to check the presence of co-integration between the stock index (Sensex) and other variables. Co-integration is a well accepted indicator of a long term relationship between more than one time series variables. The study took into consideration past ten years experience of Indian economy reflected into the stock index, wholesale price index and exchange rates. A causal relationship could not be established without the existence of co-integration between the selected macroeconomic variable

Dharmendra Singh (2010) tried to explore the relation especially the causal relation between stock market index i.e. BSE Sensex and three key macro economic variables by using correlation, unit root stationarity tests and Granger causality test. Monthly data has been used for all the variables and results showed that the stock market index, IIP, WPI, and exchange rate contained a unit root and were integrated of order one. They found that results show bilateral

granger causality between IIP and Sensex while WPI is having strong correlation and unilateral causality with Sensex which means Indian stock market is approaching towards informational efficiency at least with respect to two macroeconomic variables, viz. exchange rate and inflation

Tripathy (2011) studied investigated the market efficiency and causal relationship between selected Macroeconomic variables and the Indian stock market by using Ljung-Box Q test, Breusch-Godfrey LM test, Unit Root test, Granger Causality test. The study confirms the presence of autocorrelation in the Indian stock market and macro economic variables which implies that the market fell into form of Efficient Market Hypothesis. Then the Granger-causality test shows the bidirectional relationship between stock market and interest rate and exchange rate, international stock market and BSE volume, exchange rate and BSE volume. The study also reported unidirectional causality running from international stock market to domestic stock market, interest rate, exchange rate and inflation rate indicating sizeable influence in the stock market movement.

Dasgupta (2012) has attempted to explore the long-run and short-run relationships between BSE Sensex and four key macroeconomic variables of Indian economy by using descriptive statistics, ADF tests, Johansen and Juselius's cointegration test and Granger causality test. Monthly data has been used for all the variables, i.e., BSE Sensex, WPI,, IIP, EX and call money rate. Results showed that all the variables has contained a unit root and are integrated of order one. Johansen and Juselius's cointegration test pointed out at least one cointegration vector and long-run relationships between BSE Sensex with index of industrial production and call money rate. Granger causality test was then employed. The Granger causality test has found no short-run unilateral or bilateral causal relationships between BSE Sensex with the macroeconomic variables. Therefore, it is concluded that, Indian stock markets had no informational efficiency.

Several other studies have considered the relationship between stock prices or returns and long- term bonds (Fama and French, 1989), Tobin's q theory (Barro, 1990), output (Chen, Roll and Ross, 1986; Fama, 1990; Dhakal, Kandil and Sharma, 1993; Humpe and Macmillan, 2009), budget deficits (Darrat, 1990a; Abdullah and Hayworth, 1993), the money supply (Bulmash and Trivoli, 1991; Abdullah and Hayworth, 1993; Dhakal, Kandil and Sharma, 1993; Humpe and Macmillan, 2009), interest rates (Bulmash and Trivoli, 1991; Abdullah and Hayworth, 1993; Dhakal, Kandil and Sharma, 1993; Humpe and Macmillan, 2009), the exchange rate (Abdullah and Hayworth, 1993; Choi, 1995; Ajayi and Mougoue, 1996; Nieh and Lee, 2001), the inflation rate or the consumer price index (Chen, Roll and Ross, 1986; Abdullah and Hayworth, 1993; Dhakal, Kandil and Sharma, 1993; Humpe and Macmillan, 2009), and other related variables. Their findings suggest that most of these variables are associated with stock prices or returns to varying degrees.

STATEMENT OF HYPOTHESIS

The hypothesis for this study has been stated below:

NULL HYPOTHESIS
H_0 : There is no significant relation between Index of industrial production and SENSEX
H_0 : There is no significant relation between Consumer Price Index and SENSEX
H_0 : There is no significant relation between Call Rate and SENSEX
H_0 : There is no significant relation between Dollar price and SENSEX
H_0 : There is no significant relation between Gold price and SENSEX
H_0 : There is no significant relation between Crude oil and SENSEX
H_0 : There is no significant relation between Foreign Institutional Investment and SENSEX
H_0 : There is no significant relation between all these macroeconomic variables and Stock market sector wise

NULL HYPOTHESIS
H_a : There is a significant relation between Index of industrial production and SENSEX
H_a : There is a significant relation between Consumer Price Index and SENSEX
H_a : There is a significant relation between Call Rate and SENSEX
H_a : There is a significant relation between Dollar price and SENSEX
H_a : There is a significant relation between Gold price and SENSEX
H_a : There is a significant relation between Crude oil and SENSEX
H_a : There is a significant relation between Foreign Institutional Investment and SENSEX
H_a : There is a significant relation between all these macroeconomic variables and Stock market sector wise

Note: First differencing of all the variables has been considered for testing the hypothesis.

DATA DESCRIPTION

Data study

Title of study

"A Study of the effect of Macroeconomic Variables on Stock Market: Indian Perspective"

Objective of study

Main Objective

The main objective is to investigate the relationship between Indian stock market and seven macroeconomic variables namely Index of Industrial production (IIP), Consumer price Index (CPI), Call Money Rate (CMR), Dollar Price (DP), Foreign Institutional Investment (FII), Crude Oil Prices (CO), Gold Price (GP). BSE SENSEX has been considered as representing Indian stock market.

Other objectives

- Studying the impact of Macroeconomic variables on Indian stock market sector wise.
- Examining the existence of correlation between stock price & macroeconomic variables & the extent to which they are correlated.

Scope of study

The current study unravels the linkage between stock market & macroeconomic variables in the Indian context using techniques like regression, Granger causality test, ADF test & Unit root test using SPSS. A time span of 7 years has been chosen for this study from April, 2005 to March, 2012 uses monthly data to portray a larger view of the relationship.

The study also attempts to analyze the impact of macroeconomic variables on stock market sector wise. Five sectors have been taken for this analysis namely Auto, metals, Capital goods, FMCG and Consumer Durables sectors of BSE.

Not only the domestic economic variables have been considered but the linkage with the external world through the exchange rate movement has also been included in the analysis.

The study does not assume any a prior relationship between these variables and the stock market and is open to the possible two-way relationship between them which has been tested through Granger causality test.

Limitations of study

There are four limitations that need to be acknowledged and addressed regarding the present study. And these limitations are as follows:

- *Reliability*

This study is based on the analysis of the secondary data that has been collected. Secondary data is the data that is already available & has been used for analysis & thus might not be reliable.

- *Accuracy*

The result & conclusion of this study might not be accurate due to reliability of the secondary data & limitation on the variables selected & the time span considered.

- *Time period*

A time span of only 7 years has been considered for examining the relation between macroeconomic variables and Indian stock market.

- *Limited variables*

This study mainly focuses on selected seven independent variables which may not completely represent the macroeconomic variables.

Importance of study

Stock market is an important part of the economy of a country. The stock market plays a pivotal role in the growth of the industry and commerce of the country that eventually affects the economy of the country to a great extent. Stock market is seen as a very significant component of the financial sector of any economy. Furthermore it plays a vital role in the mobilization of capital in many of the emerging economies.

The importance of this study stems from the vital role of the Indian stock Market in the economy for the following reasons:

Indian stock market plays an important role in collecting money and encouraging investments, so this study was designed to explore the influences of some factors on stock market prices in BSE.

This study will be useful for the investors who might be able to identify some basic economic variables that they should focus on while investing in stock market and will have an advantage to make their own suitable investment decisions.

Many different kinds of investors would find this study as an assistant, especially, individual investors, portfolio managers, institutional investors and foreign investors.

Big businesses also depend on the stock market for floating their share & Initial public offering thus might consider factors that affect stock market.

Variable selection and data source

This empirical analysis has used particular software like Gretl and SPSS and depends on both availability of data and established statistical criteria that are frequently used in the selection of variables.

The Bombay Stock Exchange- Sensitive Index (SENSEX) has been considered as a proxy of the Indian Stock Market and used to obtain a measure of market price movement of Indian securities since this index is comprehensive. To address the objective of this research 7 variables and 5 sectors namely Auto, Metals, Capital goods, Consumer goods, FMCG have been considered. Consumer price index has been used as a proxy to inflation in Indian economy, Call rate as a proxy of domestic interest rate affecting stock market, dollar price to show the effect of external world on Indian stock market. To test the common perception that Foreign Institutional Investment has been a driver to stock market in India we have included FII as another crucial variable. Also any slight fluctuation in crude oil and gold prices can have both indirect & direct influence on the economy of the country. Thus these 2 variables have also been included to analyze their effect on stock market. Even after being a very important variable GDP growth rate was not included in the analysis because of unavailability of monthly data series of GDP growth rate (only quarterly series was available). Industrial Production Index of all commodities is considered as a proxy to GDP growth rate.

The empirical investigation is carried out using monthly data from April, 2005 to March, 2012 which covers 84 monthly observations. The data of BSE SENSEX (including sector wise data) has been extracted from BSE website. Database of Industrial Production Index (including sector wise data) & Consumer price index has been extracted from DULS website. RBI website has been referred for FII, gold price, call rate and dollar price data. Lastly Index Mundi has been referred for database of crude oil (Shown in table 2.1).

Indian stock market

BSE Sensitive Index

Stock market is a market in which shares are issued and traded either through exchanges or over-the-counter markets. The Indian stock exchanges hold a place of prominence not only in Asia but also at the global stage. Till the decade of 1980s there was no scale to measure the ups and downs in the Indian stock markets. In 1986, the BSE came out with a stock index (i.e., the SENSEX) that subsequently became the barometer of the Indian stock markets. **.** There are currently two major stock exchanges in India, The Bombay Stock exchange (BSE) and The National Stock Exchange (NSE). Our study has used BSE indices as representing the Indian stock market.

Table 2.1: Description of Variables

Symbol	Variable	Base year	units
BSE	BSE Sensex 30	1978-79=100	Crore
IIP	Index of Industrial Production	2004-05=100	Weight (1000)
CPI	Consumer Price Index		
CO	Crude Oil	Actual value	INR per barrel
CMR	Call Money Rate	Percentage	Percentage per annum
GP	Gold Price	Actual value	Rupee per 10gm
FII	Foreign Institutional Investment	Actual value	Billion (Rs)
DP	Dollar Price	Actual value	Rupee per unit of foreign currency

Bombay stock exchange or BSE is the largest stock exchange in India in terms of number of listed companies in the exchange and the market capitalization of the listed companies. The prime index of the Bombay Stock Exchange is the BSE 30 that is popularly known as the Sensex. First compiled in 1986, Bombay Stock Exchange Sensitive (SENSEX) is a basket of 30 constituent stocks representing a sample of large, liquid and representative companies. The base year of SENSEX is 1978-79 and the base value is 100. The index is widely reported in both domestic and international markets through print as well as electronic media. The SENSEX is not only scientifically designed but also based on globally accepted construction and review methodology By including the prestigious companies & due to is wide acceptance amongst the Indian investors; SENSEX is regarded to be the pulse of the Indian stock market. As the oldest index in the country, it provides the time series data over a fairly long period of time (From 1979 onwards). Also it is a value weighted stock average, using the free float market capitalization methodology, of 30 largest and most actively traded stocks of Indian stock markets from varied sectors being the most quoted Index. So, BSE-SENSEX has been selected for this study as the representative of Indian stock markets.

If the SENSEX goes up, it means that the prices of the stocks of most of the companies under the BSE SENSEX (30 companies) have gone up. If the Sensex goes down, this tells you that the stock price of most of the major stocks on the BSE have gone down.

Explanatory Variables

Index of Industrial Production (IIP)

Industrial Production Index is used as proxy to measure the growth rate in real sector. Industrial production presents a measure of overall economic activity in the economy and affects stock prices through its influence on expected future cash flows. Thus, it is expected that an increase in industrial production index is positively related to stock price. The IIP and stock prices are positively related because increase in IPI results in increase in production of industrial sector that leads to increase in the profit of industries and corporations. As dividend increases, it results in increase of share prices, therefore, it is expected to have positive relationship between IPI and share price according to economic theory.

Consumer Price Index (CPI)

Inflation is measured by changes in the Consumer Price Index (CPI). High rate of inflation increase the cost of living and a shift of resources from investments to consumption. This leads to a fall in demand for market instruments which lead to reduction in the volume of stock traded.. High rate of inflation increase the cost of living and a shift of resources from investments to consumption. This leads to a fall in demand for market instruments which lead to reduction in the volume of stock traded. Also the monetary policy responds to the increase in the rate of inflation with economic tightening policies. Inflation is ultimately translated into nominal interest rate and an increase in nominal interest rates increase discount rate which results in reduction of present value of cash flows. High Inflation affects corporate profits, which in turn causes dividends to diminish thereby lower stock prices. When inflation begins to move upward, it likely leads to tight monetary policies which result in increase in the discount rate. It indicates that the cost of borrowing increases which in turn leads to investment reduction in the stock market. So, it is said that an increase in inflation is negatively related to equity prices.

Crude Oil (CO)

Crude oil is an indispensable input for production and therefore, the price of oil is included as a proxy for real economic activity. India is largely an importer of crude oil and consequently, oil price takes part an imperative role in Indian economy. It is apparent that any key movement in oil prices leads to uncertainties in the stock market which could persuade investors to suspend or delay their investments. Moreover, increase in oil prices results in higher transportation, production and heating costs which have negative effect on corporate earnings. Rising fuel prices also raise alarm about inflation and diminish consumers' discretionary spending. Therefore, the financial risk of investments increases when there is wide fluctuation in oil prices. Therefore, for oil importing countries like India, an increase in oil price will lead to an increase in production costs and hence to decreased future cash flow, leading to a negative impact on the stock market. Therefore, an increase in the price of oil in the international market means lower real economic activity in all sectors which will cause stock price to fall.

Call Money Rate (CMR)

The observations in regard to the relationship between interest rates and stock prices generally suggests that an increase in interest rates increases the opportunity cost of holding money and thereby causing substitution of stocks with interest bearing securities, and hence would result in falling stock prices. It is mention worthy here that the expected exchange rate (Rs./US$) and inflation rate do play roles in the determination of the domestic interest rates along with the domestic money supply. The CMR has been selected in this study as a proxy to interest rate. It is selected because the Reserve Bank of India (RBI) has no control on it unlike the Repo Rate, Cash Reserve Ratio (CRR), Prime Lending Rate (PLR), etc. This rate is fully market-driven and dependent on the demand-supply equilibrium relationships. Changes in the CMR affect the Indian stock markets by affecting the corporate profits, general demand for goods and services in the economy, relative attractiveness of competing financial assets like shares, bonds, and other fixed-interest investments, the way companies finance their operations and cost of borrowing money for the purchase of shares.

Dollar Price (DP)

The next macroeconomic variable used in this study has been the exchange rate/dollar price, which represents the bilateral nominal rate of exchange of the Indian Rupee (Rs.) against one unit of a foreign currency. US Dollar ($) has been taken to be the foreign currency against which the Indian Rupee exchange rate is considered. This is because the US Dollar has remained to be the most dominating foreign currency used for trading and investment throughout the period of this study. Generally, a depreciating currency causes a decline in stock prices because of expectations of inflation. On an average, export-oriented companies are adversely affectedly a stronger domestic currency while import-oriented firms benefit from it. Though these arguments suggest a linkage between exchange rates and stock prices, the empirical evidence supporting such a linkage was weak at best.

Also, at the micro level, exchange rate changes influence the value of a portfolio of domestic and multinational firms and it is predicted that a negative relationship exists between the strength of the home currency and the aggregate stock prices index.

Gold Price (GP)

Gold is a substitute investment avenue for Indian investors. As the gold price rises, Indian investors tend to invest less in stocks, causing stock prices to fall. Therefore, a negative relationship is expected between gold price and stock price. Thus this very important macroeconomic variable has also been included in this study.

Foreign Intuitional Investment (FII)

FII includes an investor or investment fund that is from or registered in a country outside of the one in which it is currently investing. Institutional investors consist of hedge funds, insurance companies, pension funds and mutual funds. The term is used most commonly in India to refer to outside companies investing in the financial markets of India. International institutional investors must register with the Securities and Exchange Board of India to participate in the market. FII is allowed to enter into our country only through stock exchanges either in the form of equity or debt. Thus it makes an impact on the rise or fall of SENSEX, since FII is allowed to be purchased or sold daily. The daily transaction of FII is the reason behind the volatility in the stock markets movement to a greater extent. It has been observed that Sensex increases when there are positive inflows of FIIs & decreases when there are negative FII inflows.

METHODOLGY

Theoretical Framework

With a view to accomplish the pre determined set of objectives of our research, different set of techniques and tests have been adopted. First and foremost, to fulfill the research objectives, descriptive statistics technique like mean, standard deviation, variance, etc are carried to show the nature and basic characteristics of the variables used in the analysis. ADF test is used to find the stationarity or non stationarity variables of data series. Inferential statistics technique is used to inference about the results by using different ways of inferential statistics like Correlation matrix analysis which finds any strength of association between Bombay stock exchange indices (share price) and selected macroeconomic variables. Then the second type of inferential statistics is used that is linear regression analysis which create a mathematical model that can be used to predict the values of a stock price of Bombay stock exchange indices based upon the values of an macroeconomic variables. In other words, we use the model to predict the value of Y when we know the value of X. Here, we used the sign-f to analysis the overall significance of the sample regressions and t- test and p-value to check the individual significance of the macroeconomic variables. Then**,** finally we see the two way relationship between variables by using granger causality test.

Descriptive statistics technique

Descriptive statistics is the discipline of quantitatively describing the patterns and general trends of a dataset and summarize it in single value. It enables a reader to quickly understand and interpret the set of data that has been collected. In our study, descriptive statistics provide a useful quantitative summary of macroeconomics variables and BSE indices. Here, descriptive statistics provide a historical account of variables behavior and convey some future aspects of the distribution of dataset. We used measures of central tendency (mean) and measures of Variability (standard deviation, range, minimum and maximum) to explain the dataset.

Inferential statistics technique

Inferential statistics is defined as the branch of statistics that is used to make inferences/ valid judgments about the characteristics of a populations based on sample data. These statistics are ways of analyzing data that allow the researcher to make conclusions about whether a hypothesis was supported by the results.

A ***hypothesis*** is an educated guess about a trend, group difference or association believed to exist. A null hypothesis states that the results will be due to chance whereas an alternate hypothesis tells that the results are due to the manipulation of the independent variable. Here in our study, ***null hypothesis (H0)*** is there is no relationship between Bombay stock exchange indices and selected macroeconomics variables while ***alternate hypothesis (Ha)*** is that there is relationship between

Bombay stock exchange indices and selected macroeconomics variables. There are different ways to inference the results. Here, we used correlation matrix analysis and linear regression analysis (t-ratio, f-sign, p- value, r-square) which allows us to make a conclusion related to our hypothesis. We have used 5% of level of significance and two tailed test so as to accept or reject our null hypothesis according. Regression analyses are typically done using statistics software and here we used SPSS.

Correlation matrix analysis

Correlation is a term that refers to the strength of a relationship between two variables. A strong, or high, correlation means that two or more variables have a strong relationship with each other while a weak, or low, correlation means that the variables are hardly related. Correlation coefficients can range from -1.00 to +1.00. The value of -1.00 represents a perfect negative correlation while a value of +1.00 represents a perfect positive correlation. A value of zero means that there is no relationship between two variables.

Here, the study used Karl Pearson r, type of correlation coefficient, which is also referred to as linear or product-moment correlation. This analysis assumes that the two variables being analyzed are measured on at least interval scales. The coefficient is calculated by taking the covariance of the two variables and dividing it by the product of their standard deviations. It is used to show the strength and the relationship between Bombay stock exchange indices and macroeconomic variables.

Econometric Regression Model

The term ***regression*** was introduced by Francis Galton. Linear regression analysis is an inferential statistical technique that is used to learn more about the relationship between a independent variable (referred to as X) and dependent variable (referred to as Y) When there is only one independent variable, the prediction method is called simple regression. So, the regression equation $\boldsymbol{Yi = \beta 0 + \beta 1\ Xi + ui}$ where *Yi* is the dependent variable, *X*i is the independent variable, $\beta 0$ is the constant (or intercept), $\beta 1$ is the slope of the regression line which represent the strength and direction of the relationship between the independent and dependent variables and *ui* is random error term. Here, in our study we carried out this method to see and interpret the effect of macroeconomic variables on stock exchange indices (share price).

Statistic test

R-square: also known as the coefficient of determination is commonly used to evaluate the model fit of a regression equation. That is, how good are all of your independent variables at predicting your dependent variable? The value of R-square ranges from 0.0 to 1.0 and can be multiplied by 100 to obtain a percentage of variance explained.

Sign-F: whether the model as a whole is significant. It tests whether R- square is significantly different from zero.

T-ratios: the reliability of our estimate of the individual beta. For that we can look at p- values.

Unit root test (Augmented Dickey –Fuller test)

Empirical research in stock markets is based on time series data. And the stationarity of a data series is a prerequisite for drawing meaningful inferences in a time series analysis and to enhance the accuracy and reliability of the models constructed. If the variable is not stationary estimation can obtain a very high R^2, although there is no meaningful relationship between the variables. This situation reflects the problem of spurious regression between totally unrelated variables generated by a non-stationary process. Generally a data series is called a stationary series if its mean and variance are constant over a given period of time and the covariance between the two extreme time periods does not depend on the actual time at which it is computed but it depends only on lag amidst the two extreme time periods.

One of the common methods to find whether a time series is stationary or not is the unit root test. There are numerous unit root tests. One of the most popular among them is the Augmented Dickey-Fuller (ADF) test. Augmented Dickey -Fuller (ADF) is an extension of Dickey -Fuller test. Following equation of ADF test checks the stationarity of time series data:

$$\Delta Y_t = \alpha + \beta T + \rho Y_{t-1} + \sum_{i=1}^{k} \gamma_i \Delta Y_{t-i} + e_t$$

where Y_t is the variable in period t, T denotes a time trend, Δ is the difference operator, e_t is an error term disturbance with mean zero and variance σ^2 , and k represents the number of lags of the differences in the ADF equation. The ADF is restricted by its number of lags. It decreases the power of the test to reject the null of a unit root, because the increased number of lags necessitates the estimation of additional parameters and a loss of degree of freedom. The test for a unit root is conducted on the coefficient of y_{t-1} in the regression. If the coefficient is significantly different from zero (less than zero) then the hypothesis that y contains a unit root is rejected. Rejection of the null hypothesis denotes stationarity in the series.

Null and alternative hypothesis are as follows:

H_0 : $\rho=0$ [Variable is not stationary]

H_a : $\rho<0$ [Variable is stationary]

Our study also contains time series data. The time series variables considered in this paper are the stock market indices and seven macroeconomic variables. This necessitates the inclusion of ADF test in the present study. Also our study includes Granger causality test which assumes that the variables involved are stationary. Thus prior to testing and implementing the Granger Causality test, econometric methodology needs to examine the stationarity for each individual time series. If the variables are not stationary the standard assumptions for asymptotic analysis in the Granger

test will not be valid. Null hypothesis in this case would be that particular macroeconomic variable /SENSEX is not stationary & alternative being that they are stationary.
Note: We have considered P value for testing at 5% significance level. If the p-value is smaller than 0.05 then Null hypothesis will be rejected & variables would be stationary & vice versa.

Granger causality test

Granger (1969) and Sim (1972) were the ones who first developed Granger causality test to examine the application of causality in economics. Granger causality test is a technique for determining whether one time series is significant in forecasting another. The standard Granger causality test seeks to determine whether past values of a variable helps to predict changes in another variable. Granger causality technique measures the information given by one variable in explaining the latest value of another variable. In addition, it also says that variable Y is Granger caused by variable X if variable X assists in predicting the value of variable Y. If this is the case, it means that the lagged values of variable X are statistically significant in explaining variable Y. The null hypothesis (H_0) that we test in this case is that the X variable does not Granger cause variable Y and variable Y does not Granger cause variable X. In summary, one variable (X_t) is said to granger cause another variable (Y_t) if the lagged values of X_t can predict Y_t and vice-versa. The test is based on the following regressions:

$$Y_t = \beta_0 + \sum_{k=1}^{M} \beta_k Y_{t-k} + \sum_{l=1}^{N} \alpha_l X_{t-l} + u_t$$

$$X_t = \gamma_0 + \sum_{k=1}^{M} \gamma_k X_{t-k} + \sum_{l=1}^{N} \delta_l Y_{t-l} + v_t$$

Where Y_t and X_t are the variables to be tested, and u_t and v_t are mutually uncorrelated errors, and t denotes the time period and 'k' and 'l' are the number of lags.
The null hypothesis is:

H_0 : $\alpha_t = \delta_t = 0$ for all i [X does not granger cause Y]

The alternative hypothesis is:

H_a : $\alpha_t \neq 0$ and $\delta_t \neq 0$ for at least some i [X granger cause Y]

If the coefficient α_t are statistically significant but δ_t are not, then X causes Y. In the reverse case, Y causes X. But if both α_t & δ_t are significant, then causality runs both ways. The null hypothesis is tested by using the standard F-test of joint significance.

The F-test is applied, as follows:

$$F = \frac{(RSS_R - RSS_{UR})/m}{RSS_{UR}/(n-k)}$$

Here RSS_R & RSS_{UR} are the restricted and unrestricted residual sum of squares respectively. M is the number of lags, n is the number of observations and k is the parameters in the unrestricted equation. If the computed *F*-value exceeds the critical *F*-value at the chosen level of significance, the null hypothesis is rejected. This would imply that macroeconomic variable 'Granger cause' or improve the prediction in stock prices and vice versa.

Note: That it has been taken one period lag in the above equation. In practice, the choice of the lag is arbitrary.

In the present study Granger Causality Model has been used to test the causality between Indian stock market and macroeconomic variables. Here the test signifies whether past information on macroeconomic variables predict stock prices in India, Null & Alternative hypothesis being:

H_0 : Macroeconomic variables do not granger causes Indian stock market.

H_a : Macroeconomic variables granger causes Indian stock market.

Note: A lag of four years has been considered.

EMPIRICAL ANALYSIS

Empirical results and discussions are presented here in the different subsections.

Descriptive Statistics Analysis

Table 4.1: Descriptive Statistics

	Mean	Std. Deviation	Sum	Maximum	Minimum	Range
SENSEX	14523.90	3825.04	1220008.20	20509.00	6154.40	14354.60
BSE Metal	11554.28	4172.02	970559.80	20020.00	4383.40	15636.60
BSE Auto	5904.54	2281.41	495981.50	10235.00	2330.60	7904.40
BSE CG	10883.21	3862.39	914190.10	19795.00	3286.90	16508.10
BSE FMCG	2529.66	859.88	212491.80	4493.10	1111.80	3381.30
BSE CD	4091.19	1542.94	343660.50	6956.80	1542.70	5414.10
IIP	143.82	22.47	12081.50	193.10	99.10	94.00
IIP Metals	156.36	25.23	13135.00	202.10	105.60	96.50
IIP Auto	172.62	55.65	14500.20	306.90	74.00	232.90
IIP CG	215.73	65.66	18121.400	392.20	85.30	306.90
IIP FMCG	153.11	27.64	12861.40	208.00	101.70	106.30
IIP CD	215.10	65.74	18068.700	327.10	102.70	224.400
CPI	130.40	23.71	10954.00	173.57	98.32	75.24
Call rate	6.09	2.11	512.2683	14.0700	.7300	13.3400
Dollar price	45.24	3.03	3800.46	52.67	39.37	13.30
FII	43.7	86.38	3672.28	295.06	-134.61	429.68
Crude oil price	3527.89	1007.63	296343.08	5927.55	2020.10	3907.45
Gold price	14041.90	6111.50	1179520.33	28451.69	5899.96	22551.73
Observations	84	84	84	84	84	84

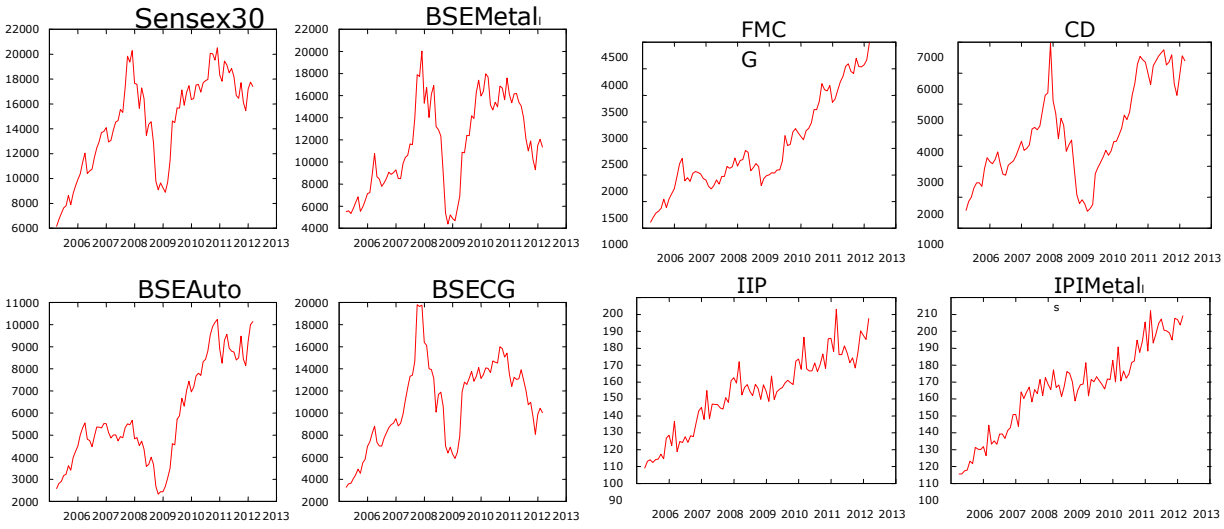
Table 4.1 presents a summary of descriptive statistics of all the variables. Sample mean, standard deviation, sum, maximum, minimum and range have been reported. These variables are Bombay stock exchange's main and sectors, Index of Industrial Production and its sectors, CPI, call rate, dollar price, FII, gold price and crude oil price. In the group of 84 observations, the mean of share price (SENSEX) is 14,523.90, while its maximum price is 20,509.00 for our data series and the standard deviation is 3,825.04 which is considered to be very high. It reflects significant variability in stock prices (SENSEX). Similarly, the mean of BSE Metal, Auto, CG, FMCG and CD sectors are 11,554.28, 5,904.54, 10,883.21, 2,529.66 and 4,091.19 and the standard deviation of the same are 4,172.02, 2,281.41, 3,862.39, 859.88 and 1,542.94 respectively. All Bombay stock exchanges sectors also have very high and significant variability form their mean. IIP and its sectors mean and standard deviation are shown in the table 4.1 and all IIP variables have moderate variability form their respective means. Consumer price index mean is 130.40 and standard deviation is 23.71 implying that there is moderate variability in consumer price index. Maximum value of CPI is 173.57 and minimum is 98.32.Call rate mean is 6.09 and standard deviation is 2.11. It shows that

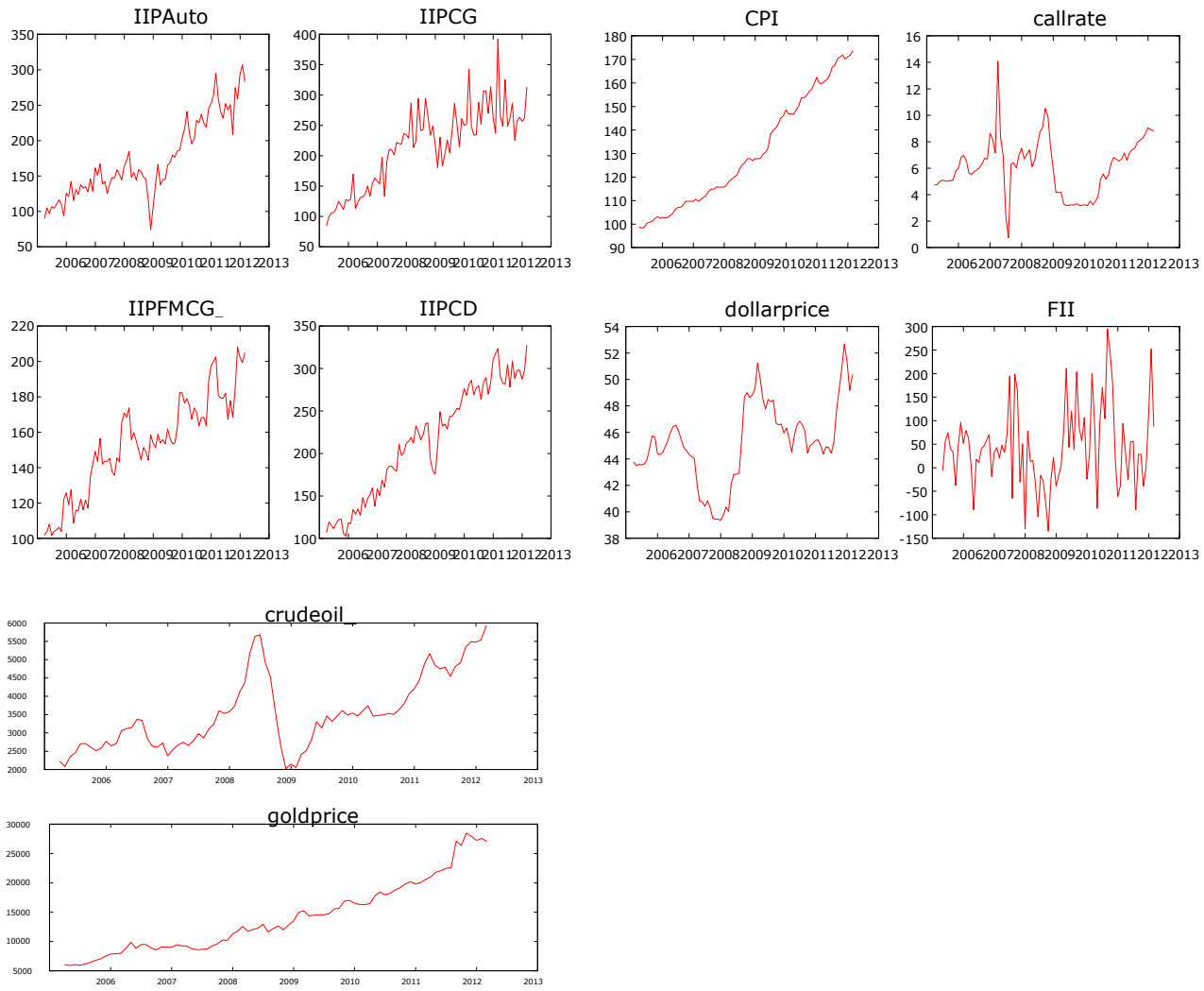
there is moderate variability in call rate. Dollar price mean is 45.24 and standard deviation is 3.03. So, there is not so significant variability in dollar price form its mean. The maximum and minimum values of dollar price are 52.67 and 39.37 respectively. FII mean is 43.7 and its standard deviation is 86.38 which imply that there is a greater degree and even more than variability of standard deviation from FII mean and there is possibility why FII data have so greater standard deviation because of that fact it is normally distributed among its means. Crude oil and gold price mean are 3,527.89 and 14,041.90 and its standard deviation is 1,007.63 and 6,111.50 respectively. There is high moderate variability in oil and gold prices. The maximum price of gold is 28,451.69 for our data series and minimum is 2,020.10.

ADF Test

As already stated stationarity of a data series is a prerequisite for drawing meaningful inferences in a time series analysis. It enhances the accuracy and reliability of the models constructed. Reason being that if the variable is not stationary it might lead to spurious result in the analysis. The first and simplest type of test one can apply to check for stationarity is to actually plot the time series and may look for possibility of trend in mean and variance, evidence of autocorrelation and seasonality in the data. If these patterns are found in the series then the series can be regarded as non stationary. The eighteen time series displayed in figure: dataset graph exhibit different such patterns. BSE FMCG, IIP, IIP Metals, IIP CG, IIP FMCG, IIP CD, CPI, and gold prices seem to exhibit a trend in the mean since they have a clear upward slope. In fact, sustained upward or downward sloping patterns (linear or nonlinear) are signs of a non-constant mean. This is a sign of non-stationarity.

Figure 1: dataset graph





Apart from visual inspection, formal test for stationarity is essential to opt for appropriate methodological structure. As a first step, we tested all the variables for stationarity by applying ADF test which is one of the common types of Unit Root test which help to describe whether a time series is stationary or not. The result of ADF test statistics is gives in the table below.

Table 4.2: ADF Level

Null Hypothesis	P value	Null Hypothesis	Result
Sensex is not stationary	0.1534	ACCEPT	Variable is not stationary
BSE metal is not stationary	0.08648	ACCEPT	Variable is not stationary
BSE auto is not stationary	0.8192	ACCEPT	Variable is not stationary
BSE CG is not stationary	0.07356	ACCEPT	Variable is not stationary
BSE FMCG is not stationary	0.9814	ACCEPT	Variable is not stationary
BSE CD is not stationary	0.5786	ACCEPT	Variable is not stationary
IIP main is not stationary	0.6738	ACCEPT	Variable is not stationary
IIP metal is not stationary	0.6703	ACCEPT	Variable is not stationary
IIP auto is not stationary	0.9658	ACCEPT	Variable is not stationary
IIP CG is not stationary	0.4766	ACCEPT	Variable is not stationary
IIP FMCG is not stationary	0.6322	ACCEPT	Variable is not stationary
IIP CD is not stationary	0.8521	ACCEPT	Variable is not stationary
CPI is not stationary	0.999	ACCEPT	Variable is not stationary
Call rate is not stationary	0.2874	ACCEPT	Variable is not stationary
Dollar price is not stationary	0.427	ACCEPT	Variable is not stationary
Gold price is not stationary	0.9992	ACCEPT	Variable is not stationary
FII is not stationary	0.04164	REJECT	Variable is stationary
Crude oil is not stationary	0.6191	ACCEPT	Variable is not stationary

From the table it can be concluded that none of the variables except FII attains stationarity in the time series as the P-values of all these variables is greater than the critical P-value at 5%. Thus the null hypothesis that variables are not stationary was accepted. However FII is the only variable that has attained stationarity as its P-value is less than the critical P value.

Now in order to do analysis it is important to make these variables stationary. Thus we have calculated the first differencing of all the variables except FII. ADF Test results for variables with first differencing are given below.

Thus first differencing of the variables is stationary at 5 % as the P value is less than the critical p value thus rejecting the null hypothesis and accepting the alternative hypothesis that the variables are stationary (shown in table 4.3).

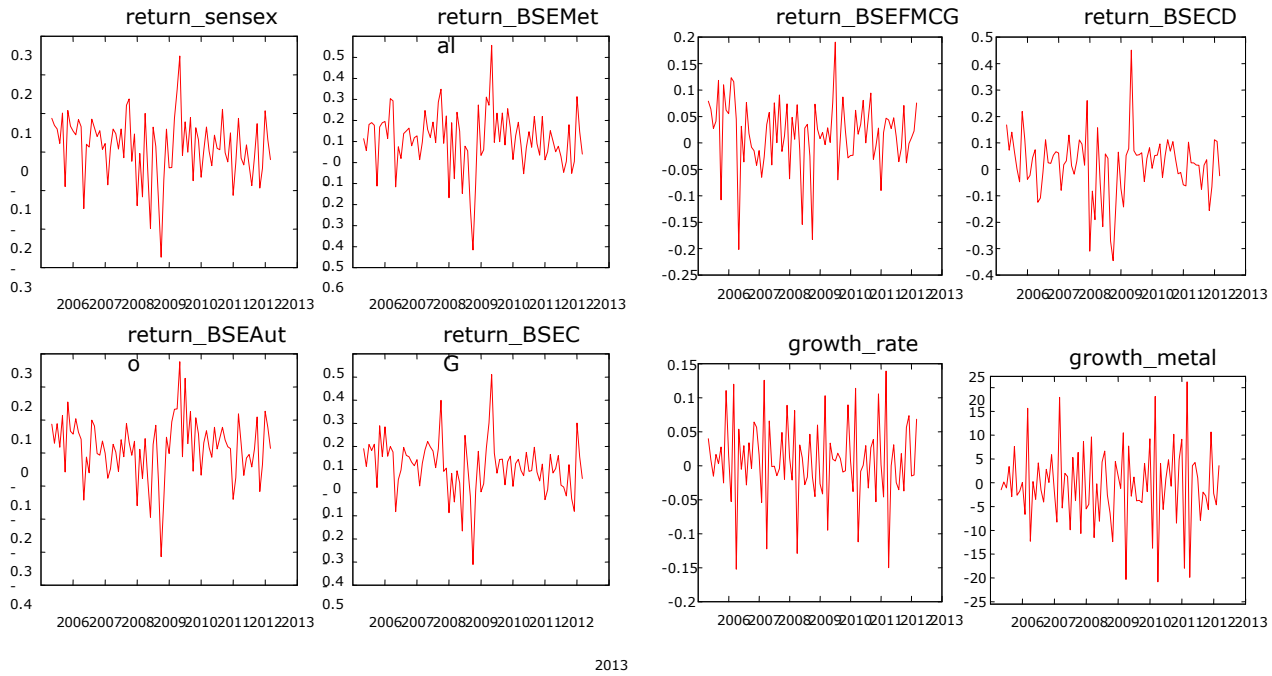
Table 4.3: ADF 1st difference

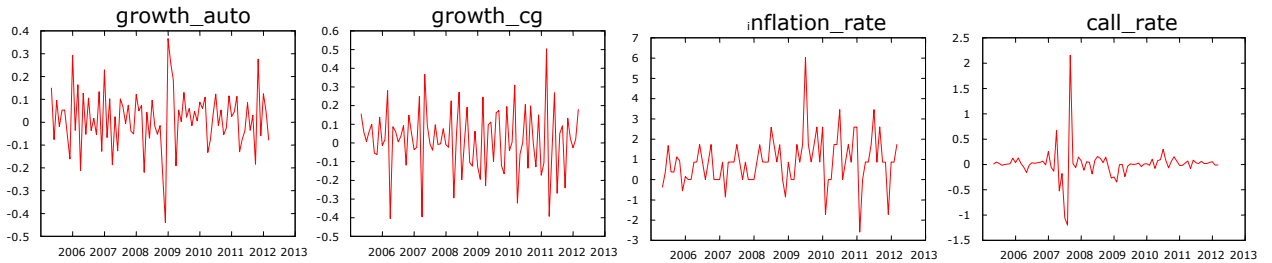
Null Hypothesis	P value	Null Hypothesis	Result
Sensex return is not stationary	0.0103	REJECT	Variable is stationary
BSE metal return is not stationary	0.01078	REJECT	Variable is stationary
BSE auto return is not stationary	0.0289	REJECT	Variable is stationary
BSE CG return is not stationary	0.0124	REJECT	Variable is stationary
BSE FMCG return is not stationary	0.0011	REJECT	Variable is stationary
BSE CD return is not stationary	0.0238	REJECT	Variable is stationary
IIP growth rate is not stationary	4.078e-005*	REJECT	Variable is stationary
IIP metal growth rate is not stationary	2.221e-005*	REJECT	Variable is stationary
IIP auto growth rate is not stationary	1.71e-006*	REJECT	Variable is stationary
IIP CG growth rate is not stationary	2.871e-007*	REJECT	Variable is stationary
IIP FMCG growth rate is not stationary	3.128e-007*	REJECT	Variable is stationary
IIP CD growth rate is not stationary	4.538e-006*	REJECT	Variable is stationary
CPI (inflation)is not stationary	6.257e-006*	REJECT	Variable is stationary
Call rate is not stationary	2.764e-005*	REJECT	Variable is stationary
Dollar rate is not stationary	0.04236	REJECT	Variable is stationary
Gold rate is not stationary	0.0001	REJECT	Variable is stationary
Crude oil rate is not stationary	4.398e-005*	REJECT	Variable is stationary

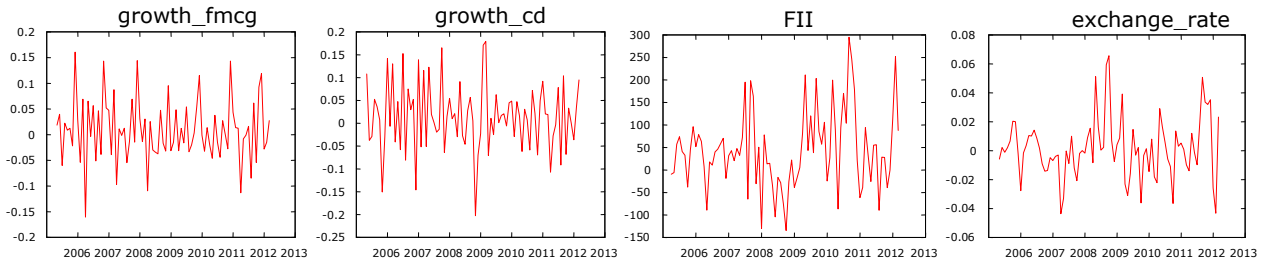
* 4.078e-005 = 4.078 * 10^ (-5). This formula has been applied to all such values. All the values are less than 0.05.

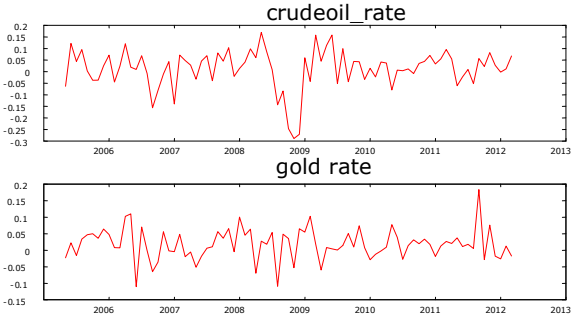
The graphs of first difference of the variables also show a trend of stationarity (shown in the graphs below). Hence now granger causality test & regression analysis can be applied using first differencing of the variables.

Figure 2:- Return graphs


return_sensex
return_BSEMetal
return_BSEFMCG
return_BSECD
return_BSEAuto
return_BSECG
growth_rate
growth_metal
2006 2007 2008 2009 2010 2011 2012 2013


growth_auto
growth_cg
inflation_rate
call_rate
2006 2007 2008 2009 2010 2011 2012 2013


growth_fmcg
growth_cd
FII
exchange_rate
2006 2007 2008 2009 2010 2011 2012 2013


crudeoil_rate
gold rate
2006 2007 2008 2009 2010 2011 2012 2013

Inferential statistics Analysis

Correlation matrix

Table 4.4 shows the correlation matrix of stock exchanges indices and macroeconomic variables. Correlations of all variables with their difference have been reported. Here, we have used Karl Pearson's correlation analysis with two tailed and 5% significant level. It assumes that the two variables are measured on at least interval scales, and it determines the extent to which values of the two variables are proportional to each other.

The results reveal that there is no significant instead there is very low or low or moderate relationship among macroeconomic variables and Bombay Stock Exchanges indices. Correlation coefficient between Bombay Stock Exchanges indices and many macroeconomic variables showed the weak relationship.

Inflation rate (-5.4%), exchange rate (-46.1%), and gold rate (-21.8%) are negatively correlated with SENSEX where as growth rate (3.1%), call rate (9.3%), FII (63.3%) and oil rate (16.4%) are positively correlated. FII and exchange rate have moderate positive correlation with SENSEX. Inflation rate and exchange rate are negatively correlated with Bombay stock Exchange (BSE-SENSEX) in accordance economic theory that provides the increase discount rate leads in reduction in the present values of expected future cash flows. Similarly, depreciation in home currency affects negatively to SENSEX returns in expectations of inflation. Growth rate of metal (11.6%), call rate (4.6%), FII (61.6%) and oil rate (28.6%) are positively correlated and Inflation rate (-4.3%), exchange rate (-50.5%), and gold rate (-18.5%) are negatively correlated with BSE metal. Here, FII, oil rate and exchange rate have moderate correlation with BSE Metal and other has low relation.

Growth rate of auto (4.1%), Inflation rate (4.9%), call rate (5.3%), FII (61.1%) and oil rate (13.9%) are positively correlated and exchange rate (-35.5%), and gold rate (-14%) are negatively correlated with BSE Auto. Here, FII and exchange rate have moderate correlation with BSE Metal and other has low correlation degree. Growth rate of capital goods (7.2%), FII (56.1%) and oil rate (16.7%) are positively correlated with BSE Capital goods and Inflation rate (-4.9%), call rate (-0.1%) exchange rate (-54.2%) and gold rate (-19.1%) are negatively correlated. Here also, FII and exchange rate have moderate correlation with BSE Metal and other has low correlation degree where as call rate have significantly no correlation with BSE Capital goods.

Growth rate of FMCG (-8%), exchange rate (-24.3%), and gold rate (-20.5%) are negatively correlated while inflation rate (3.3%), FII (43.4%), call rate (8.2%) and oil rate (2%) are positively correlated with BSE Fast moving consumer goods. Here, FII have moderate correlation with BSE FMCG and other has low degree of correlation. Growth rate of Consumer durables (-5.2%), inflation rate (-4.1%), exchange rate (-48.8%), and gold rate (-23.9%) are negatively correlated with BSE Consumer durables while FII (57.2%), call rate (5.6%) and oil rate (17.4%) are positively correlated. Here, FII have moderate correlation with BSE Consumer durables (BSE CG).

Table: 4.4 Correlation Matrix

Variables	Δ Sensex	Δ BSE metal	Δ BSE auto	Δ BSE CG	Δ BSE FMCG	Δ BSE CD
Δ IIP	3.1%	11.6%	4.1%	7.2%	-8%	-5.2%
Δ CPI	-5.4%	-4.3%	4.9%	-4.9%	3.3%	-4.1%
Δ Call rate	9.3%	4.6%	5.3%	-0.1%	8.2%	5.6%
Δ Dollar price	-46.1%	-50.5%	-33.5%	-54.2%	-24.3%	-48.8%
Δ Gold	-21.8%	-18.5%	-14%	-19.1%	-20.5%	-23.9%
Δ Oil price	16.4%	28.6%	13.9%	16.7%	2%	17.4%
Δ FII	63.3%	61.6%	61.1%	56.1%	43.4%	57.2%

We can conclude that the proportion of variation in Bombay stock exchange indices is weakly attributed to macroeconomic variables. Since correlation matrix analysis is not a strong analysis to make conclusion of our study hypothesis for see the effect of macroeconomics variables on stock exchange indices (share price). So, for make our study more relevant for relationship between variables, we will conduct simple regression by creating econometric model.

Econometric Regression analysis

Econometric Regression analysis is a technique to check the effect macroeconomics variables on stock exchange indices (share price) and we have found some interesting results for a the relationship. Exchange rate and FII does affect Bombay stock exchange for all the BSE-30 and BSE sectors while there is no relationship growth rate and its different sectors with Bombay stock exchange indices. Similarly, Inflation rate, call rate and oil rate does affect BSE-30 and BSE sectors. Simple regressions models between SENSEX and macroeconomic variables, BSE Metal and macroeconomic variables, BSE Auto and macroeconomic variables, BSE CG and macroeconomic variables, BSE FMCG and macroeconomic variables and BSE CD and macroeconomic variables have been reported. The null hypothesis has been tested on the basis of the P-value while the overall significance of model has been tested on the basis of F-sign. If the P-value and F- sign is less than the critical P value and F- sign at 5% than the null hypothesis is rejected and there will be a significant relation between the variables.

Table 4.5: Simple regression between Δ SENSEX and Macroeconomic Variables

	R^2 (R square)	Intercept value	Slope value	T stats	P value	F Sign	Remark
Δ Growth rate	0.001	0.012	0.042	0.276	0.784	0.784	***Accept Ho***
Δ Inflation rate	0.003	0.016	-0.516	-0.490	0.626	0.626	***Accept Ho***
Δ Call rate	0.009	0.012	0.023	0.840	0.403	0.403	***Accept Ho***
Δ Exchange rate	0.213	0.016	-1.788	-4.678	0.000	0.000	***Reject Ho***
Δ FII	0.401	-0.014	0.001	7.362	0.000	0.000	***Reject Ho***
Δ Oil rate	0.027	0.011	0.159	1.498	0.138	0.138	***Accept Ho***
Δ Gold rate	0.047	0.019	-0.377	-2.009	0.048	0.048	***Reject Ho***

Null Hypothesis (H_0): No significant relationship between SENSEX with each macroeconomic variable.

Alternative Hypothesis (H_a): Significant relationship between SENSEX with each macroeconomic variable.

The table above shows simple regression test for seven macroeconomic variables and BSE SENSEX. It was found through P-value and F-sign that there is significant relationship between exchange rate and SENSEX, FII and SENSEX and gold rate and SENSEX. Hence, means exchange rate, FII and gold rate does affect SENSEX. We can accept the alternative hypothesis. R^2 shows the model fitness of a regression equation and growth rate; inflation rate, call rate, oil rate and gold rate explain very low variation in SENSEX while FII and exchange rate explain 40.1% and 21.3% of variation in SENSEX respectively. In the table, there are Intercept values and Slope values with help us in forming meaning regression equations in the form $Yi = \beta 0 + \beta 1\ Xi$.

Similarly, The tables below show simple regression test for BSE five sectors namely metal, auto, capital good (CG), FMCG, Consumer durables (CD).

Table 4.6: Simple regression between Δ Sensex Metal and Macroeconomic Variables

	R^2 (R square)	Intercept value	Slope value	T stats	P value	F Sign	Remark
Δ Growth rate (Metal)	0.014	0.006	0.304	1.056	0.294	0.294	***Accept Ho***
Δ Inflation rate	0.002	0.013	-0.699	-0.389	0.699	0.699	***Accept Ho***
Δ Call rate	0.002	0.009	0.019	0.413	0.681	0.681	***Accept Ho***
Δ Exchange rate	0.255	0.014	-3.338	-5.260	0.000	0.000	***Reject Ho***
Δ FII	0.380	-0.035	0.001	7.046	0.000	0.000	***Reject Ho***
Δ Oil rate	0.082	0.003	0.472	2.684	0.009	0.009	***Reject Ho***
Δ Gold rate	0.034	0.019	-0.548	-1.697	0.093	0.093	***Accept Ho***

Null Hypothesis (H_0): No significant relationship between BSE metal with each macroeconomic variable.

Alternative Hypothesis (H_a): Significant relationship between BSE metal with each macroeconomic variable.

It was found through P-value and F-sign in the table that exchange rate, FII and oil rate does affect BSE Metal. We can accept the alternative hypothesis. R^2 shows that metal growth rate; inflation

rate, call rate, oil rate and gold rate explain very low variation in BSE Metal while FII and exchange rate explain 38% and 25.5% of variation in BSE Metal respectively.

Table 4.7: Simple regression between Δ Sensex Auto and Macroeconomic Variables

	R^2 (R square)	Intercept value	Slope value	T stats	P value	F Sign	Remark
Δ Growth rate (Auto)	0.002	0.016	0.029	0.373	0.710	0.710	***Accept Ho***
Δ Inflation rate	0.002	0.013	0.518	0.444	0.658	0.658	***Accept Ho***
Δ Call rate	0.003	0.016	0.015	0.479	0.633	0.633	***Accept Ho***
Δ Exchange rate	0.126	0.019	-1.523	-3.421	0.001	0.001	***Reject Ho***
Δ FII	0.373	-0.012	0.001	6.944	0.000	0.000	***Reject Ho***
Δ Oil rate	0.019	0.015	0.149	1.266	0.209	0.209	***Accept Ho***
Δ Gold rate	0.020	0.021	-0.269	-1.275	0.206	0.206	***Accept Ho***

Null Hypothesis (H_0): No significant relationship between BSE Auto with each macroeconomic variable.

Alternative Hypothesis (H_a): Significant relationship between BSE Auto with each macroeconomic variable.

It was found through P-value and F-sign in the table exchange rate and FII does affect BSE Metal. We can accept the alternative hypothesis. R^2 shows that auto growth rate; inflation rate, call rate, oil rate and gold rate explain very low variation in BSE Auto while FII and exchange rate explain 37.3% and 12.6% of variation in BSE Auto respectively.

Table 4.8: Simple regression between Δ Sensex Capital Goods (CG) and Macroeconomic Variables

	R^2 (R square)	Intercept value	Slope value	T stats	P value	F Sign	Remark
Δ Growth rate (CG)	0.005	0.013	0.048	0.649	0.518	0.518	***Accept Ho***
Δ Inflation rate	0.002	0.018	-0.664	-0.445	0.657	0.657	***Accept Ho***
Δ Call rate	0.000	0.013	0.000	-0.013	0.990	0.990	***Accept Ho***
Δ Exchange rate	0.293	0.018	-2.971	-5.799	0.000	0.000	***Reject Ho***
Δ FII	0.315	-0.020	0.001	6.107	0.000	0.000	***Reject Ho***
Δ Oil rate	0.028	0.011	0.229	1.526	0.131	0.131	***Accept Ho***
Δ Gold rate	0.037	0.022	-0.469	-1.754	0.083	0.083	***Accept Ho***

Null Hypothesis (H_0): No significant relationship between BSE CG with each macroeconomic variable.

Alternative Hypothesis (H_a): Significant relationship between BSE CG with each macroeconomic variable.

It was found through P-value and F-sign in the table that exchange rate and FII does affect BSE CG. We can accept the alternative hypothesis for these two variables. R^2 shows that CG growth rate; inflation rate, call rate, oil rate and gold rate explain very low variation in BSE CG and Call rate explain 0% variation in BSE CG. FII and exchange rate explain 31.5% and 29.3% of variation in BSE CG respectively.

Table 4.9: Simple regression between Δ Sensex Fast moving Consumer Goods (FMCG) and Macroeconomic Variables

	R^2 (R square)	Intercept value	Slope value	T stats	P value	F Sign	Remark
Δ Growth rate (FMCG)	0.006	0.018	-0.087	-0.724	0.471	0.471	***Accept Ho***
Δ Inflation rate	0.001	0.015	0.246	0.296	0.768	0.768	***Accept Ho***
Δ Call rate	0.007	0.017	0.016	0.745	0.459	0.459	***Accept Ho***
Δ Exchange rate	0.059	0.018	-0.743	-2.257	0.027	0.027	***Reject Ho***
Δ FII	0.188	0.003	0.000	4.330	0.000	0.000	***Reject Ho***
Δ Oil rate	0.000	0.017	0.015	0.178	0.859	0.859	***Accept Ho***
Δ Gold rate	0.042	0.022	-0.280	-1.885	.063	0.063	***Accept Ho***

Null Hypothesis (H_0): No significant relationship between BSE FMCG with each macroeconomic variable.

Alternative Hypothesis (H_a): Significant relationship between BSE FMCG with each macroeconomic variable.

It was found through P-value and F-sign in the table exchange rate and FII does affect BSE FMCG. We can accept the alternative hypothesis for these two variables. R^2 shows that FMCG growth rate; inflation rate, call rate, exchange rate, oil rate and gold rate explain very low variation in BSE FMCG and each Inflation rate. Oil rate explain 0% variation in BSE FMCG while FII explain 18.8% of variation in BSE FMCG respectively.

Table 4.10: Simple regression between Δ Sensex Consumer Durables (CD) and Macroeconomic Variables

	R^2 (R square)	Intercept value	Slope value	T stats	P value	F Sign	Remark
Δ Growth rate (CD)	0.003	0.018	-0.082	-0.472	0.638	0.638	***Accept Ho***
Δ Inflation rate	0.002	0.021	-0.550	-0.367	0.715	0.715	***Accept Ho***
Δ Call rate	0.003	0.017	0.020	0.509	0.612	0.612	***Accept Ho***
Δ Exchange rate	0.238	0.021	-2.686	-5.028	0.000	0.000	***Reject Ho***
Δ FII	0.328	-0.017	0.001	6.281	0.000	0.000	***Reject Ho***
Δ Oil rate	0.030	0.014	0.239	1.586	0.117	0.117	***Accept Ho***
Δ Gold rate	0.057	0.028	-0.588	-2.215	.030	0.030	***Reject Ho***

Null Hypothesis (H_0): No significant relationship between BSE CD with each macroeconomic variable.

Alternative Hypothesis (H_0): Significant relationship between BSE CD with each macroeconomic variable.

It was found through P-value and F-sign in the table that exchange rate, gold rate and FII does affect BSE CD. We can accept the alternative hypothesis for these two variables. R^2 shows that CD growth rate; inflation rate, call rate, oil rate and gold rate explain very low variation in BSE CD and FII and exchange rate explain 32.8% and 23.8% of variation in BSE CD respectively.

Granger causality test

Granger causality test is a technique for determining whether one time series is significant in forecasting another or not. Here Granger-causality test has been conducted to study the causal relationship between macroeconomic variables and the Indian stock market. The tables below reports granger causality test results with lag of 4 that is the appropriate selection of lags. The null hypothesis has been tested on the basis of the P-value. If the P-value is less than the critical P value at 5% than the null hypothesis is rejected and there will be a significant relation between the variables. First differencing of the variables has been used to apply granger causality test.

Table 4.11: Pairwise Granger Causality Tests for SENSEX

Null Hypothesis	P-Value	Result	Relationship
IIP growth rate does not granger cause SENSEX	0.8697	ACCEPT	NO RELATION
SENSEX does not granger cause IIP growth rate	0.1280	ACCEPT	
Inflation rate does not granger cause SENSEX	0.2923	ACCEPT	NO RELATION
SENSEX does not granger cause Inflation rate	0.4587	ACCEPT	
Call Rate does not granger cause SENSEX	0.0042	REJECT	UNIDIRECTIONAL
SENSEX does not granger cause Call Rate	0.6400	ACCEPT	RELATION
Exchange Rate does not granger cause SENSEX	0.1114	ACCEPT	UNIDIRECTIONAL
SENSEX does not granger cause Exchange Rate	0.0088	REJECT	RELATION
Gold Rate does not granger cause SENSEX	0.9530	ACCEPT	NO RELATION
SENSEX does not granger cause Gold Rate	0.8868	ACCEPT	
Oil Rate does not granger cause SENSEX	0.0876	ACCEPT	NO RELATION
SENSEX does not granger cause Oil Rate	0.0690	ACCEPT	
FII does not granger cause SENSEX	0.3145	ACCEPT	NO RELATION
SENSEX does not granger cause FII	0.4224	ACCEPT	

The table above shows granger causality test for seven macroeconomic variables and BSE Sensex. It can be concluded that there is a unidirectional relation between Call rate and Sensex, exchange rate and Sensex. Exchange rate does not affect stock market (SENSEX). However Sensex does influence exchange rate. On the other hand call rate influences stock market (SENSEX). Granger causality test shows no relation between IIP and Sensex, CPI (inflation) and Sensex, oil rate and Sensex, gold rate and Sensex and FII and Sensex. Thus only call rate affects Indian stock market.

The tables below show Granger causality test for five sectors namely metal, auto, capital good (CG), FMCG, Consumer durables(CD).

Table 4.12: Pairwise Granger Causality Tests for BSE METAL

Null Hypothesis	P-Value	Result	Relationship
IIP growth rate does not granger cause BSE metals	0.5440	ACCEPT	NO RELATION
BSE metals does not granger cause IIP growth rate	0.5584	ACCEPT	
Inflation rate does not granger cause BSE METAL	0.2824	ACCEPT	NO RELATION
BSE METAL does not granger cause Inflation rate	0.2673	ACCEPT	
Call Rate does not granger cause BSE METAL	0.0119	REJECT	UNIDIRECTIONAL
BSE METAL does not granger cause Call Rate	0.6506	ACCEPT	RELATION
Exchange Rate does not granger cause BSE METAL	0.1423	ACCEPT	UNIDIRECTIONAL
BSE METAL does not granger cause Exchange Rate	0.0449	REJECT	RELATION
Gold Rate does not granger cause BSE METAL	0.7663	ACCEPT	NO RELATION
BSE METAL does not granger cause Gold Rate	0.8617	ACCEPT	
Oil Rate does not granger cause BSE METAL	0.0619	ACCEPT	NO RELATION
BSE METAL does not granger cause Oil Rate	0.0035	REJECT	
FII does not granger cause BSE METAL	0.8484	ACCEPT	NORELATION
BSE METAL does not granger cause FII	0.5294	ACCEPT	

The table above shows granger causality test for BSE metal and macroeconomic variables. Call Rate and BSE metal, exchange rate and BSE metal depict a unidirectional relation. Thus exchange rate does not lead BSE metal however call rate influences BSE metal. The test result shows no relation between IIP and BSE metal, Inflation and BSE metal, gold rate and Sensex, oil rate and Sensex, FII and Sensex. Thus in metal sector only call rate affects stock market.

Table 4.13: Pairwise Granger Causality Tests for BSE Auto

Null Hypothesis	P-Value	Result	Relationship
IIP growth rate does not granger cause BSE AUTO	0.2510	ACCEPT	UNIDIRECTIONAL
BSE AUTO does not granger cause IIP growth rate	0.0020	REJECT	RELATION
Inflation rate does not granger cause BSE AUTO	0.7284	ACCEPT	NO RELATION
BSE AUTO does not granger cause Inflation rate	0.3629	ACCEPT	
Call Rate does not granger cause BSE AUTO	0.0322	REJECT	UNIDIRECTIONAL
BSE AUTO does not granger cause Call Rate	0.8385	ACCEPT	RELATION
Exchange Rate does not granger cause BSE AUTO	0.0335	REJECT	BIDIRECTIONAL
BSE AUTO does not granger cause Exchange Rate	0.0093	REJECT	RELATION
Gold Rate does not granger cause BSE AUTO	0.9279	ACCEPT	NO RELATION
BSE AUTO does not granger cause Gold Rate	0.8414	ACCEPT	

Oil Rate does not granger cause BSE AUTO	0.2012	ACCEPT	NO RELATION
BSE AUTO does not granger cause Oil Rate	0.1210	ACCEPT	
FII does not granger cause BSE AUTO	0.1681	ACCEPT	NO RELATION
BSE AUTO does not granger cause FII	0.3707	ACCEPT	

The table above shows granger causality test for BSE auto and macroeconomic variables.IIP and BSE auto, Call rate and BSE auto shows a unidirectional relation. IIP does not lead stock market in this sector but stock market does lead IIP. On the other hand call rate influences BSE Auto but BSE Auto does not influence Call rate. Exchange rate and BSE auto shows a bidirectional relation. And Inflation and BSE auto, gold rate and BSE auto, oil rate and BSE auto, FII and BSE auto depict no relation. Thus in the auto mobile sector only call rate and exchange rate influences stock market.

Table 4.14: Pairwise Granger Causality Tests for BSE CG

Null Hypothesis	**P-Value**	**Result**	**Relationship**
IIP growth rate does not granger cause BSE CG	0.7688	ACCEPT	NO RELATION
BSE CG does not granger cause IIP growth rate	0.1199	ACCEPT	
Inflation rate does not granger cause BSE CG	0.3175	ACCEPT	NO RELATION
BSE CG does not granger cause Inflation rate	0.4909	ACCEPT	
Call Rate does not granger cause BSE CG	0.0046	REJECT	UNIDIRECTIONAL
BSE CG does not granger cause Call Rate	0.5019	ACCEPT	RELATION
Exchange Rate does not granger cause BSE CG	0.0614	ACCEPT	UNIDIRECTIONAL
BSE CG does not granger cause Exchange Rate	0.0426	REJECT	RELATION
Gold Rate does not granger cause BSE CG	0.8893	ACCEPT	NO RELATION
BSE CG does not granger cause Gold Rate	0.6441	ACCEPT	
Oil Rate does not granger cause BSE CG	0.2229	ACCEPT	NO RELATION
BSE CG does not granger cause Oil Rate	0.1998	ACCEPT	
FII does not granger cause BSE CG	0.7186	ACCEPT	NO RELATION
BSE CG does not granger cause FII	0.1702	ACCEPT	

The table above shows granger causality test for BSE CG and macroeconomic variables. Call Rate and BSE CG, exchange rate and BSE metal depict a unidirectional relation. Thus exchange rate does not lead BSE CG however call rate influences BSE CG. The test result shows no relation between IIP and BSE CG, Inflation and BSE CG, gold rate and Sensex, oil rate and Sensex, FII and Sensex. Thus in CG sector only call rate affects stock market.

Table 4.15: Pairwise Granger Causality Tests for BSE FMCG

Null Hypothesis	P-Value	Result	Relationship
IIP growth rate does not granger cause BSE FMCG	0.3959	ACCEPT	NO RELATION
BSE FMCG does not granger cause IIP growth rate	0.1902	ACCEPT	
Inflation rate does not granger cause BSE FMCG	0.6619	ACCEPT	NO RELATION
BSE FMCG does not granger cause Inflation rate	0.6881	ACCEPT	
Call Rate does not granger cause BSE FMCG	0.4105	ACCEPT	NO RELATION
BSE FMCG does not granger cause Call Rate	0.7121	ACCEPT	
Exchange Rate does not granger cause BSE FMCG	0.1131	ACCEPT	NO RELATION
BSE FMCG does not granger cause Exchange Rate	0.5875	ACCEPT	
Gold Rate does not granger cause BSE FMCG	0.9355	ACCEPT	NO RELATION
BSE FMCG does not granger cause Gold Rate	0.0874	ACCEPT	
Oil Rate does not granger cause BSE FMCG	0.8042	ACCEPT	UNIDIRECTIONAL
BSE FMCG does not granger cause Oil Rate	0.0318	REJECT	RELATION
FII does not granger cause BSE FMCG	0.0790	ACCEPT	NO RELATION
BSE FMCG does not granger cause FII	0.8999	ACCEPT	

The table above shows granger causality test for BSE FMCG and macroeconomic variables. Granger causality test in FMCG sector shows that there is a unidirectional relation between oil rate and BSE FMCG. Here, only BSE FMCG influences oil rate but oil rate does not affect BSE FMCG. Also there is no relation between IIP and BSE FMCG, CPI (inflation) and BSE FMCG, call rate and BSE FMCG, exchange rate and BSE FMCG, gold rate and BSE FMCG and FII and BSE FMCG. Thus in FMCG sector none of the macroeconomic variables affect stock market.

Table 4.16: Pairwise Granger Causality Tests for BSE CD

Null Hypothesis	P-Value	Result	Relationship
IIP growth rate does not granger cause BSE CD	0.0321	REJECT	UNIDIRECTIONAL
BSE CD does not granger cause IIP growth rate	0.0841	ACCEPT	RELATION
Inflation rate does not granger cause BSE CD	0.7179	ACCEPT	NO RELATION
BSE CD does not granger cause Inflation rate	0.2498	ACCEPT	
Call Rate does not granger cause BSE CD	0.0018	REJECT	UNIDIRECTIONAL
BSE CD does not granger cause Call Rate	0.3539	ACCEPT	RELATION
Exchange Rate does not granger cause BSE CD	0.0759	ACCEPT	UNIDIRECTIONAL
BSE CD does not granger cause Exchange Rate	0.0398	REJECT	RELATION

Gold Rate does not granger cause BSE CD	0.8629	ACCEPT	NO RELATION
BSE CD does not granger cause Gold Rate	0.7550	ACCEPT	
Oil Rate does not granger cause BSE CD	0.2139	ACCEPT	NO RELATION
BSE CD does not granger cause Oil Rate	0.1541	ACCEPT	
FII does not granger cause BSE CD	0.4194	ACCEPT	NO RELATION
BSE CD does not granger cause FII	0.0894	ACCEPT	

The table above shows granger causality test for BSE CD and macroeconomic variables. In the Consumer durables sector IIP growth rate and BSE CD, call rate and BSE CD, exchange rate and BSE CD shows a unidirectional relation. Here IIP and call rate lead the stock market but BSE CD does influence IIP and call rate. Also BSE CD leads exchange rate but exchange rate does not lead BSE CD. Thus BSE CD can be used to as a leading indicator of exchange rate .However, Oil rate and BSE CD, CPI (inflation) and BSE CD, gold rate and BSE CD and FII and BSE CD do not show any relation. Thus only IIP and call rate affects BSE Sensex in consumer durables sector.

CONCLUSION

In this paper, the study performed necessary analyses to answer the research question of whether some of the identified macroeconomic factors can influence the Indian stock market. The macroeconomic variables are represented by the industrial production index, consumer price index, interest rate (call rate), exchange rate, gold price, oil price, foreign institutional investment. Indian stock market is represented by BSE SENSEX. The paper also includes sectoral analysis of five sectors (metal, auto, capital goods, FMCG, consumer durables). Monthly data for a time span of 7 years (from April 2005 – March 2012) was considered. The paper employed Granger causality test, regression analysis and correlation analysis to examine such relationships. The results are interesting and useful in understanding the Indian stock market pricing mechanism as well as its return generating process.

On the basis of overall analysis and sectoral analysis it can be concluded that three out of seven variables are relatively more significant and likely to influence Indian stock market. These factors are exchange rate, foreign institutional investment and call rate. There is a positive relation between FII and Sensex, call rate and Sensex whereas exchange rate and Sensex shows a negative relation. The result has been concluded on the bases of the granger causality test in which call rate has been seen as affecting BSE in almost all the sectors (except FMCG sector) and regression analysis in which exchange rate and FII is affecting all the sector. This simply concludes that in long term the Indian stock market is more driven by domestic macroeconomic factors rather than global factors.

The results of this analysis should not be treated as conclusive for an investment. Apart from understanding Indian stock market based on the contributions of the significant variables, there remain other important issues that affect the return generating process. These issues are the cost of equity capital, asset valuation, industry analysis, a firm's management and operational efficiency analysis, and so on. Any investor should consider all relevant sources of information when making an investment decision.

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Data source links:

Monthly Bombay stock exchange indices like SENSEX, BSE: auto, BSE: metal, BSE: capital goods, BSE: CD and BSE: FMCG taken from Bombay Stock exchange limited site.
http://www.bseindia.com/

Monthly Index of industrial production and monthly sector wise Index of industrial production of auto, metal, capital goods, CD and FMCG was taken from Central Statistical Office site.
http://mospi.nic.in/Mospi_New/site/home.aspx

Monthly data of call money rate, exchange rate (dollar price), gold price and Foreign Institutional Investments in the capital market was extracted from Reserve Bank of India (RBI) database site.
http://dbie.rbi.org.in/

Monthly crude oil (petroleum) was taken index mundi site.
http://www.indexmundi.com/india/