Stock Return Volatility and Macroeconomic Fundamentals in India: Time Series Analysis

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Certificate

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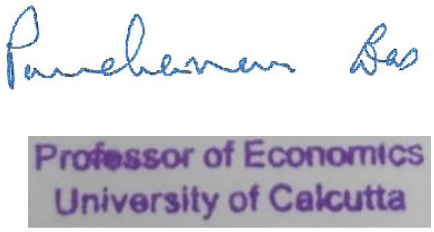

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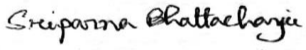
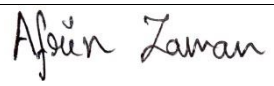
1. Sriparna Bhattacharjee	C93/ECO/191202	
2. Afrin Zaman	C93/ECO/191019	
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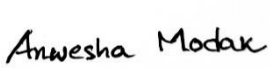
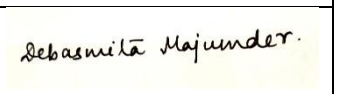
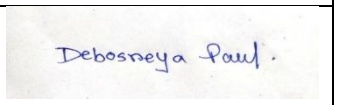
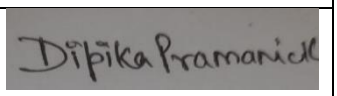
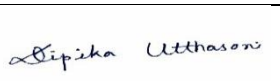
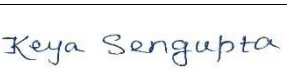
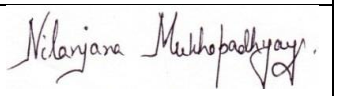
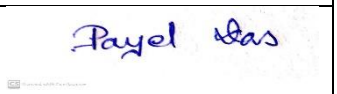
4. Anwesha Modak	C93/ECO/191036	
5. Debasmita Majumder	C93/ECO/191061	
6. Debosreya Paul	C93/ECO/191069	
7. Dipika Pramanick	C93/ECO/191075	
8. Dipika Utthasoni	C93/ECO/191076	
9. Keya Sengupta	C93/ECO/191087	
10. Nilanjana Mukhopadhyay	C93/ECO/191108	
11. Payel Das	C93/ECO/191113	
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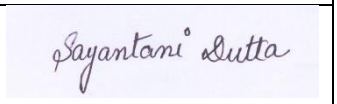
13. Sayantani Dutta	C93/ECO/191158	
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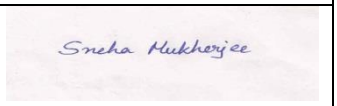
15. Sneha Mukherjee	C93/ECO/191180	
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Table of Content

List of Acronyms

ACF	Autocorrelation Function
ADF	Augmented Dickey Fuller
ARCH	Autoregressive Conditional Heteroscedasticity
BOP	Balance of Payments
BSE	Bombay Stock Exchange
BVAR	Bivariate Vector Autoregression Model
CD	Consumer Discretionary
CG	Consumer Goods
CMR	Call Money Rate
CPI	Consumer price index
CS	Consumer Staples
EGARCH	Exponential Generalised Autoregressive Conditional Heteroscedasticity
FDI	Foreign Direct Investment
FMCG	Fast Moving Consumer Goods
FII	Foreign Institutional Investors
FPI	Foreign Portfolio Investment
GARCH	Generalised Autoregressive Conditional Heteroscedasticity
GDP	Gross Domestic Product
GNP	Gross National Product

HC	Healthcare
ICSS	Iterative Cumulative Sum of Squares
IMF	International Monetary Fund
IIP	Index of Industrial Production
IT	Information Technology
KPSS	Kwiatkowski-Phillips-Schmidt-Shin-Test
NEP	New Economic Policy
NI	National Income
NSE	National Stock Exchange
PACF	Partial Autocorrelation Function
PP	Phillips-Perron-Test
PSU	Public Sector Units
RBI	Reserve Bank Of India
REER	Real effective exchange rate
RIR	Real interest rate
TARCH	Threshold Autoregressive Conditional Heteroscedasticity
TECK	Technology
SENSEX	Stock Exchange Sensitive Index
VAR	Vector Autoregression
VECM	Vector Error Correction Model
WPI	Wholesale Price Index

Abstract

Measuring volatility of stock market return has been one of the most crucial and important issues in the current period since the financial sector very much reflects the overall economic situation of a country. After the introduction of the New Economic Policy (NEP) in 1991 India opened its door for the global market and India transitioned from a state-controlled economy to a market determined economy which induced a lot of fluctuations in the financial sector. In this study we are trying to analyse the volatility of the Indian stock return for the period of 1991 to 2021 considering stochastic seasonality with monthly time series. And it has been done in three parts. First the trending pattern of Sensex along with top 10 major companies selected on the basis of market capitalization has been analysed. Second, the study analyses the contribution of the macroeconomic variables (inflation, exchange rate, interest rate, money supply) to the overall market return and finally, how the volatility of real macroeconomic factors affects the volatility of Indian stock return using the BSE Sensex. These empirical findings suggest that close price series has persistent stochastic behaviour at seasonal frequencies. But the stock return series has no pure trend in the long run. The trending pattern of the 10 major companies shows that they are not homogeneous. The empirical interdependence among asset returns and real macroeconomic factors after controlling for other macro factors show that causality goes from stock return to the real economy but not the other way round. Detailed impact of BSE Sensex return on Indian economy is figured out once it is derived that fluctuation in rate of growth of industrial productivity and inflation is a consequence of fluctuation in Sensex return. This draws the major interpretation that, the volatility in financial sector can influence the volatility in real sector highly.

Key words: Stock returns volatility, Macroeconomic Fundamentals, BSE Sensex, India

JEL Code: G1, E44, C22, C58

Chapter 1: Introduction

In the recent year financial market volatility has a wider influence in the economy as a whole, since for any country financial market development indicates economic prosperity or growth of the country. It is believed that the financial development has strong impact on GDP growth (Lavine and Zerovs, 1996). Now stock market being the heart of the financial system transforms savings into investments and finances the real sectors and augments economic growth by boosting savings as well as accelerates both quality and quantity of investment. Investors always want to reduce the risk associated in particular asset, the higher the volatility associated in any asset, the riskier the asset becomes. But sometimes high risk also yields high return and because of this analysing volatility estimation and forecasting has become very crucial for risk management. Market volatility is unavoidable and desirable up to a certain degree as the fluctuations in stock price indicate changing values across economic activities and it facilitates better resource allocation. But extreme volatility disrupts smooth functioning of the stock market as frequent and wide stock market fluctuations cause uncertainty about the value of asset and affects the confidence of the investors. The first section of this study is an introduction to the financial market in India and its importance in the real economy. It is further divided into four subsections: the research problem of the study, the relevance of this study, a survey of literature conducted in the past on related issues, a discussion of research gaps in previous literature and the objective of this analysis respectively. This is followed by Section 2 that provides with a brief description of the data sets used and the constructed variables in the study. Section 3 elaborates on the analysis of the objective of this study through the consequent Chapters in details. Section 4 concludes the study.

1.1 Research Problem

This study analyses stock return volatility considering the macro fundamentals with Indian data. Stock market has been more active after the financial sector reform towards free movement of capital and market openness in transitional emerging economies like India. The removal of barriers in free movement of capital in emerging markets at the end of the 1980s and the early 1990s opened up markets for foreign investors as well as domestic investors. Stock market volatility has appeared as one of the important issues particularly in the context of development of the transitional developing countries after opening of the emerging economies. The financial sector openness enhances stock market integration globally. Market openness has allowed free access to foreign investors to capital markets in every country. More integrated financial markets are expected to increase vulnerability to global shocks by transmitting the crisis across the global markets. Also, financial openness is expected to increase investment opportunities, reduce cost of capital, and, ultimately, improves economic growth through international competition and risk sharing, and promoting domestic financial markets (Bekaert and Harvey 2003, Carrieri et al. 2007).

Against this background the focus of this study is to look into the pattern of stock return volatility with Indian data during the post liberalisation period. For understanding the pattern of volatility, the study looks into the problem mainly from two perspectives: how does the stock price of the major players affect the trending behaviour of stock market; and how the macro fundamentals have effect on stock return. In this study, we try to find out the contribution of major players and determinants of stock market volatility and analyse the short run and long run dynamics by taking into account macroeconomic fundamentals during the period

1991 to 2021. We examine the trend behaviour of stock prices of 10 major players on the basis of market capitalisation in Bombay Stock market, and BSE (Bombay Stock Exchange) Sensex (Stock Exchange Sensitive Index) by carrying out unit root test. We analyse how stock prices of these market players affect the stochastic behaviour of stock index in the market by applying cointegration analysis.

The primary objective of this study is on the analysis of volatility of stock returns by taking into account the effects of inflation and other macroeconomic variables. The stochastic behaviour of Sensex provides a gross idea about the financial market in India. This index has been constructed by taking weighted average of stock prices of 30 major companies listed in BSE on the basis of their market capitalisation. Thus, the time movement of it depends on the price movement of the constituent stocks. In this study we analyse the behaviour of monthly stock prices and the return series of top 10 companies in BSE: how they are cointegrated and how they affect financial market in India. Theoretically, stock price is determined by the demand-supply mechanism through a complicated process. Demand for financial assets of better performed companies is expected to be high. We try to find out the behaviour of individual stock price of the top 10 selected cSompanies which ultimately have effect on the collective behaviour in the financial market reflected in the shape of temporal movement of Sensex. The study also tries to analyses the linkage between the financial sector and real economy.

Macro-economic variables have a huge impact on the changes in stock return movements (Kakoti, 2019). Any change in any one of the macroeconomic factors will result in a change in different sectors of the economy specially the financial sector. Stock returns and exchange rate are the two fundamental instruments of financial markets in the world, which plays key role in an international business all

over the world. So, it is necessary to understand the relationship between both the markets. Theory of portfolio balance approach states the causality between exchange rate and movement of stock prices to be negative. On the other hand, the traditional approach states a positive relation between the exchange rate and stock prices. That is the health of national currency can significantly affect the market value of firms (Suriani, Kumar, Jamil, Muneer, 2015).

Factors like interest rate and industry production are also expected to have impact on stock return. Interest rate is expected to have a negative impact on stock prices. A rise in interest rate makes borrowing expensive not only for consumers but also for the companies, leading to a fall in stock prices. Similarly, industrial production index has a positive impact on stock prices are. Index of Industrial production (IIP) reflects the total production activity that happens in the country during a particular period as compared to a reference period, if it reduces stock prices will fall. Among all the macroeconomic variables, inflation is one of the important factors which significantly affect the stock returns. Inflation induces variability in relative prices which leads to microeconomic inefficiencies in the allocation of resources. And inflation also represents the price variation in real sector. Moreover, the relationship between stock return volatility and inflation is still not established properly in emerging countries.

There is a disagreement in theoretical literature regarding the relationship between inflation and stock return. Early inferences suggested that an asset's underlying value remains unchanged when faced with inflation. According to the hypothesis presented by Irving Fisher financial assets represent claims against real assets and work as a hedge against inflation. Then there should be a positive relationship between nominal stock return and inflation rate (Fisher, 1930). On the other hand, Fama

(1981) suggests that a negative relationship between the stock return and inflation are proxy for positive correlation between stock return and the real activity as real sector and inflation rate are negatively correlated. Macroeconomic factors cannot be ignored because any change in any of the factors has an effect on the real economy. So, it is very important to analyse the behaviour of the volatility in stock returns with the changes in the macro-economic factors.

This study unravels the linkage between the stock market and the growth rate of real macroeconomic variables like exchange rate, interest rate, broad money supply (M3) and IIP in the Indian context in the post reform-era. Monthly data of five macroeconomic variables are taken into consideration over the period 1991:01–2021:04. For empirical analysis this study uses vector autoregressive model to explore the relationship between stock market index and these macroeconomic variables. Since volatility persists in the stock market, analysing the stock return volatility is important, not only for the investors for making efficient decisions but also for the economy as efficiency in financial market induces economic prosperity and growth. The study also tries to explore the linkage between the price variation in real sectors (inflation) with that of the price variation in money sector (stock return) and draw some useful insights using monthly time series data in the context of India. For convenience of the study REER (Trade Based) is proxying for exchange rate; log difference of Wholesale Price Index (WPI) is taken the proxy for inflation rate; M3 for money supply; Call money rate for interest rate and lastly Index of Industrial Production (IIP) for industrial growth.

1.2 Relevance of the Problem

As the economy move towards the path of development, the fundamental values of stock market evolve gradually. Stock returns movements augment growth in real economic activity. The financial market plays an important role in the process of economic growth and development by facilitating savings and channelizing funds from savers to investors. Earlier, the stock market was not that much transparent, the settlements were paper based and forward trading used to cause unnecessary speculations. India had experienced accelerated economic growth in 1980s, but the relatively high rates of GDP growth was accompanied by macroeconomic imbalance and a persistently rigid structure of Indian economy which actually resulted in stagnation of the growth process (RBI Annual Report, 1991-92).

One of the major contemporary economic concerns that have not sufficiently been emphasized by economists is the unambiguous volatility pattern in the Indian stock market since the post liberalisation period. After a relatively strong economic performance in the late 1980s, Indian economy entered into a phase of liquidity crisis during 1990-91. Rise in GDP growth was accompanied by higher fiscal deficit, rising current account deficit. With no Foreign Direct Investment (FDI) and Foreign Portfolio Investment (FPI), this higher current account deficit translated into increasing levels of external debt. In such a situation there was no question about the need for structural reform and India had to take the path of IMF style reform. New economic Policy (NEP) of 1991 opened up India's door for global exposure. Transition from a state-controlled economy to a market determined economy resulted in a lot of fluctuations.

The period around 1991 experiencing BOP (Balance of Payment) crisis and the subsequent initiation of economic reforms in India is the most volatile period in

Indian stock market (Batra, 2004). Financial liberalisation calls for larger volumes of international financial flows. Bullishness is often driven by events outside the country. Perfect capital mobility has also caused the country's business cycle to be easily affected by the boom and recessionary situation happening in the rest of the world. Removal of restrictions on foreign inflow and outflow of capital has increased financial fragility. The unregulated capital flows across the nations have led to volatility in the financial market. Market volatility is unavoidable and desirable up to a certain degree as the fluctuations in the stock price indicate changing values across economic activities and it facilitates better resource allocation. As the organizations of investment market improve, the risk of predominance of speculation does, however, increase (Keynes, 1936). But frequent and wide fluctuations cause uncertainty about the value of the asset affecting the confidence of the investors.

Now, in the context of investment portfolio, unsystematic risk specific to industries can be reduced through diversification (Ignatius, 1991). The present study concentrates on the top 10 companies segmented industry wise. The behaviour of the companies belonging to similar industries is expected to be cointegrated implying that their performance will be similar in real economy. But there will be heterogeneity in the price movements of the companies belonging to different industries. Also, these companies do not affect BSE Sensex in the same way. The individual company's price movement and the movement of Sensex may not be cointegrated exhibiting different types of trend. An impeccable link always works between the real economy and the financial market. During the phase of economic boom, the aggregative level of economic activity is high reflecting in a rising level of consumption and investment expenditure and a sense of optimism works in the mind of the investors pursuing them to invest more in the share market.

Real economic activity with lofty investments, both in quality and quantity, would result in growth with macroeconomic stability and a fewer financial uncertainty. Excessive financial market volatility affects real economic activity and the functioning of capital markets and it may sabotage the economic growth as a whole. The random returns from a subset of assets depend on market factor returns which can be represented by a GNP (Gross National Product) factor (Ross, 1976). Bubbles and crashes in the stock market instigate boom and recessionary situation in the real sector and do have an impact on National Income (NI) of a country. Market offers another kind of risk, namely the systematic risk, which affects the overall performance of the financial markets. Since all other types of risk can be avoided by diversification, only the responsiveness of an asset's rate of return to the level of economic activity is relevant in assessing its risk (Sharpe, 1964). So along with the pattern of volatility of top 10 major companies, it is also important to look at the overall market volatility caused by macro fundamentals.

In developed nations, the linkage between the financial sector and real economy is strong as the stock market is well-organised. Fewer distortions in case of collecting financial capital for small investors make it easy to start new ventures. But developing countries like India experiences difficulties in collecting financial capital due to many restrictions and less organised markets. Uncertainty about the market is one of the driving factors of volatility. Indeed, volatility in stock market is frightening from the view point of the investors, but for the economy it plays an important role. High volatility creates pessimistic expectations which in turn affect the market. A low growth of the economy tends to set investors‟ expectations more sensitive to economic variables. A desirable or undesirable event prompts them to inflow or outflow fund from the market, which results in a high volatility. As the

economic institutions are inter-linked, collapse of one institution adversely affects the others. Conversely high growth of the economy stabilizes the investors' expectations concerning to risk premium and return which result in less volatility.

So, volatility can be used as great projection of the economic situation of the country and because of this measuring volatility and understanding the driving factors of the volatility of stock markets and the macro-economic factors which influences the stock market volatility has become an important task. In recent years, the financial crisis of 2007-08 caused Indian stock market to fall sharply. The economy entered into recession affecting the global investment climate. Cut in interest rate created high volatility. Probably, this is the first most falls in history. Again, in March 2020, in the atmosphere of complete lockdown, the economy has experienced trading halt after a gap of almost 12 years. Stock prices started falling, however, around June it has shown an upward tendency even though the economy has been shrinking. All these pieces of information have motivated to analyse the pattern of volatility in Indian stock market in the post liberalization era and how the major players' behaviour along with the macroeconomic fundamentals affect the stock prices.

1.3 Literature Survey

1.3.1 Literature on analysis of stock price and volatility

During reform (after 1991 crisis) high structural changes in the volatility pattern has been observed but liberalization has no impact on stock market (Batra, 2004**).** This literature analysed time variance of volatility in Indian stock market during 1979 to 2003 by using conditional GARCH model and examines if there has been any increase in volatility in Indian stock market during financial liberalization along with shifts in volatility of stock price. By using augmented GARCH model the nature of events that causes the shift has been considered. She has found that in case of

monthly data stock market volatility has fallen but volatility has continuously remained very high and no leverage effect is present. In case of daily data mean volatility has increased. At different break date the nature of volatility has been different, in case of budget date volatility was high, and in case of actual policy announcement volatility was constant, in case of actual entry of FIIs volatility decreased. An observation is that Initial policy announcement has effect on volatility. On the other hand, again using GARCH (1,1) Kavita (2017) has shown that volatility of the previous days Sensex is indeed affecting todays Sensex during April 2000 to March 2015 this indeed tell us a highly volatile market would indeed result in current volatility. She has used BSE Sensex as a represent of Indian equity market. Again, too much volatility can be a sign of inefficient stock market as higher volatility is an indicator of higher risk. Low volatility is preferred as it reduces unnecessary risk borne by investors. Normally low volatile stocks tend to provide significant positive abnormal returns over high volatile stocks, but in case of India it is different (Pandey and Sehgal, 2017). They have used BSE 200 Index as proxy. They ranked stocks were divided into 10 portfolios from P1 to P10. P1 is low volatile portfolio and P10 is high volatile portfolio. This strategy is called 12/1 strategy. The process continues from June 2002 – November 2013. The result shows unadjusted returns increase monotonically from P1 to P10. Thus, in India, high volatility stocks outperform the low volatility stocks. The volatility in the BSE Sensex exhibits the characteristics like volatility clustering, asymmetry effect and persistence of volatility in their daily return (Ali, 2016). He examined the nature of volatility clustering of the BSE stock exchange and the relationship between the return and volatility of BSE stock Exchange by using GARCH-M. Conclusion of this study is that the recent as well as past news both has an impact on volatility and the

negative shocks or bad news have more impact on volatility than that of positive shocks or good news and the relation between returns and volatility is statistically insignificant.

Shalini (2014); Mallikarjuna and Rao (2017); Manimaran and Anand (2017), have examined the volatility in Indian stock markets, for different sectoral indices. Shalini (2014) has concluded that the series is stationary and sectoral returns are white noise. Mallikarjuna and Rao (2017) have used GARCH family of models for the six indices of BSE namely; AUTO, BANKEX, ENERGY, HEALTHCARE, FMCG and IT (Information Technology) from 04th January 2010 to 30th October 2015. They found that the Technology related industry won't guarantee a good investment return which is proved by the low return from Telecom industry. But there is an interesting result is that the Sensex has exhibited less volatility in comparison with other sectoral indices, and the positive relation among all the indices except a few (Venkataramanaiah and Gowri, 2016). The correlation between risk and return of different SENSEX and banking stock indices have been examined by Ravi and Patil (2018) in Indian stock market by using secondary data over a period of 15 years from January 1, 2001 to December 31, 2015 of 4 banks i.e. HDFC Bank, ICICI Bank, Axis Bank and SBI. According to them FII plays an important role to acquire major investment from foreign investors and it actually increase risk connected investment because it actually gives higher investment. Acharya and Pradhan (2019); Avdalović and Milenković (2017); Al and Shubiri (2010); Khan et al. (2011) have worked on various company specific microeconomic factors affecting individual stock prices volatility of different companies by taking various stock exchange for different countries. To start with a study which has considered 55 companies listed at Karachi Stock Exchange and analyses the effects of dividend policy and Retention

Ratio on Stock Prices after controlling the variables like Earnings per Share, Profit after Tax and Return on Equity (Khan, et al. 2011). By considering more company specific factor other than previous study like company size, return on assets, return on equity, earnings per stock, book value, price-earnings ratio, price-to-book ratio and leverage and the stock price of companies that compose the BelexLine index, Avdalović and Milenković (2017) have taken 42 companies that are listed in Serbia's Belgrade Stock Exchange, and observed the impact of these company specific factors on the company's stock prices. According to their study these microeconomic factors have positive impact on stock prices. The stock market and banking sectors are complementary to each other at the early stages of development of stock market, so for the development of stock markets in emerging markets well-developed banking sector is important (Al and Shubiri, 2010). The paper suggests that economic growth is very much important in stock market development. The firm size followed by market capitalization is the most influencing factor that explains the changes in stock return in insurance companies (Acharya and Pradhan, 2019).

1.3.2 *Literature on stock returns volatility and macroeconomic fundamentals*

A large number of empirical studies have been conducted to examine the relationships between stock prices and selected factors which could affect the volatility of stock market. To begin with Fama (1981) attempted to explain negative relation between stock return and inflation during post 1953, which is a spurious result of negative relation between inflation and real activity. The relations among the real variables presumed to be the fundamental determinants of stock returns. Considering two types of models expected inflation is estimated and compared: one is based on decomposition of interest rates into expected inflation rates and expected

real returns; another is based on money demand theory and the quantity theory of money. The study established that inflation for month, quarter, or a year is related to the growth rate of real activity for the following year. He found that measures of inflation and expected inflation are strongly related to future real activity, as well as real stock returns are also strongly related to future real activity. The study also reveals consistent evidence stock returns and inflation rates are strongly related to measures of future real activity (with opposite signs), but future real activity does not explain the negative relations between real stock returns and unexpected inflation and finally concluded that expected real returns for both common stocks and bonds are determined in the real sector, so the spurious negative relations between inflation and expected real returns are resulted by a somewhat unexpected characteristic of the money supply process during the post 1953 period. The study of Chopin and Zong (2000) examines the inverse relationship between stock returns and inflation during the post- World War II period. The relationship between stock return and expected and unexpected inflation during post World War II period contradicts that of the positive relationship between nominal stock return and inflation proposed by Fisher (1930). According to Fama (1981) the inverse inflation-stock return correlation is a proxy for the negative relationship between inflation and real activity. On the other hand, Geske and Roll (1983) argued that the negative correlation is due to changes in government expenditures which affect real economic conditions of an economy and monetization of budget deficits. This paper tries to find out the hypothesis which is more compatible with the negative relationship between stock returns and inflation. The short run causality results show that Fama's hypothesis is more compatible for explaining the inverse relationship during the examined period. This study also shows that the real activity and monetary fluctuations are due to long-run

disequilibria of macro economy. In other words, the spurious correlation between stock return and inflation can be explained as: when the economy moves toward long-run equilibrium, there are short-run changes in real activity and money supply which may induce such correlation. The results suggests that the long-run relations and short-run adjustments as the economy moves toward equilibrium offer a plausible explanation of the negative correlation between stock returns and inflation.

The studies of Bhattacharya and Mukherjee (2002), Ahmed (2008), Tripathi and Seth (2014) focused on the effects of multiple macro variables on Indian stock market. Bhattacharya and Mukherjee (2002) have suggested that there was no significant linkage between stock prices and money supply, national income and interest rate but IIP affected the stock price, and there was two- way causation between stock price and inflation rate. Even though a unidirectional causal relationship of BSE Sensex has been found with exchange rate and IIP, NSE Nifty does not have any influence on these variables (Ahmed, 2008). In the short run, the causal pattern does not create any differential impact. There is a unidirectional causal relation for both BSE Sensex and NSE Nifty with exchange rate, exports, IIP, money supply while interest rate and FDI have caused both BSE Sensex and NSE Nifty. Tripathi and Seth (2014) detected a negative effect of exchange rate and inflation, and positive response of IIP and oil prices on stock returns. Venkatraja (2014) found that WPI, IIP, FII, REER has strong positive influence on BSE stock market performance, while there is a negative relationship with gold price and Kakoti(2019) concluded that even though inflation and money supply do have a positive effect on stock prices, but variables like REER and RIR has influenced stock prices negatively. According to Ahuja et al (2012) in long term the Indian stock market is more driven by domestic macroeconomic factors rather than global factors. On the

other hand Chaudhuri and Koo (2001) found that both domestic macroeconomic variables and international variables have explanatory power for stock return volatility in context with some Asian stock market including India, South Korea, Malaysia, and Thailand. The study of Kumar (2013) added that "favourable macro environment is a boon for the stock market and showed Industrial performance is positively related with performance of NSE though the policy rate has no sustainable impact on it. Hosseini et al (2011), on the other hand focused on a comparative study between Indian and Chinese stock market. The contemporaneous effects of these macro variables were insignificant except the negative contemporaneous impact of inflation in India. Likewise in China contemporaneous impact of crude oil price, increase in money supply and industrial production on Shanghai Stock Exchange (SSE) index was insignificant. But the contemporaneous effect of inflation on SSE was positive and significant. Regarding the association between the health of the stock market and health of the economy Rashid (2008) reported that in Pakistan although there is no short-run association between stock prices and the macroeconomic variables excluding money market rate, the study indicates that in the long run, there is a two-way causal link between stock prices and the macroeconomic variables. In contrary Tangjitprom (2012) based on his work, stated macroeconomic variables are less important to predict the future performance of stock return for Thailand. Rashid (2008) investigated the dynamic interactions between four macroeconomic variables suggested that unemployment rate and inflation rate are insignificant to determine the stock return. Using deposit rate (proxy for interest rate), CPI (proxy for inflation), local currency per US dollar (proxy for exchange rate), M2 (proxy for money supply), market index (proxy for stock market), Barakat et al (2015) proposed that there was a relationship between

these macroeconomic variables and stock market both for Egypt and Tunisia. It is generally assumed that the emerging markets are less efficient than the developed markets. To look into the volatility in developed country Schwert (1989) found in his paper that financial volatility helped to predict future macroeconomic volatility.

Canova and Nicolo (2000) filled the gap by analysing empirical interdependencies among financial markets, real activities and inflation from international point of view. They concluded that it is true that the shock originating in the US have important real and informational effect which do not possess by the other countries. The primary source of disturbances at national and international levels appears to be shocks originating in real activity and those originating in financial markets have an insignificant role in generating significant cyclical fluctuations. Indian Stock market is a casino for the sub-period of post liberalization and for the entire ten-year event study period. There is no support for the hypothesis that the Indian stock market development is linked with the economic growth in India during the study period from 1981 to 2001. But support for relevance of stock market to economic development during the pre-liberalization sub-period was there. (Azarmi et al.2005).

1.4 Research Gap and Objective

The above survey of literature elicited that in the emerging markets the pattern of volatility has received considerable attention since the post liberalization period. There are ample studies like Mallikarjuna and Rao (2017), Shalini (2014) etc. which focus to explain the behavioural pattern of stock prices by looking at the volatility pattern of sectoral indices. In this regard many literatures linked stock price or stock return with microeconomic factors such as company size, price to earnings ratio, dividend yields, leverage etc. Also, many studies like Kakoti (2019), Ahmed (2008),

Chaudhuri and Koo (2001)) focus to capture the linkage between macroeconomic variables and stock market performance. But these studies do not find any unique relation between the behavioural pattern of the variables and market index in the context of developing country. So, the relation between stock return and macro variables in developing country cannot be accurately predicted from the literature. The literature as cited above rarely studied the stock market behaviour by looking at how both the seasonal behaviour of companies' stock price as well as macro variables are related to stock returns behaviour and the causal link between financial volatility and macroeconomic volatility in Indian economy after liberalization. The present study of stock return volatility with Indian data tries to fill this gap through analysing first, how the behaviour of top 10 companies listed in BSE are related to market behaviour by looking at whether the individual stock price behaviour of different companies and behaviour of Sensex are cointegrated or not. Then after analysing the trending pattern of macroeconomic variables, it emphasizes to capture effect of macroeconomic variables on stock return volatility. The main contribution of this study is to consider the intra year movement of the variables i.e. the seasonal behaviour, for this the methodology used here becomes different and we followed the methodology used in the work of Das (2020).

The main objective of this study is to analyze the volatility of Indian stock return since 1991-2021 and it has been done in three parts. In the first part of the study, it analyses that how the behavior of top 10 companies listed in BSE affect market volatility by looking at whether the individual stock price behavior of different companies and behavior of Sensex are cointegrated or not. This study actually considers the direct relationship between BSE Sensex return and company's return by using market value proxies by market capitalization. Analyzing how the trend

behavior of stock prices of 10 major players on the basis of market capitalization in Bombay Stock Market, and BSE Sensex closed price by carrying out seasonal unit root test and co-integration is one of the important factors of this study. Since the trending patterns of all the 10 companies are different so their influence on BSE Sensex may differ so analyzing that is also very important. The second part of this study takes into consideration how the real sector influences the financial sector which means the impact of macroeconomic variables on stock market. This study will analyze the behavioral pattern or trend behavior for each of the selected macroeconomic variable, to find out the nature of transmission of the shocks between stock return and Macroeconomic variables. The selected macro variables for the study are Call money rate as a proxy for interest rate, M3(broad money supply), Real effective exchange rate trade based (REER_Tr), Index of industrial production (IIP) and growth rate of Whole sale price index (WPI) as a proxy for inflation rate. Finally, the study analyses how the volatility in macroeconomic variables affect the volatility in stock return. Macroeconomic volatility has emerged as a key issue in analysing the determinants of economic growth during this global crisis. There are several costs and consequences of macroeconomic volatility. Indeed, under certain conditions the positive relationship between risk and capital return can explain a positive relationship between economic volatility and growth. The inclusion of macroeconomic variables in the modeling of the volatility of stock return is essential to further explain the volatility of stock return. The present study therefore tries to explore the causal relationship between volatility in BSE Sensex return and the volatility of major macro determinants such as exchange rate, inflation rate, money supply, Industrial growth and interest rate.

1.5 Data

The analysis is based on monthly time series data from January 1991 to April 2021. The data regarding Sensex, 10 companies' stock close price is collected from the official website of BSE. The companies are selected based on their market capitalisation in BSE (collected in January, 2021).The 10 companies are - Reliance Industries Ltd.(market capitalisation 1228330.03), Tata Consultancy Services Ltd.(market capitalisation 1213371.12), HDFC Bank Ltd.(market capitalisation 807615.27), Infosys Ltd.(market capitalisation 572957.16), Hindustan Unilever Ltd.(market capitalisation 552592.14), Housing Development Finance Corp. Ltd. (market capitalisation 473801.61), ICICI Bank Ltd. (market capitalisation 374745.94), Kotak Mahindra Bank Ltd. (market capitalisation 369082.01), Bharti Airtel Ltd. (market capitalisation 328697.33), Bajaj Finance Limited (market capitalisation 294156.020). For empirical analysis the study considers log value of the close price of stock and the return series of Sensex and 10 listed companies are calculated by taking first difference of the log value of close price.

The macroeconomic variables used in this study are – Call money rate (to measure interest), IIP (measure of industrial production), M3 (measure for money supply) WPI (measure inflation) and REER trade-based index is consider here (to measure exchange rate). Monthly data of IIP and WPI are collected from Ministry of Statistics and Programme Implementation (MOSPI). The monthly data of M3, REER (trade-based index) and call money rate are collected from RBI Handbook Statistics on Indian Economy. For the purpose of the study, we applied backward splicing method in case of IIP, REER and WPI data and converted the base year into 2011-12. The inflation is measured by taking first difference of the log value of WPI and

for analysis the study considers the log value of each of the macroeconomic variables. In the next section the study focuses on the structure of analysis and methodology and findings of respective analysis.

1.6 Econometric Methods

This part of the study considers a brief discussion of the econometric methodologies used in this study. The econometric technique used for analysis is known as the seasonal time series analysis. Monthly time series data based on the financial sector tend to present strong pattern of seasonality and may be subject to intra year movement which is caused by changes in seasonal factors like changes in weather, climate or even due to changes in institutional factors. It brings about many difficulties to model specification, estimation, and inference. Seasonal process may be deterministic or stochastic. A deterministic trend can be depersonalised by using seasonal dummy variables by eliminating the effects of each of the seasons. However if the data followed a stochastic seasonal process then the effect of innovation have a permanent effect which reshape the seasonal pattern. This suggests that unit roots may be present in the long run (or at the zero frequency) or in each of the seasons or both.

The data taken under this analysis are in monthly frequency so this study will follow the HEGY test proposed by Hylleberg, Engle, Granger and Yoo (1990) and extended by del Barrio Castro, Osborn, and Taylor (2012) to discriminate between deterministic and stochastic behaviour of seasonality. This test is developed for roots in linear time series corresponding to seasonal frequencies and studied with different models including different combinations of constant, trend and seasonal dummies. The HEGY test is used to test for specific seasonal or non-seasonal unit roots. The

test by Hylleberg et al. (1990) detects seasonal unit roots at different seasonal frequencies. This test relies on the shape of the polynomial expansion for φ(L). The regression equation used in HEGY test in augmented form –

$$\Delta_{12}\tilde{y_t} = \pi_0\tilde{y}_{0,t} + \pi_6\tilde{y}_{6,t} + \sum_{i=1}^{5}(\pi_{1i}\tilde{y}_{1i,t} + \pi_{2i}\tilde{y}_{2i,t}) + \sum_{j=1}^{k}\tau_j\,\Delta_{12}\tilde{y}_{t-j} + \varepsilon_t$$

(1.1)

To carry out seasonal unit root tests the optimum lag length of the series is determined. The lag order is to be determined endogenously by using AIC and SIC. The most popular way of determining the order of augmentation in the augmented Dickey–Fuller tests is with the modified Akaike information criterion (MAIC) proposed by Ng and Perron (2001). Later on, the MAIC criteria have been extended by del Barrio Castro et al. (2016) to augmented HEGY tests. For monthly data maximum 12 unit roots can be obtained.

After carrying out the HEGY test to determine the presence of unit roots the study tries to find out cointegration relationship between BSE Sensex and the 10 major players. This analysis opts for the multivariate case of cointegration test which is the conventional Johansen test for cointegration in order to analyse the long run association considering the logarithm of close price of BSE Sensex as the dependent variable and the close prices of 10 major players as the response variable. The ranks of the variance covariance matrix give the idea whether the series is cointegrated or not. The analysis constructs the model on the basis of the assumption that the non-stationarity present in BSE close price is mainly due to fact that stock prices of individual companies of BSE is also non-stationary and hence verifying the cointegration relationship of BSE stock price with stock prices of top 10 companies.

The order of integration is identified for each variable by applying HEGY test and by considering 5 % critical value, it checks for cointegration. After carrying out the HEGY test to determine the presence of unit roots the study tries to find out cointegration relationship between selected variables. The concept of cointegration was first developed by Granger (1981). This analysis opts for the multivariate case of cointegration test which is the conventional Johansen test for cointegration in order to analyse the long run association considering the logarithm of close price of BSE Sensex as the dependent variable and the close prices of 10 major players as the response variable. The ranks of the variance covariance matrix give the idea whether the series is cointegrated or not. The analysis constructs the model on the basis of the assumption that the non-stationarity present in BSE close price is mainly due to fact that stock prices of individual companies of BSE is also non-stationary and hence verifying the cointegrating relationship of BSE stock price with stock prices of top 10 companies.

Based on the cointegration result the study applies restricted or unrestricted VAR according to the results. In a reduced VAR model it considers only the past values of the variables in right hand side. VAR is basically an extension of univariate auto regression model. It is commonly used for financial modelling, forecasting when considered a system of interrelated time-series and for analysing the dynamic impact of random disturbances on the system of variables. In a VAR (p) with k dimension the reduced form is given by –

$$x_t = \pi_0 + \pi_1 x_{t-1} + \cdots + \pi_p x_{t-p} + e_t \qquad (1.2)$$

Where, x_t is a vector of (k × 1)

$\pi_i$is a matrix of (k × k) for all i >0 and π_0 is a vector of (k × 1)

e_t is a vector of (k × 1)

The e_t follows vector white noise

$E(e_t) = 0$

$E(e_t \acute{e}_s) = \Omega$ when t = s

= 0 otherwise

In case of Ω, it a variance-covariance matrix of order k, whose diagonal elements are variance and it should be positive definite matrix.

Inorder to check the pattern of volatility the study considers the stationary variables. We have looked first the autocorrelation function and fit an OLS regression model with constant and check Engle's Lagrange multiplier test for ARCH effect. After that the applied ARCH/GARCH process accordingly.

In time series data variance of random error become time dependent which indicates risk. The conditional variance of random disturbance (ε_t) measures volatility of the series. ARCH models were introduced by Engle (1982). The focus of the model is on conditional variance function of random error. Engle (1982) defined ARCH model by assuming -

$$\varepsilon_t \sim N(0, \sigma_t^2)$$

Where, $\sigma_t^2 = \theta_0 + \theta_1 \varepsilon_{t-1}^2 + \theta_2 \varepsilon_{t-2}^2 + \cdots \ldots + \theta_p \varepsilon_{t-p}^2$ (1.3)

In this process we analyse σ_t^2 which depends on ε_t^2. If ε_t^2 follows AR(p) then we can say ε_t will follow ARCH(p) process.

This model was generalized by Bollerslev (1986) and popularly known as GARCH model where, the conditional variance function is specify in the following format –

$$\sigma_t^2 = \beta_0 + \sum_{i=1}^{p} \theta_i \varepsilon_{t-i}^2 + \sum_{j=1}^{q} \beta_j \sigma_{t-j}^2 \qquad (1.4)$$

The GARCH(p,q) process of ε_t is equivalent to ARMA process followed by ε_t^2.

In reality behaviour of volatility depends on situation. The risk is not similar in good and bad situation. To examine the leverage effect EGARCH (Exponential Generalised Auto Regressive Conditional Heteroscadasticity) model can be used. ARCH and GARCH models are unable to capture the "leverage effect" or asymmetric information. Nelson (1991) proposed exponential GARCH model or EGARCH model. In this case the conditional variance equation becomes –

$$\ln(\sigma_t) = \theta_0 + \sum_{i=1}^{p} \left(\theta_i \frac{\varepsilon_{t-i}}{\sqrt{\sigma_{t-i}}} + \lambda_i \left| \frac{\varepsilon_{t-i}}{\sqrt{\sigma_{t-i}}} \right| \right) + \sum_{j=1}^{q} \beta_j \ln(\sigma_{t-j}) \qquad (1.5)$$

In this study we will utilise the three different models according to the univariate structure. Then predict the value of volatility and estimate the VAR model as mentioned in chapter 2.

1.7 Structure of the Study

The study is divided into five chapters. The first chapter of this study is an introduction to the financial market in India and its importance in the real economy. It is further divided into four subsections: the research problem of the study, the relevance of this study, a survey of literature conducted in the past on related issues, a discussion of research gaps in previous literature and the objective of this analysis respectively. It is followed by a detailed discussion on each of the objectives in three chapters. The second chapter presents the results with respect to stock return of 10 major companies affecting the overall market return in BSE. The third chapter

concentrates on unravelling the causality between the real macroeconomic variables and the BSE SENSEX return. The fourth chapter deals with facts relating to the volatility in Indian stock market with that of the volatility in real macroeconomic variables. The fifth chapter concludes the study. The second chapter analyses the trend behaviour of stock prices of 10 major players on the basis of market capitalisation in Bombay Stock Market, and BSE Sensex closed price by carrying out unit root test and co-integration. Also analysis of the trend behavior of stock prices of 10 major players on the basis of market capitalization in Bombay Stock Market, and BSE Sensex closed price by carrying out seasonal unit root test and co-integration has been done in this chapter. Since the trending patterns of all the 10 companies are different so there influence on BSE Sensex also differs. Now in the third chapter how the real sector influences the financial sector which means the impact of macroeconomic variables on stock market has been shown. For this purpose, the study analyses the behavioural pattern or trend behaviour for each of the selected macroeconomic series and after observing trend behaviour, to find out the nature of transmission of the shocks between stock return and Macroeconomic variables the study applied a vector auto regressive process. The selected macro variables are Call money rate as a proxy for interest rate, M3(broad money supply) , Real effective exchange rate trade based (REER_Tr), Index of industrial production (IIP) and growth rate of Whole sale price index (WPI) as a proxy for inflation rate. Finally, in the fourth chapter the study analyses how the volatility in macroeconomic variables affect the volatility in stock return. Macroeconomic volatility has emerged as a key issue in analysing the determinants of economic growth during this global crisis. There are several costs and consequences of macroeconomic volatility. The inclusion of macroeconomic variables in the modeling of the volatility of stock return is essential to further explain the volatility of stock return. The present study therefore tries to explore the causal relationship between volatility in BSE Sensex return and the volatility of major macro determinants such as exchange rate, inflation rate, money supply, Industrial growth and interest rate.

1.8 Concluding Remarks

In this study our concern is to study and examine the behavior of Indian Stock Market since it is one of the crucial pillars of any market structure. Since financial

development has a strong impact on GDP growth, so the stock market is able to enhance growth by transforming savings into investments and finances the real sectors and augments economic growth by boosting savings as well as accelerate both quality and quantity of investment. Even though volatility may always persists in the stock market as it is desirable up to a certain degree as the fluctuations in stock price indicate changing values across economic activities and it facilitates better resource allocation but the extent of this volatility has become a major issue of concern and needs to be analyzed. The stock market not only the heart of the financial sector but It also helps in understanding the overall economic condition and thus helps policy makers to frame the policies accordingly and improve the market structure.

CHAPTER 2: Trend behaviour in Indian Stock Market

2.1 Introduction

Stock market, being one of the most versatile sectors in the financial system, plays an important role in the process of economic development. At any given point in time, current stock prices reflect all the information available to the investors (Fama, 1960). Except for the noise traders, the primary concern for all the investors is to reduce risk by diversifying their portfolios from highly volatile assets to lesser volatile stocks. In India, one of the major stock exchanges registered with the Securities and Exchange Board of India (SEBI) is the Bombay Stock Exchange (BSE). BSE, the first and largest security market lists almost 6000 companies coming from different sectors. Sensex (also known as S & P BSE Sensex) is the representative of a sample of 30 large and liquid companies. In present analysis BSE Sensex is taken as the aggregative measure for the stock price movement of the top

10 companies. The study examines how the individual stock returns affect the overall performance of the BSE Sensex return. The paper considers Reliance Industries Ltd.(market capitalisation 1228330.03), Tata Consultancy Services Ltd.(market capitalisation 1213371.12), HDFC Bank Ltd.(market capitalisation 807615.27), Infosys Ltd.(market capitalisation 572957.16), Hindustan Unilever Ltd.(market capitalisation 552592.14), Housing Development Finance Corp. Ltd. (market capitalisation 473801.61), ICICI Bank Ltd. (market capitalisation 374745.94), Kotak Mahindra Bank Ltd. (market capitalisation 369082.01), Bharti Airtel Ltd. (market capitalisation 328697.33), Bajaj Finance Limited(market capitalisation 294156.020) chosen according to their market capitalization in BSE.

In a free market scenario, stock prices are affected by supply and demand for securities. But the demand and supply of the securities, in turn, depend on several factors. Based on the literature, factors can be company specific microeconomic (internal) factors like releasing new products, amounts of dividend that they pay, a change of management, earnings of the company, profits etc. or macroeconomic (external) factors like inflation, exchange rates etc. A change in any of the factors will result in the change in stock price of a company. When a company is doing well then everyone would want to buy the share of that company and like the usual demand-supply mechanism, stock prices would increase due to shortages and so returns.

Stock return is an indicator of the financial performance of a company stock. The financial objective of the firm is to maximize investment returns, which are reflected by the change in the company stock prices. According to Ross et al (2010) return of traded stock is divided into two parts; The normal or expected returns based on the information of stocks to the shareholders and market understanding based on the

stock which is dependent on the influencing factors in the coming year and that actually make the return uncertain and risky. This risky portion depicted from unexpected information within the year is due to the profit warning announcement. Again the trending pattern of stock prices of different companies depends on the sectors to which they belong. If two or more company belongs to the same industry it is possible to have similar trending pattern but if those companies belong to different sectors their trending pattern may also differ, as good news for one company can be bad news for the other. So it is possible to draw some insights by comparing the movement of stock price of two or more companies as they are not homogeneous.

A company's financial performance information gives a way to the investors whether invest into specific company or search for others. Company's good performance gives high investment value which attracts the investors for investing money into the specific company that actually increase the stock prices because stock prices are the function of a company value. Fama and French (1993) showed that stock return average has no relationship with company size and market risk but has indirect relationship with financial leverage bond value and direct relationship with financial leverage market by using stock return average on market risk, company size, finance leverage, stock holders' salary bond value to market value, stock holders' salary and profit to price ratio as a factor. Khan et al (2011) has analysed 55 companies listed on the Karachi Stock Exchange, in the period from 2001-2010 and found that dividend, earnings per stock, return on equity and net profit positively impacts stock prices, while retention ratio has a negative effect on stock prices. Another significant study has been conducted by Balkrishnan (1984), Zahir and Khanna (1982) and Sharma (2011). They found that book value of stocks

is another positive determinant of stock prices. The empirical findings of the study conducted by Sharif, Purohit and Pillai (2015) on the stock price of 41 companies listed on the Bahrain Stock Exchange suggests that factors like return on equity, book value per stock, ratio dividend paid and number of stock outstanding, ratio stock price and earning per stock and market capitalization reveal a positive and significant effect on stock prices. So, from the above discussion it can be suggested that the stock prices of the 10 major players which are selected under this study can be significantly different from each other due to differences in any of the above-mentioned reasons.

In recent times, various literatures on Indian stock market have cited volatility for different stock indices. Shalini (2014) employing monthly data for different sectoral indices over the period 2001 to 2012 has found that the return series are stationary. Again, the IT sector fails to generate a good investment return while consumer driven sectors, banking and specially automobiles industries has yielded high return and the manufacturing sector has yielded moderate return (Anand, 2017). And there is found to be positive correlation in different sectors (Venkataramanaiah and Gowri, 2016).

Most of the studies discussed so far are either focused on the company specific factors affecting the stock price of different companies or the effect of sectoral indices on BSE but has yet to analyse the direct effect of the major companies on BSE. The present study of stock return volatility with Indian data tries to fill this gap by analysing how the behaviour of top 10 companies listed in BSE affect market behaviour by looking at whether the individual stock price behaviour of different companies and behaviour of Sensex are cointegrated or not. This study actually

considers the direct relationship between BSE Sensex return and company's return by using market value proxies by market capitalisation.

The Chapter analyses the trend behaviour of stock prices of 10 major players on the basis of market capitalisation in Bombay Stock Market, and BSE Sensex closed price by carrying out unit root test and co-integration. The study analyses how stock prices of these market players affect the stochastic behaviour of stock index in the market by applying co-integration analysis i.e. the study considers top 10 companies in the BSE: how they are co-integrated and how they affect the financial market in India.The top 10 companies have different pattern and their influence on BSE Sensex also differs. Under this analysis BSE Sensex has been taken as a function of stock price of different companies and analyse volatility of stock returns for individual companies and whether there is any long run association between them.

2.2 Econometric Methodology

The first objective of this study is to examine the trend behaviour of Indian stock prices and mainly the return series of BSE Sensex which is obtained by taking first difference of the close price series and the 10 major players of BSE on the basis of their market capitalisation in BSE. The logarithm of the series has been considered in order to avoid heteroscedasticity in the model. This study uses monthly data of close prices from https://www.bseindia.com/ covering the time span 1991-2021.The study will follow similar methodology for checking seasonal unit root as adopted by Das (2021). The econometric technique used is known as the seasonal time series analysis. Monthly time series data based on the financial sector tend to present strong pattern of seasonality and may be subject to intra year movement which is caused by changes in seasonal factors like changes in weather, climate or even due to changes

in institutional factors. It brings about many difficulties to model specification, estimation, and inference. Seasonal process may be deterministic or stochastic. A deterministic trend can be depersonalised by using seasonal dummy variables by eliminating the effects of each of the seasons. However, if the data followed a stochastic seasonal process, then the effect of innovation have a permanent effect which reshapes the seasonal pattern. This suggests that unit roots may be present in the long run (or at the zero frequency) or in each of the seasons or both.

The data taken under this analysis are in monthly frequency so this study will follow the HEGY test proposed by Hylleberg, Engle, Granger and Yoo (1990) and extended by del Barrio Castro, Osborn, and Taylor (2012) to discriminate between deterministic and stochastic behaviour of seasonality. The seasonal time series data follow Autoregressive process in this case. As financial data has a lot of fluctuation it is appropriate in this case to consider a stochastic process so it is appropriate to consider the HEGY test. The test was in the form –

$$y_{ts} = \mu_{ts} + x_{ts} \qquad (2.1)$$

Where S => seasonal frequency, μ => deterministic component and x => stochastic component.

The stochastic part can be explained by –

$\alpha_s(L)x_{ts} = u_{ts}$, where, $\alpha_s(L)$ is a lag polynomial.

The deterministic part is specified by –

$$\mu_{ts} = \delta' w_{ts} \qquad (2.2)$$

The deterministic part is an important one as it plays role in distribution of seasonal unit root test. To test for unit root the first step is to detrend the data after estimation in the form –

$$\tilde{y}_{ts} = y_{ts} - \hat{\delta}' w_{ts} \qquad (2.3)$$

Then apply the approach of Hylleberg et al. (1990) on the detrend series. The data can be detrended by using OLS or GLS. Rodrigues and Taylor (2007) used the GLS detrending to the Augmented-HEGY tests to get more power as compared to OLS detrending. The hegy test has been done for the total of eleven series including BSE Sensex.

The regression equation used in HEGY test in augmented form –

$$\Delta_{12}\tilde{y}_t = \pi_0 \tilde{y}_{0,t} + \pi_6 \tilde{y}_{6,t} + \sum_{i=1}^{5}(\pi_{1i}\tilde{y}_{1i,t} + \pi_{2i}\tilde{y}_{2i,t}) + \sum_{j=1}^{k} \tau_j \Delta_{12}\tilde{y}_{t-j} + \varepsilon_t$$

(2.4)

Where, k is order of Autoregression.

$$\tilde{y}_{0,t} = \tilde{y}_{t-1} + \tilde{y}_{t-2} + \cdots \ldots . . + \tilde{y}_{t-11} + \tilde{y}_{t-12} \qquad (2.5)$$

$$\tilde{y}_{6,t} = -\tilde{y}_{t-1} + \tilde{y}_{t-2} - \ldots \ldots . . - \tilde{y}_{t-11} + \tilde{y}_{t-12}$$

$$\tilde{y}_{1i,t} = \sum_{m=0}^{11} cos\{(m+1)6\pi i\}\tilde{y}_{t-m-1}$$

$$\tilde{y}_{2i,t} = -\sum_{m=0}^{11} sin\{(m+1)6\pi i\}\tilde{y}_{t-m-1}$$

$$i = 1,2,\ldots,5$$

Before testing the augmented HEGY test it is needed to find out the optimum lag length or the order of augmentation. As suggested by del Barrio Castro, Osborn and

Taylor (2016), the Modified Akaike Information Criterion (MAIC) is useful in this case.

The HEGY test is more useful than the Dickey-Fuller test because it is flexible here to check here the presence of unit root at different frequency (Das, 2021). For this purpose the null hypothesis for the presence of unit root at different frequency is given by –

$H_{0,0}$: $\pi_0 = 0$ for frequency 0

$H_{0,6}$: $\pi_6 = 0$ for frequency π

$H_{0,i}$: $\pi_{1,i} = 0$ & $\pi_{2,i} = 0$ for i = 1 for frequency $\pi/6$

for i = 2 for frequency $\pi/3$

for i = 3 for frequency $\pi/2$

for i = 4 for frequency $2\pi/3$

for i = 5 for frequency $5\pi/6$

The alternative hypotheses are –

$H_{1,0}$: $\pi_0 < 0$;

$H_{1,6}$: $\pi_6 < 0$;

$H_{1,i}$: $\pi_{1,i} < 0$ & $\pi_{2,i} < 0$

For monthly data maximum 12-unit roots can be obtained. For the first two hypotheses the left tailed t test has been used and for the last hypothesis in order to test for the presence of conjugate unit root the upper tail F test has been used. If the observed test statistics is more than the critical values at 5 % level in absolute sense

and so the null hypothesis of presence of unit root is rejected. The order of integration is identified for each variable by applying HEGY test.

After carrying out the HEGY test to determine the presence of unit roots the study tries to find out cointegration relationship between BSE Sensex and the 10 major players. This analysis opts for the multivariate case of cointegration test which is the conventional Johansen test for cointegration in order to analyse the long run association considering the logarithm of close price of BSE Sensex as the dependent variable and the close prices of 10 major players as the response variable. The ranks of the variance covariance matrix give the idea whether the series is cointegrated or not. The analysis constructs the model on the basis of the assumption that the non-stationarity present in BSE close price is mainly due to fact that stock prices of individual companies of BSE is also non-stationary and hence verifying the cointegrating relationship of BSE stock price with stock prices of top 10 companies.

2.3 Empirical Findings

The monthly data may have seasonal variation. From figure 1 it can be seen that the time series may contain unit root in the long run or in seasonal frequency. So, seasonality should not be ignored. For this purpose, this study performs the Hegy test on the basis of univariate time series model with the help of STATA software to estimate the augmented form of regression equation (2.1). For frequency zero and for frequency π i.e. for long run & 6 months cycle period the t test statistic has used to test the null hypothesis related to presence of unit root. For the conjugate roots at other seasonal frequencies F test statistic has used to reject or accept H_0. It is clear from the result that at the 5% critical value Sensex and close price of the selected companies (the top 10 companies are selected on the basis of their market

capitalisation on BSE for the purpose of this study) have unit root in the long run (i.e. at zero frequency). And it is also observed that for some companies' unit root is also present at seasonal frequency. In case of Sensex the unit root is present at seasonal frequency $\frac{\pi}{2}$ & $\frac{5\pi}{6}$ i.e. cycle at 4 and 2.4 months respectively. In case of Infosys Ltd. there present unit root at the seasonal frequencies - $\pi, \frac{\pi}{3}, \frac{\pi}{2}, \frac{2\pi}{3}, \frac{5\pi}{6}$ representing cycle at 2, 6,4,3,2.4 months respectively. Unit roots at seasonal frequencies for the company close prices can be present for several reasons. For example, if selling patterns of a company changes during a period as dividend and demand for share depends on it, the share price during that period changes. There can also be shocks to the system, which appears from the external factors into the system. The major internal factors include company performance, governance, asset and liquidity position, dividends and earnings. The external factors are governmental regulations, business cycle, investor's attitude, market conditions, natural calamities and political uncertainties like strikes, blockades etc. There are two approaches namely the fundamental approach and technical approach for predicting share prices. The fundamental factors the Earning per Share, Net Asset Value per Share and Price Earnings, while the technical factors are the Gross Domestic Product, Consumer Price Index and Interest Rate Spread as the determinants of stock prices globally (Sharma, 2011).

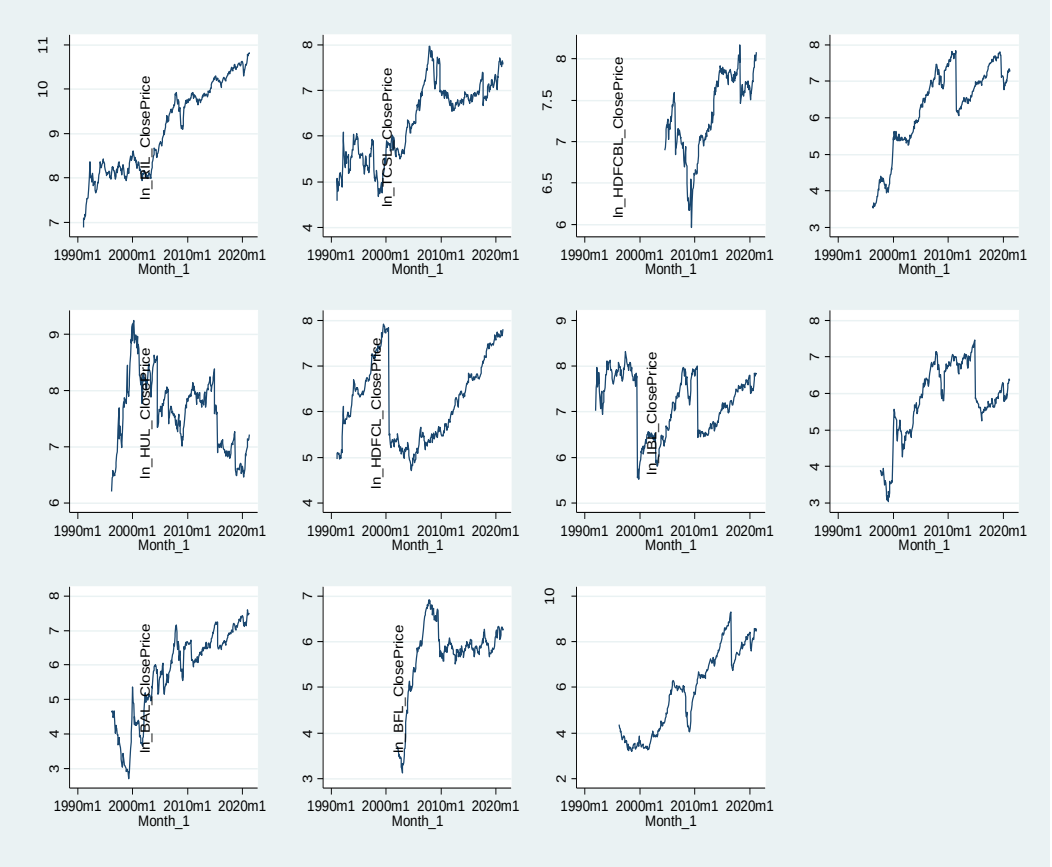

Figure-2.1: Seasonal pattern of close price of different companies; Source: (RBI, 2021), Handbook of Statistics on Indian Economy

The estimated result (Table 2.1) implies that the close price series are non-stochastic in nature and at long period there exhibit unit root for all the companies along with Sensex. The common presence of annual unit root in all the above-mentioned series suggests checking for the long run convergence via cointegration test (Engle and Granger, 1987). The Johansen test result for multivariate model (Table-2.2) shows that series are non-stationary but the behaviour of the unit roots are not similar i.e. they are non-stationary but not cointegrated which may be a spurious result due to presence of seasonal unit root. This also holds for 10 major companies (Table 2.3). The results suggest that the trending patterns of these companies are different. One possible reason can be that these companies are the representative of different sectors

– like Tata Consultancy Services Ltd., Infosys Ltd etc. are the representative of multinational Information Technology (IT) firms, while Hindustan Unilever Ltd, Reliance Industries Ltd etc. are representative of industrial sector and ICICI Bank Ltd, Kotak Mahindra Bank Ltd etc. are representative of banking sector and it is unlikely that firms coming from different industries will behave similarly.

Table2.2 Johansen tests for cointegration for Close price of companies with Sensex close price

Johansen tests for cointegration					
Maximum rank	parms	LL	eigenvalue	trace statistic	5% critical value
0	132	-14300.876		236.6509*	277.71
1	153	-14275.492	0.22517	185.8827	233.13
2	172	-14254.762	0.18807	144.4223	192.89
3	189	-14238.384	0.15177	111.6667	156.00
4	204	-14225.551	0.12101	86.0001	124.24
5	217	-14215.598	0.09518	66.0959	94.15
6	228	-14205.88	0.09305	46.6590	68.52
7	237	-14197.968	0.07644	30.8342	47.21
8	244	-14191.819	0.05992	18.5378	29.68
9	249	-14187.43	0.04315	9.7599	15.41
10	252	-14184.037	0.03353	2.9727	3.76
11	253	-14182.55	0.01483		

Source: Authors' estimate with monthly series taken from (BSE, 2021)

Now, as financial series are expected to have a lot of fluctuations, for modelling, forecasting and drawing any inference the return series are taken under analysis. The

return series is obtained by taking first difference of log values of close price of BSE and for the companies. VAR framework (Table-2.4) for the stationary series (in long run) is tested for 2 lag values of each variable. The VAR structure shows that there are 9 equations but only one model is fitted where the return from Infosys Ltd in previous month has a positive impact on return from Kotak Mahindra Bank Ltd. It is also notable that return from ICICI Bank Ltd. has negative relation with it as both of the companies belongs to same industry(banking) and this negative relation implies there competitive nature in real world. Also, the past return has an impact on present level of return from KMBL. But for others company the model is not good fitted. As the demand side components of stock market are ignored in the study one possible reason behind this may be that, investors are more interested to buy the shares of the companies providing higher dividend. As the demand for stock rises, price of that stock will automatically rise by the usual demand-supply mechanism, so the stock returns. In some situations, an undiversified portfolio may also be superior to a diversified portfolio i.e. one security may have an extremely higher yield and lower variance than all other securities so that one particular undiversified portfolio would give maximum E and minimum V (Markowitz, 1952).

Table-2.4: Vector autoregression

Variable	SENSEX_RETURN	RIL_RETURN	HDFCB_RETURN	IL_RETURN	HUL_RETURN
SENSEX_RETURN					
L1.	0.08383477	0.18307187	0.04762112	0.11927136	-0.36054244
L2.	0.04119445	-0.00293378	0.11194181	0.41945289	0.24885078
RIL_RETURN					
L1.	-0.05681448	-0.09588	-0.00221368	-0.03087813	0.03382927
L2.	0.03424672	-0.0318616	0.09521346	0.0366563	-0.00188669
HDFCB_RETURN					
L1.	0.02776023	0.01528168	-0.02779442	0.07317659	-0.06855934
L2.	-0.00549786	-0.04892014	-0.01316001	-0.06716848	0.03975293
IL_RETURN					
L1.	-0.03835554	-0.00252446	-0.02447904	-0.09586943	-0.06400507
L2.	-0.04258139	-0.06962439	-0.11306542	-0.13536919	-0.0835253
HUL_RETURN					
L1.	-0.01612696	-0.03731396	0.05819469	0.00727252	0.01714767
L2.	0.0152223	0.01197795	-0.06281781	-0.00458412	0.01655564
HDFC_RETURN					
L1.	-0.00923239	-.08860739*	-0.08528316	-0.09057122	-0.0247625
L2.	-0.00715501	-0.04538561	-0.00962926	-0.01271579	0.00944087
IBL_RETURN					
L1.	-0.01431511	0.04142752	-0.0380796	-0.05022097	0.00929873
L2.	0.00264042	0.05582702	0.0610346	0.03344705	0.05853887
KMBL_RETURN					
L1.	0.05685624	.10091951*	.14680925*	0.04044471	.17788785*
L2.	-0.04202401	-0.04437531	-0.06030529	-0.04221978	-.14278288*
BFL_RETURN					
L1.	-0.00668287	-0.02095823	0.00529276	0.00344141	0.03620503
L2.	0.02487743	-0.00452753	0.01071676	0.00783762	0.00622567
_cons	0.00775113	0.00736866	0.0071774	-0.00516893	0.00102928
R-sq	0.0513	0.0694	0.0579	0.0523	0.056
P>chi2	0.6492	0.2817	0.5057	0.6259	0.5466

Variable	HDFC_RETURN	IBL_RETURN	KMBL_RETURN	BFL_RETURN
SENSEX_RETURN				
L1.	-0.30363923	-0.03692699	0.12966326	0.20117937
L2.	0.1140383	-0.2331241	0.02093223	0.11345378
RIL_RETURN				
L1.	0.19369023	0.06177922	-0.05308132	-0.15443021
L2.	-0.01064368	0.04373175	0.04801344	-0.01633186
HDFCB_RETURN				
L1.	0.02917286	0.07079949	-0.00027165	0.1065247
L2.	-0.02172984	0.06900519	-0.11055006	-0.04325094
IL_RETURN				
L1.	-0.13957098	-0.08207782	.3259065***	-0.01789402
L2.	-0.10667895	-0.05964108	-0.04779253	-0.0607807
HUL_RETURN				
L1.	-0.0385331	-0.02343947	-0.05561645	-0.0291998
L2.	0.01239297	0.11749922	0.0162825	-0.02376236
HDFC_RETURN				
L1.	-0.11232167	-0.00993145	0.07269184	-0.01270983
L2.	0.04665456	-0.08424711	-0.06404667	-0.06022692
IBL_RETURN				
L1.	0.1027994	-0.02699549	-.25250958***	-0.0759382
L2.	-0.0818781	0.02289854	0.03220975	-0.00365886
KMBL_RETURN				
L1.	-0.03967158	.18785325*	.16956388*	0.05119857
L2.	-0.01226903	0.0299898	0.10687843	0.06153216
BFL_RETURN				
L1.	0.02066451	-0.01761348	-0.02566675	0.00515151
L2.	0.04606188	0.01267612	-0.03241323	0.01076567
_cons	-0.00116512	0.00625586	0.01375378	0.01525087
R-sq	0.0557	0.057	0.1641	0.0227
P>chi2	0.5524	0.5233	0	0.9936

legend: * p<0.05; ** p<0.01; *** p<0.001

Source: Authors' estimate with monthly series taken from (BSE, 2021)

Especially the model fails to draw any significant relationship between Sensex return and the major companies return. Basically, the model is not good fitted i.e. it has no explanatory power which implies that the return from Sensex is determine by other factors (The study considers only 10 major companies) which we have not taken under consideration.

The study also tries to analyse the trend behaviour of return series for BSE Sensex and others companies. In financial time series although assets price are non-stationary returns are usually expected to be stationary. But in the case of return for some of the companies the analysis found some contradicting results with that of theory. After estimating the equation (1) for Sensex return and return from 10 companies (Table-2.5), it is clear that the returns from the companies such as Relience Industries Ltd., HDFC Bank Ltd.,Hindustan Unilever Ltd.,Housing Development Finance Corp. Ltd.,ICICI Bank Ltd., Kotak Mahindra Bank Ltd. & Bajaj Finance Limited are stationary i.e. there is no trend which support the efficient market hypothesis. However the Hegy test regarding return from Tata Consultancy Services Ltd. & Bharti Airtel Ltd. shows presence of unit root at both long run and at seasonal frequency. As the returns are calculated from close price data, the non-stationary behaviour of return may be a spurious result due to presence of seasonality in close price. This behaviour violates the efficient market hypothesis by Samuelsson (1995) which suggests that the stock prices are conventionally non stationary but stock returns are stationary. The possible reason behind this unexpected behaviour of return schedule may be the presence of structural break in system. Some of the structural changes and economic crisis during the last quarter of 19^{th} century and the recent years can be identified in this regard. This study predicts that economic reform in 1991 and great depression of 2008 and its after effects can be a major

factor behind these big fluctuations in the return series. The new economic policy 1991 was the first step towards global exposure. The transition from a state control economy to a market determined economy resulted in a lot of fluctuations in the economy and thus can explain the fluctuations in the diagram. Financial liberalisation calls for larger volumes of international financial flows. Removal of restrictions on foreign inflow and outflow of capital has increased financial fragility. Many literatures suggest that the unregulated capital flows across the nations have led to volatility or instability in the financial markets. Thus, the ups and downs which are observed in the diagram during 1990s subsequent years can be due to reform measures undertaken during that time period. Similarly, 2008 great depression is one of the other factors which have brought about a structural change in the economy. And it is quite reasonable to assume that the outbreak of coronavirus (COVID-19) which emerged from China in late December and has spread in 216 countries is one of the major factors behind the ups and downs observed in the return series during 2021. According to the findings the negative impact of pandemic on emerging stock markets has gradually fallen and begun to taper off by mid-April 2020. The pandemic can disrupt labour markets, global supply chains, consumption behaviours which can affect global markets. Among these channels the stock markets are definitely one of the most important components. The slowest pace of economic growth and lack of capital inflows resulted in a lot of disruptions in the financial market. So, all of these factors can be a major cause behind the non-stationary behaviour that is the presence of unit root in the return series.

If there are structural break in the seasonal time series, the HEGY approach of testing the seasonal unit root is biased towards non rejection of unit root null. But the

method will be complicated if break is incorporated in hegy test and it will reduce the power of the test.

The simple OLS regression model is used to observe the impact of the return of 10 major companies on the Sensex return. The result of this regression (Table-2.6) shows all companies' return except IL's return have significant positive impact on Sensex return i.e. the 9 major companies' return influence the overall market return. But it shows there is no significant relation between IL's return and Sensex return.

2.4 Conclusions

Many empirical studies have been done by several researchers regarding the individual factors affecting the stock market. But existing literatures has not really focused on how the major companies listed in stock market in India can influence the market return. This study takes into account the possible seasonal unit roots present in the control variables as in the companies' stock price and return series and does time series analysis and analyses the relation between stock return and the major companies listed in BSE during the period of post liberalisation.

The Hegy test for the stock price of BSE and the major companies show presence of unit root at seasonal frequency. Some reasons behind presence of seasonality in the series is selling pattern of the company which is different for different companies. Selling pattern depends on seasonal demand for the product in any company. Actually, dividend of a company regulates selling pattern of a company and it increases share demand. Additionally, share price behaviour regulates share demand from background. Another reason for non-stationarity is presence of structural break. If there is structural break in the seasonal time series, the HEGY approach of testing the seasonal unit root is biased towards non rejection of unit root null.

Presence of seasonality reflects the variable has intra year movement due to changes in seasonal factor. The institutional factors can be responsible for this seasonality. In this analysis the study finds that, for each data set that is data regarding close price of 10 major companies of BSE along with Sensex close price, there is presence of long run stochastic trend which indicates the permanent effect of any shocks that can be created by any policy change regarding the company or the overall economic structure. After financial liberalisation i.e. in the 90's the financial market has gone through several changes regarding policies. It can also be happened that these changes may indicate break in the structure. Also in case of BSE Sensex there is presence of unit root at seasonal frequency which indicates that the stock price movement is subject to cyclical change. In case of Infosys Ltd. unit root is present at several seasonal frequencies which make the trend of the series ambiguous. Infosys Ltd. belongs to the industry of "IT Consulting & Software". Their management system, to improve the functioning and to exist in growingly competitive market, may be responsible for seasonality.

The Johanson cointegration analysis of the close price of 10 major companies (Table-3) reveals that they are non-stationary and the trending pattern of the companies are different. Analysis of the companies reveals that these companies belong to different sectors – like Tata Consultancy Services Ltd., Infosys Ltd etc are the representative of multinational Information Technology (IT) firms, while Hindustan Unilever Ltd belongs to consumer goods industry, Reliance Industries Ltd is representative of energy sector and ICICI Bank Ltd, Kotak Mahindra Bank Ltd etc are representative of banking sector. So the trending patterns are likely to be different. Usually investors behave according to Expected return – variance of return (E-V) rule which states that an investor either maximizes expected return for a given

level of risk or minimizes risk for a given level of anticipated return. Systematic risk or market risk which is the undiversifiable risk is represented by β. E-V rule not only implies diversification of portfolio for reasonable probability beliefs, but also suggests right kind of diversification for the right reason. For two or more company if they are similarly related to the market, when they belong to the same industry this β value will be close to each other so that the variation in one affects the other. It is more likely that firms coming from same industry to behave more or less in a similar manner. That is any good news for one of the companies will also positively impact the other and vice versa. Again, securities may also have high covariances among themselves leading to greater amount of risk (Markowitz, 1952). Again, macroeconomic policies, investor's incentive and perception regarding the market and several industry specific factors affect the stock market. Many researchers have found that higher investments are associated with fiscal incentives and tax incentives. They are used to exploit investment opportunities. Behavioural factors like investor perceptions are another important factor driving individual stock price because the investors are the participants of the stock markets and they are humans, led by emotions and attitudes. A Survey carried out by the IOSCO (2002) revealed that Incentives strengthen investor confidence in the stock exchange and foster investor participation. As a result differences in trending pattern of stock price can be observed as a result of investors incentive, as trading stock were driven by investors incentive.

This study also tries to analyse the behaviour of return series. Now theoretically returns must be stationary. Although returns fluctuate substantially, but in the long run they give rise to roughly exponential growth. The HEGY test results of the return series reveals that there is presence of unit root in companies such as Tata Consultancy

Services Ltd. & Bharti Airtel Ltd., except for these two the return is stationary. The non-stationary behaviour of return may be a spurious result due to presence of seasonality in close price. The figure 2 shows several peak points which may indicate the presence of unit root in return series. The other possible reason behind this unexpected behaviour of return schedule may be the presence of structural break in system or certain market inefficiencies. This non-stationary behaviour of return violates the efficient market hypothesis by Samuelsson (1995). Presence of unit root in return indicates stock price series have multiple unit roots i.e. the series has long memories. In other words, the effect of shock is persistent in the system. In an efficient market the market price fully reflects all available information at a particular time point. The stock price follows random walk implying at any point of time the stock price reflects the good estimates of intrinsic value of a stock. As return series for TCSL and BAL does not follow random walk hypothesis then it means successive changes in an individual stock price are not independent. The price mechanism is affected by real world economic and political events as opposed to the hypothesis suggested by Fama(1965). The behaviour of stock price is an important determinant of a market structure i.e. whether the market takes the weak form or Semi-strong form or strong form of efficient market hypothesis (Fama, 1970).

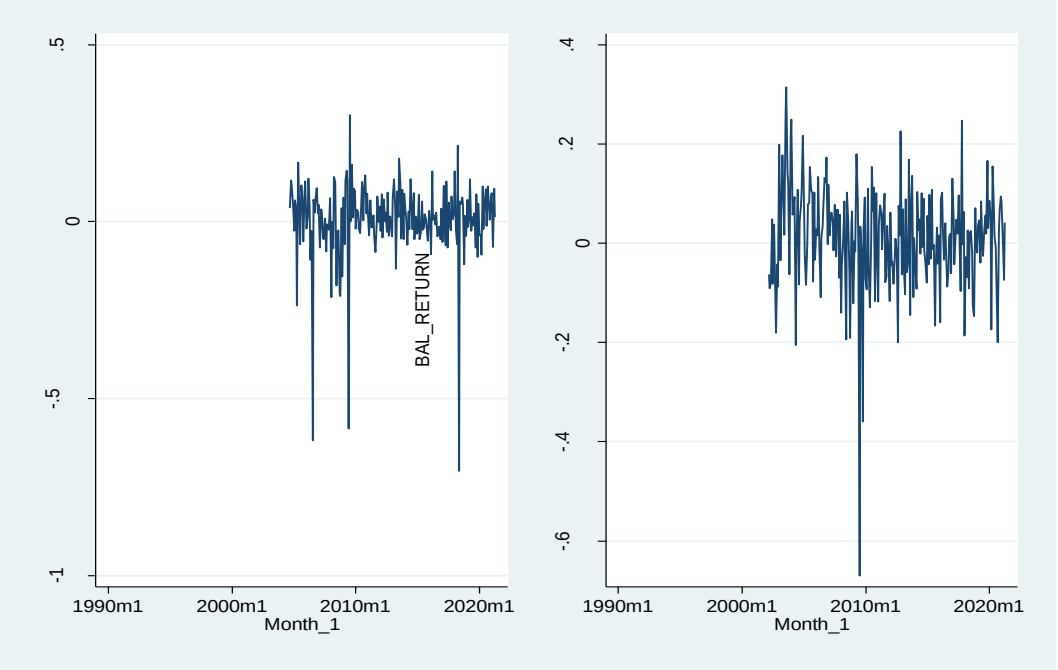

Figure: 2.2- Return Series of TCSL and BAL stock prices. Source: BSE data collected in January, 2021.

The analysis of var suggests that the stock return of 10 major players selected on the basis of their market capitalisation on BSE has no significant impact on BSE return. One possible reason for such a result can be simply that the major companies selected for our analysis are ranked as top 10 during the period of our estimation that is 2019 but as stock prices vary over time and have fluctuations, the market capitalisation of these companies is likely to change and so their rank in BSE. So, lack of significance can be justified as the study has taken under consideration a period of 30 years which is rather long and the major companies have changed over the years. Most of the companies which are used to analyse the BSE return became powerful only at early 2000.HDFC Bank Ltd.(market capitalisation 807615.27), Infosys Ltd.(market capitalisation 572957.16), Hindustan Unilever Ltd.(market capitalisation 552592.14), ICICI Bank Ltd. (market capitalisation 374745.94), Kotak Mahindra Bank Ltd. (market capitalisation 369082.01), Bajaj Finance Limited(

market capitalisation 294156.020) all of these companies acquired market power during the last 10 years or so. Thus, they are not able to explain BSE return. Again, the result of the var estimation also shows that the lag values of most of the company's return are not able to impact the present value of return this means that historical values does not predict the future observations of stock return.

The VAR estimation reveals that companies like Housing Development Finance Corp. Ltd. has an adverse effect on the return of Reliance Industries and one period lag values of return from Kotak Mahindra Bank Ltd. positively impacts Reliance Industries, HDFC Bank Ltd., Hindustan Unilever Ltd., ICICI Bank Ltd. but two period lag values have an adverse effect on Hindustan Unilever Ltd. and one period lag values of Infosys Ltd., ICICI Bank Ltd., Kotak Mahindra Bank Ltd. positively impacts return from Kotak Mahindra Bank Ltd. So, the results suggest there is some amount of correlation between the companies mentioned above. Although one of the reasons for such behaviour is clear, which is the different sectors to which they belong, there are several other reasons. As this study mainly deals with the supply side issues, the other demand side factors determining stock returns that are several industry specific factors are ignored. Many researchers such as Khan et al (2011) , Balkrishnan (1984), Zahir et al (1982) , Sharma (2011) , Sharif et al (2015) has analysed that companies' profit, goodwill, dividend these can lead to a change in stock price of a company. Factors such as dividend, earnings per stock, return on equity, net profit, book value of stocks, number of stock outstanding positively impacts stock prices and retention ratio has a negative effect on stock prices, these factors has not been considered under this study. For example, demand for the shares of a company will be higher which is providing higher dividend and will attract more investors. As the demand for stock rises, price of that stock will automatically rise by

the usual demand-supply mechanism, so the stock returns. In some situations, an undiversified portfolio may also be superior to a diversified portfolio i.e., one security may have an extremely higher yield and lower variance than all other securities so that one particular undiversified portfolio would give maximum E and minimum V (Markowitz, 1952).

Most importantly, it finds that market return is stationary and the Sensex close price movement is random, which supports the Efficient Market Hypothesis. The graph of the return also supports the stationary behaviour, but in the periodogram plot (figure-2.3) the data shows important peaks that could be caused by seasonal trends. Also, the descriptive statistic of the Sensex return (Table-2.7) month wise shows that there is negative return for March, which is the end month of Indian financial year and this support the tax-loss selling hypothesis which states that investors will sell the loss-making securities by the end of the year to realize capital losses for tax benefit. Also, the average return is highest in December and stayed positive till February which inclined towards the presence of January effect. These anomalies imply that Indian Stock Market is not informationally efficient and investor can earn more return by timing their investment, which may indicate presence of break point.

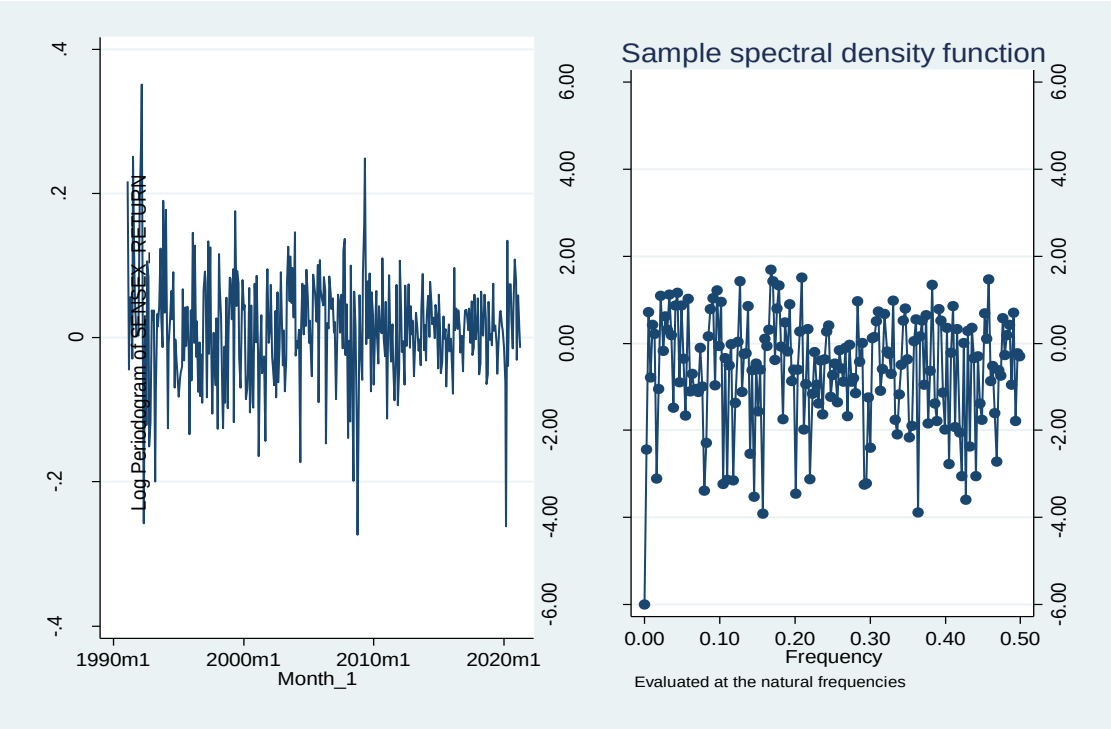

Figure-2.3- Graph of Sensex Return and periodogram plot of Sensex Return shows important peaks that could be caused by seasonal trends. Source: BSE data collected in January, 2021

.Appendix of Chapter 2

Table-2.1: Coefficients of estimated equation (1) for close price

	Sensex_P	RIL_P	TCS_P	HDFCBL_P	IL_P
t[0]	-1.861	-2.192	-1.946	-1.991	-1.927
t[Pi]	-3.939**	-6.453***	-4.256***	-4.650***	-2.086
F[Pi/6]	8.643**	35.248***	19.527***	32.361***	14.725***
F[Pi/3]	18.714***	42.873***	22.466***	28.985***	6.931*
F[Pi/2]	7.140*	35.667***	15.637***	28.484***	6.908*
F[2*Pi/3]	15.833***	24.964***	16.966***	24.416***	5.721
F[5*Pi/6]	6.351	28.507***	18.090***	26.782***	6.656

F[All seas]	16.475***	229.319***	116.931***	323.349***	8.269***
F[All]	15.472***	210.571***	107.633***	296.673***	8.214***

*** p<.01, ** p<.05, * p<.1*

	HUL_P	HDFCL_P	IBL_P	KMBL_P	BAL_P	BFL_P
t[0]	-1.810	-2.060	-1.890	-2.239	-1.846	-2.783
t[Pi]	-5.690***	-5.152***	-5.055***	-2.658	-2.819	-5.828***
F[Pi/6]	29.352***	27.497***	20.815***	8.892**	8.974**	24.152***
F[Pi/3]	38.186***	30.631***	22.781***	10.439***	5.464	30.371***
F[Pi/2]	36.186***	31.264***	27.691***	9.594**	7.949*	25.413***
F[2*Pi/3]	34.386***	41.010***	31.818***	12.908***	6.995	25.323***
F[5*Pi/6]	37.865***	32.701***	31.397***	9.074**	10.154**	27.155***
F[All seas]	381.841***	225.495***	293.789***	14.068***	7.999***	282.195***
F[All]	350.077***	206.884***	269.700***	13.485***	7.813***	259.962***

*** p<.01, ** p<.05, * p<.1*

Source: Authors' estimate with monthly series taken from (BSE, 2021)

Table-2.3: Cointegration between companies close price

Johansen tests for cointegration					
Trend: constant			Number of obs = 199		
Sample: 2004m10 - 2021m4			Lags = 2		
Maximum rank	parms	LL	eigenvalue	trace statistic	5% critical value
0	110	1511.6837		196.1480*	233.13
1	129	1536.8096	0.22316	145.8962	192.89
2	146	1555.4301	0.17067	108.6551	156.00

3	161	1568.1587	0.12008	83.1979	124.24
4	174	1578.1149	0.09522	63.2856	94.15
5	185	1586.5133	0.08094	46.4887	68.52
6	194	1594.2089	0.07443	31.0976	47.21
7	201	1601.0632	0.06657	17.3890	29.68
8	206	1605.7653	0.04616	7.9848	15.41
9	209	1609.7534	0.03929	0.0086	3.76
10	210	1609.7577	0.00004		

Source: As for Table 2.1

Table-2.5: Coefficients of estimated eq. (1) for Return series

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Variable	Sensex_re	RIL_re	TCS_re	HDFCB_re	IL_re	HUL_re	HDFC_re
__00001X	-.06341042**	-.0870876***	-.071131*	-.08786343***	-.08928016***	-.07611987***	-.09901494***
__00001Y	-.0774577***	-.11309292***	-.06090805*	-.07319093***	-.05369011**	-.08717474***	-.06391431***
__00001Z	-.12953262***	-.11441063***	-.18805382***	-.20109422***	-.17466896***	-.16442112***	-.14608322***
__000024	.03838894	.03535817	.05129453	-.02167973	-.02192545	.00369808	-.00862546
__000020	-.17222554***	-.17024039***	-.19667563***	-.18331076***	-.15226452***	-.20111832***	-.1440899***
__000025	.06461652*	.05459578	-.00148938	.00542504	.00691097	.01088945	.01310811
__000021	-.17971843***	-.13138389***	-.14190002***	-.18739293***	-.19192201***	-.19845633***	-.15982933***
__000026	.01134675	-.05170582	.01604591	-.01670127	.04747019	.00833956	.01628014
__000022	-.0898991***	-.08524055***	-.17782669***	-.16621066***	-.14340615***	-.18696794***	-.17429851***
__000027	-.00087639	.02888798	.05724538	-.01005438	.01912742	.00411452	.0192895
__000023	-.14703081***	-.10723516***	-.14865723***	-.1780298***	-.25327075***	-.17929205***	-.13828472***
__000028	-.01565587	-.02579476	.02869938	.00271073	-.06692515	.00324532	.01725294
__00001W							
L1.	.07402839	.02372633	-.04373935		-.05581366		
L2.	.1210872*	.07492016	-.01403957		-.01323611		
L3.	-.01753987	.00481735	.01645321		-.10606904		
L4.	.05136014	.01798334	-.07349655		-.02512043		
L5.	-.00645235	-.07034971	-.00776804		.08404387		
L6.	-.01514841	.04860041	.0013053		-.05712061		
L7.	.00233719	.06337894	-.02764268		.03050839		
L8.	-.00353867	.0425991	-.07046006		-.03356188		
L9.	-.03835232	-.07488668	.01486406		.14678626*		
L10.	-.06359141	-.06064739	.01747654				
L11.	-.05989106	.00718989	.03668002				
L12.	-.12890335*	-.1604798**					
N	339	339	177	288	280	351	339

legend: * p<0.05; ** p<0.01; *** p<0.001

Variable	IBL_re	KMBL_re	BAL_re	BFL_re
__00001X	-.08225497***	-.08135202***	-.04791954*	-.08134331***
__00001Y	-.08841205***	-.06711824***	-.09182226**	-.10505039***
__00001Z	-.14441075***	-.12474296***	-.21695221***	-.15627495***
__000024	-.02951932	-.04736979*	.03598002	-.02941331
__000020	-.17573096***	-.1760376***	-.16461538***	-.17087974***
__000025	.00831706	-.01823323	.02404737	-.02804442
__000021	-.15095557***	-.13359598***	-.16288744***	-.16669345***
__000026	.03466149	-.03288912	.01440865	-.0122108
__000022	-.17714701***	-.20288582***	-.14240025***	-.20040001***
__000027	-.00487594	-.02580148	-.01689109	.00821159
__000023	-.18670653***	-.13805373***	-.17812485***	-.15415922***
__000028	-.01675901	-.04317323	-.04676745	.00684818
__00001W				
L1.			.026692	-.03597762
L2.			.09911938	-.04085747
L3.			.01352617	.04497592
L4.			.01765212	
L5.			-.06904672	
L6.			-.05146489	
L7.			-.03376419	
L8.			-.01810481	
L9.			.06080571	
L10.			-.05476954	
L11.				
L12.				
N	271	289	208	285

legend: * p<0.05; ** p<0.01; *** p<0.001

Source: As for Table 2.1

Table-2.6: Linear regression

SENSEX_RETURN	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
RIL_RETURN	0.12	0.022	5.35	0	0.075	0.164	***

TCS_RETURN	0.096	0.022	4.26	0	0.051	0.14	***
HDFCB_RETURN	0.062	0.016	3.74	0	0.029	0.094	***
IL_RETURN	0.02	0.021	0.97	0.331	-0.021	0.061	
HUL_RETURN	0.109	0.033	3.26	0.001	0.043	0.174	***
HDFC_RETURN	0.07	0.017	4.05	0	0.036	0.104	***
IBL_RETURN	0.095	0.018	5.37	0	0.06	0.13	***
KMBL_RETURN	0.097	0.018	5.34	0	0.061	0.132	***
BAL_RETURN	0.098	0.024	4.13	0	0.051	0.144	***
BFL_RETURN	0.044	0.011	4.05	0	0.022	0.065	***
Constant	0.004	0.002	1.87	0.062	0	0.009	*

Source: As for Table 2.1

Table-2.7

Summary statistics: mean sd max min by (month)

m	mean	sd	Max	min
1	0.009	0.079	0.188	-0.139
2	0.026	0.08	0.27	-0.085
3	-0.009	0.112	0.351	-0.262
4	0.013	0.069	0.161	-0.117
5	0	0.097	0.249	-0.257
6	0.014	0.064	0.126	-0.198
7	0.02	0.071	0.251	-0.122
8	0.016	0.06	0.123	-0.105
9	0.01	0.07	0.121	-0.143
10	-0.01	0.081	0.137	-0.273
11	0.012	0.076	0.19	-0.134
12	0.029	0.042	0.146	-0.049

Source: As for Table 2.1

CHAPTER 3: Stock Returns and Macroeconomic Fundamentals

3.1 Introduction

Financial development enhances the growth of the economy by increasing GDP growth (Lavine and Zerovs, 1996). Financial institutions utilizes various financial instruments like domestic and foreign currency, demand deposits, stocks, bonds and smoothens the door for trade in goods and services and transfers resources from savers to investors which enhances economic growth. This has been articulated by Goldsmith (1969) and McKinnon (1973). So, in an economy, real sectors to a great extent are dependent on the stock market which is the heart of the financial sector. Stock market not only accelerates the both quality and quantity of investments but also amplifies the efficiency of the financial system through competition among different classes of financial instruments. Thus, stock market of any country is considered as one of the most important segments in the economy.

Indian capital market has undergone tremendous changes in terms of financial sector reforms since 1991, after the government has adopted liberalization and globalization polices. Today stock market has become a key driver of modern market-based economy. The development processes in Indian stock markets have been very smooth. At the present time SENSEX is around 51,941.64 points. The economy has been also growing at a faster rate. The expeditious growth of Indian economy during the last two decades raises empirical questions regarding the basic connection between stock return and key macroeconomic indicators. Some of the

researchers like Shah et all (1997) supported that stock market can reflect the real economy. But researchers like Agrawalla (2006) opposed this view.

There are several studies analysing the interaction of share market returns and the macroeconomic variables and all studies provide different conclusion related to their test and methodology.

For example, to measure the relationship between the stock market and money, Friedman (1988) supported the wealth and substitution effects. To explain the theoretical relationship between the stock market and the exchange rate, three different hypotheses have been propounded: Asset market hypothesis (Frenkel, 1976), Goods market hypothesis (Dornbusch and Fischer1980), and Portfolio balance hypothesis (Frankel, 1983). Several studies have shown that the choice of the impact of financial and macroeconomic variables on stock market is puzzling and intriguing. These literatures have tried to give the anomalous relationship through different hypotheses [Fama (1981), Geske and Richard (1983), Ram and Spencer (1983), Fama (1990), Schwert (1990), Cochrane (1991) and Lee (1992)]. The relationship among asset returns, real activity, and inflation is at the centre of the research agenda of financial economists. Many of the recent studies have focused on the causal linkage between the stock returns and macro variables. In case US, IIP has influenced stock prices positively and inflation and long-term interest rate have influenced negatively in a significant manner but the effect of money supply is insignificant to stock prices. While Japan recorded a negative relation between money supply and stock price (Humpe & macmillan, 2007). In Indian context Ahmed (2008) has found a unidirectional causal relation between BSE Sensex and real variables. More elaborately, BSE Sensex has caused exchange rate, exports, IIP, money supply while interest rate and FDI. Again Kakoti(2019) has revealed that

inflation and money supply has impacted Indian Stock market positively while the interest rate and exchange rate have impacted negatively.

An increasing number of empirical studies have been focusing on relation between the stock prices and macroeconomic factors for both developed and emerging economies (Mukherjee and Naka, 1995; Wongbampo and Sharma, 2002; Maysami et al., 2004; Ratanapakorn and Sharma, 2007; Rahman et al., 2009; Asaolu and Ognumuyiwa, 2011 to name a few). For Indian stock market and economic factors, however, a negligible amount of research has been conducted until recently. Thus, the conclusion might be inadequate.

The objective of the current study is to unravel the linkage between the stock market and the growth rate of real macroeconomic variables in the Indian context in the post reform-era. Monthly data of five macroeconomic variables are taken into consideration over the period 1991:01–2021:04. For the analysis this study uses vector autoregressive model to explore the relationship between stock market index and these macroeconomic variables.

According to the Efficient Market Hypothesis (EMH) which was propounded in the 1960s by Eugene Fama, it is impossible to beat the market as prices already incorporate and reflect all relevant information. All relevant information about the changes in macroeconomic factors is fully reflected in the current stock prices in the efficient market (Fama 1970). Efficient market means all the important information is captured and is getting mirrored in the prices. This happens if these macroeconomic variables are insignificant in explaining stock returns and stock returns are also insignificant in explaining macroeconomic variables. Again, according to the Arbitrage Price Theory (Ross, 1976) the random returns from a

subset of assets depends on market factor return which can be represented by "GNP" factor. This provides a link between macro factors and stock price.

Many empirical findings shows that stock price can be affected by macroeconomic variables. Fama(1981) works on the causes behind negative stock return-inflation relation in post 1953. It is evidence from the study that real stock returns are positively related to measure of real variable. The study concludes that this negative relation between stock return and inflation are somewhat resulted by unexpected characteristic of money supply in that period. Also the study of Schwert (1989) based on New York Stock Exchange concludes that financial volatility helped to predict future macroeconomic volatility. In literature there are different views regarding the relationship between inflation and stock returns. Geske et al (1983) and Marshall (1992) has empirically found that there is negative relationship between stock returns and expected and unexpected inflation. Inflation-stock return correlation reflects changes in government expenditures, real economic conditions and monetization of budget deficits (Geske and Roll, 1983). Again, according to Fisher (1930) there exists a positive relationship between expected inflation and nominal asset returns, and he stated that common stocks are hedges against inflation. The negative inflation-asset returns correlation may be generated by real economic fluctuations, by monetary fluctuations, or possibly changes in both real and monetary variables (Marshall, 1992). Mukherjee and Naka (1995), Sohail and Hussain (2009) has shown that there is a positive relation between money supply and stock prices. Interest rate is negatively related to stock prices. Mukherjee and Naka (1995) also conclude that exchange rate is positively related with stock returns. But some studies like Agrawalla (2006) stated that rising indices in the Indian stock markets cannot be taken to be a prominent indicator of the revival of the economy and vice-

versa. Real sector variables cannot significantly influence stock return. Indian Stock market is a casino for the sub-period of post liberalization and for the entire ten-year event study period. No support is found for the hypothesis that the Indian stock market development is linked with the economic growth in post liberalization (Azarmi et al.2005). Factors influencing stock prices can be microeconomic company specific (internal) factors or macroeconomic (external) factors. From the previous section, it has been observed that the top 10 major players individually do not have any significant influence on stock return.

The studies as discussed are all on the basis of the impact of macroeconomic variables on stock market. But existing literatures has not considered the seasonality present in the variables. This paper takes into consideration the presence of possible unit roots in monthly data and takes growth rate of the macroeconomic variables as the independent variables and tries to analyse how the real sector influences the financial sector. For this purpose, the study analyses the behavioural pattern or trend behaviour for each of the selected macroeconomic series and after observing trend behaviour, to find out the nature of transmission of the shocks between stock return and Macroeconomic variables the study applied a vector auto regressive process. For the purpose of analysis, we have collected the monthly data from handbook statistic of RBI 2021 for 1991:01 - 2021:04. The selected macro variables for the study are Call money rate as a proxy for interest rate, M3(broad money supply), Real effective exchange rate trade based (REER_Tr), Index of industrial production (IIP) and growth rate of Whole sale price index (WPI) as a proxy for inflation rate.

3.2 Econometric Methodology

For the purpose of analysis, we have collected the monthly data from handbook statistic of RBI 2021 for 1991:01-2021:04. These variables are transformed into the natural log value so that after multiplying by 100 that changes in the variables represent the relative changes or percentage changes (Gujarati, 1998). Inflation rate is calculated by taking the first difference of log of WPI. And for analysis, the study considers the model as follows:

$$y_t = \beta_0 + \beta_1 x_{1t} + \beta_2 x_{2t} + \beta_3 x_{3t} + \beta_4 x_{4t} + \beta_5 x_{5t} + \beta_6 x_{6t} + \varepsilon_t \qquad (3.1)$$

Where x_{1t} is log of Call money rate, x_{2t} is log of money supply, x_{3t} is log of IIP, x_{4t} is log of trade based real effective exchange rate, x_{5t} is inflation rate, ε_t is the disturbance term and $\beta_{1,2,3,4,5}$ are coefficients of independent variables.

The study will follow similar methodology used in Chapter-2 of this study for checking seasonal unit root as adopted by Das (2021). The order of integration is identified for each variable by applying HEGY test and by considering 5 % critical value.

After checking the trend behaviour of the variables, we will check for cointegration if we find that variables are integrated and apply restricted or unrestricted VAR according to the results. In a reduced VAR model, we consider only the past values of the variables in right hand side. VAR is basically an extension of univariate auto regression model. It is commonly used for financial modelling, forecasting when considered a system of interrelated time-series and for analysing the dynamic impact of random disturbances on the system of variables. In a VAR (p) with k dimension the reduced form is given by –

$$x_t = \pi_0 + \pi_1 x_{t-1} + \cdots + \pi_p x_{t-p} + e_t \qquad (3.2)$$

Where, x_t is a vector of (k x 1)

$\pi_i$is a matrix of (k x k) for all i >0 and π_0 is a vector of (k x 1)

e_t is a vector of (k x 1)

The e_t follows vector white noise

E(e_t) = 0

E($e_t \acute{e}_s$) = Ω when t = s

= 0 otherwise

In case of Ω, it a variance-covariance matrix of order k, whose diagonal elements are variance and it should be positive definite matrix.

The equation in (3.2) is similar to univariate autoregressive model but it also includes lagged values of the other variables. And suppose macro-economic variables BSE_Return, Call_money_rate, M3, IIP, REER_Tr, inflation rate, which are interrelated. If each series are separately modelled it might involve an auto regression of each of these variables. However this approach will fail to capture any interaction between the variables that might be present. VAR modelling considers equation for each and every variable. For example, consider the variable BSE it is related not only to its own lagged values but also to other five variables. This process has one dimension as in the length of the longest lag in auto regression and the other is k number of variables which are considered jointly.

3.3 Empirical Findings

Analysis of BSE SENSEX in the previous chapter tells that the Sensex close price is non-stationary but return is stationary. In the figure – 3.1, the diagram for some macroeconomics variables show clear upward trend. In case of IIP data it also have an upward trend but with a clear seasonal fluctuation. Also for other variables there exist several peak points in the respective graph which indicates the non-stationary behaviour of the monthly series. So this takes the similar approach as in the previous chapter for checking for unit root .i.e. the Hegy test on the basis of each univariate time series model with the help of STATA software to estimate the augmented form of regression equation (3.1).

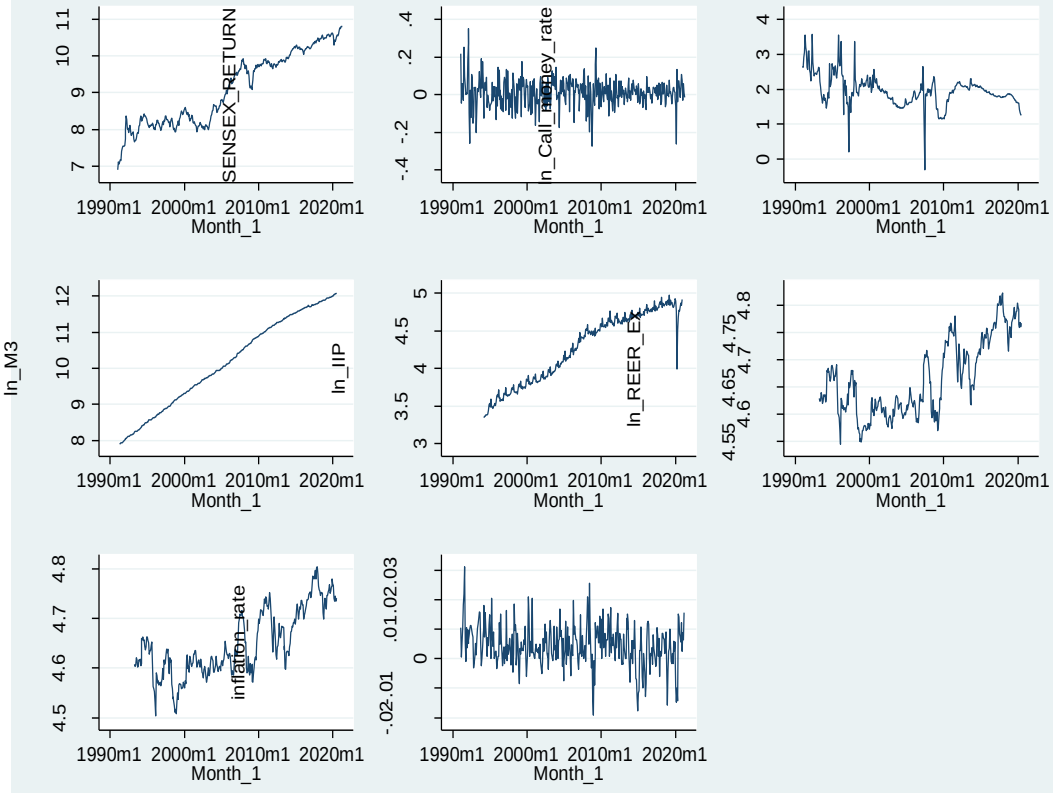


Figure: 3.1- Trending pattern of Sensex close price, Sensex Return and selected Macro variables. Source: As for Table 3.1.

The testing procedure of hegy test for the macroeconomic variables is similar as before (Table 3.1). For each univariate model the study found that there was no unit root for REER (trade based) and inflation rate. But at long run we find that for interest rate (Call money rate), Money supply i.e. M3, IIP there present unit root as we consider 5% critical value. The test result shows that for call money rate there is a presence of unit root at the long run at 0 frequency. For broad money M3 there is a presence of unit root at long run at frequency π_i at frequency $\pi_{i/6}$ and $\pi_{i/2}$. Now for IIP (which denotes the company's total production activity) the result shows it has unit root at 0 frequency which means in the long run IIP is non-stationary. REER_tr and WPI do not have any presence of unit root in seasonal or non-seasonal time frame. In case of M3 we find that seasonal unit root is present at bi-annual frequency.

One possible reason for seasonality in money supply can be elucidated by demand for money. As RBI consider demand deposits at the time of accounting M3. This demand deposit is related to transaction demand for money and any innovation in financial sector affect the transaction demand. In the on-going era of innovation in payment system we can't ignore possibility of stochastic seasonality in money demand which in turn can cause seasonality in M3.

As all the variables are not non-stationary, cointegration will not provide any meaningful result (Das, 2021). So we cannot apply restricted VAR model. In this case we can apply the unrestricted VAR by considering the variables – Sensex return, Call money rate, M3, IIP, REER (trade based), inflation. The first difference of the variables such as Call money rate, IIP and second difference of money supply has been taken for estimation; basically this makes the variables stationary which is a

prerequisite for applying VAR model. Since the macroeconomic variables are interrelated the paper uses VAR model for analysis. In the VAR model we have 7 equations and the R square value suggest that except the equation regarding Sensex return as dependent variable others are good fitted. The p-value of chi-square test also supports that.

Table – 3.2 VAR of Sensex Return and Macroeconomic Variables

Variable	SENSEX_RETURN	D_ln_Call_money	D2_ln_M3	D_ln_IIP	ln_REER_Tr	D_ln_WPI
SENSEX_RETURN						
L1.	0.00638448	0.3238081	-0.0035918	.22712747***	.02985339*	0.00446131
L2.	0.06334926	-0.04445554	-0.00692856	0.00424013	-0.00379914	.01238511**
ln_Call_money						
LD.	0.01614659	-.31772498***	0.00119943	0.00302002	0.00465347	0.00042925
L2D.	0.00480486	-.24839442***	-0.00014027	0.01616852	.00695763*	-0.00049406
ln_M3						
LD2.	0.0122739	-1.6170346	-.62195952***	-.95865841**	-0.11331505	.06658373**
L2D2.	0.05143111	1.4189172	-.22230765***	-0.10538498	-.15745185*	0.02351249
ln_IIP						
LD.	0.02827268	-0.03562833	0.01388402	-.4061408***	0.00532638	.01767504***
L2D.	0.03113418	0.12722087	.02401958*	-.14177469*	0.00871202	-.01342984**
ln_WPI						
LD.	-0.61484838	2.2112442	-.36747887**	-0.64817825	0.16788167	.50794626***
L2D.	0.06125313	2.1585958	0.17635936	0.57034266	-0.26821523	-0.0378959
ln_REER_Tr						
L1.	0.2593353	-1.6449326	0.0309227	-0.07043254	1.0203383***	-.07671391***
L2.	-0.3224593	1.8548089*	-0.02915059	0.02580991	-0.04769898	.07370728***
_cons	0.30197318	-0.99689285	-0.00759364	0.21291686	.12761507*	0.01583334
R-sq	0.0223	0.177	0.3008	0.2444	0.326	0.9469
chi2	7.136364	67.33498	134.6732	101.2371	151.3649	5586.915
P>chi2	0.8485	0	0	0	0	0

legend: * p<0.05; ** p<0.01; *** p<0.001

Source: Authors' estimate with monthly series taken from (RBI, 2021)

Results of the VAR are presented in Table - 9. As can be seen from the reported adjusted R2, 2% of the variation in BSE Sensex return is explained by the macroeconomic variables viz., real effective exchange rate (trade based), growth rate of real interest Rate, change in growth rate of money supply, inflation and growth rate of interest rate. Similarly, for growth rate of interest rates, it is 17%, for change in growth rate of money supply it stands at 30%, for growth of index of industrial

production it is 24% and for real effective exchange rate and inflation it is 94% and 32% respectively. It clearly suggests that only 11% of movements in stock returns are getting influenced by these macroeconomic variables at monthly frequency. Now it is clear from this that influence of macroeconomic variables in real sector on stock return is so negligible so it can be stated that the growth rate of macroeconomic variables fail to have any significant impact on the BSE return but except for money supply and interest rate BSE return has a significant impact on the growth rate of macroeconomic variables. The VAR estimation for growth rate of each macroeconomic variable gives us some significant results.

From the Table -3.2 we can clearly find that the both lag values of growth of call money rate is negatively related with present value of growth of call money rate, which implies if in previous period call money rate increases then in present period there should be a fall in call money rate

Also the value of REER period back has positive impact on growth of call money rate, i.e. if there is an increase in exchange rate which can be caused by increase in demand for foreign currency then to mitigate the demand there can be increase in interest rate.

Change in the growth of money supply can be affected by its own lag values. Also the change in industrial growth is positively related with change in the growth of money supply. It also find that here change in inflation rate is negatively related with change in growth of money supply. Money supply is one of the major components of monetary policy that the RBI uses in India. Changes in money supply can be either anticipated or unanticipated by all the people. And these anticipated changes in the money supply affect today's price level according to rational expectation but if it is

unanticipated then present inflation will not get affected. Now if there is an increase in inflation in previous period then there will be low growth in money supply in present situation. So people may behave rationally and any announcement regarding an increase in money supply increases previous periods' inflation but as inflation increases in previous period central bank will not increase the money supply today.

In case of IIP, the result shows that there is a unidirectional causal relation between the growth in IIP and Sensex return. In other words, Sensex has caused the growth in IIP positively, but this causal relation is not true from the opposite way round. This implies that the financial sector has augmented growth in real sector. In India though the real economy does not influence financial market but financial sector can influence real sector. Also, industrial growth is negatively affected by change in growth of money supply at lag 1. Its own lag values influence it negatively. This can happen because an increase in growth in previous period will lead to low industrial growth in present period.

Now one possible reason for such result can be that the major players of stock market such as mutual funds and know business strategies of big industrial houses in advance. Another explanation can be that as stock market offers unexpected high gains compared to the returns from other alternatives such as bank deposits, deposits in post office etc. domestic investors are much more interested to invest in stocks either directly or through mutual funds. As a result, demand for stocks rises and so the stock returns which in turn sets a virtuous circle in motion augmenting economic growth. Bubble and crashes in stock market instigate boom and recessionary situation in the real sector. (Ahmed, 2008) .So if money supply increases more rapidly than the output growth it can create inflation which can negatively impact the economy as prices of goods and services rises.

A unidirectional causal linkage has been found in case of exchange rate and stock return. Usually, exchange rate affects stock market in two ways – a direct effect through multinational (MNC) firms and an indirect effect through domestic firms. When rupee depreciates leading to an increase in exchange rate, export activities get a boost and export-based companies' (both MNC and domestic) stock prices rise and so the returns. The effect is just the reverse for the companies involved in imports. Their stock prices fall leading to a decline in returns. The present study has found that REER doesn't have any significant impact on stock return, but stock returns has caused exchange rate positively. One possible explanation can be that higher stock returns attracts both domestic and foreign investors to keep money in Rupees compared to Dollar as the return from Rupee is much higher. As stock return increases foreign investors will invest more in stock market to get higher return which increases demand for rupees. Also in India we have managed float system so attract foreign investment RBI may increases exchange rate. Except this growth rate of call money rate at lag 2 positively affect REER whereas change in growth of money supply at lag 2 negatively affect REER.

Even though one period lag value of inflation rate has a negative influence on stock returns, no significant causation has been observed from inflation to stock returns. But two period lag value of stock return has a significant positive impact on inflation. Since increase in stock return in previous period implies the stock price was also high and indicated boom period in financial market so this will lead to a rise in product price of the companies as higher stock price indicates more investment which will channelize in betterment of the product or service of related companies which will again led to high price level. Also change in growth rate of money supply has positive impact on inflation which proves the statement of Milton Friedman that

“Inflation is always and everywhere a monetary phenomenon”. A change in industrial growth at previous period positively influence inflation though a change in industrial growth at two periods back has negative impact on inflation.

Roughly speaking, the impact of high inflation makes the stock less attractive as inflation results in loss of real value of the wealth. So theoretically speaking, the effect of inflation on stock returns should be negative. But here the negative relation has disappeared in a multivariate framework when considering all other real sector macro variables together along with inflation (Fama, 1981). In other words, it may be that here stock return is working as a hedge against inflation. Loosely speaking, in order to avoid the loss of real value of wealth which is caused by inflation, people are preferred to keep investing on stock returns.

The simple OLS regression model is also used to observe the impact of macroeconomic variables as explanatory variables on stock return as dependent variable. From this result this study highlights that stock return has positive causal effect on Money supply and real effective exchange rate export based, although the effect is very weak. If Money supply increases by 1 unit, stock return increases by 0.0015 units, provided effect of other predictors is held constant. But the effect of real effective exchange rate export based is more than money supply. If the real effective exchange rate increases by 1 unit, stock return increases by 0.16 units. From (Table-3.3) it shows all macroeconomic variables except interest rate have insignificant impact on bse Sensex return i.e. the major macroeconomic variables do not influence the overall market returns. But it shows there is a significant negative relation between interest rate and stock return.

Clearly the study fails to have any significant relationship considering the growth rate of real macroeconomic factors as the control variable for explaining the financial sector in India. But interestingly it finds return has a positive impact on growth rate of macroeconomic variables. So there is no bilateral relationship.

3.4 Conclusions

Many empirical studies have been done by several researchers regarding the influence of macroeconomic variables on stock market. And the results were conflicting. Some researchers concluded that a range of macroeconomic variables are able to predict stock market returns (Campbell, 1987, French et al, 1987, Fama and French, 1989) where as Agarwalla (2006) and Azarmi et al.(2005) and many other economists have opposed this view. But existing literatures has not taken into consideration the possibility of presence of seasonal unit roots in the control variables and has not considered the growth rate of variables concerned. This study incorporates the seasonal behaviour in to the time series analysis and analyses the relation between stock return and the growth rate of several macroeconomic variables in Indian context during the period of post liberalisation using the VAR model.

The Vector Autoregression Model shows some interesting results. The study finds that there is no bilateral relationship between the growth rates of macroeconomic variables such as call money rate as a proxy for interest rate, broad money supply (M3), real effective exchange rate trade based, Index of industrial production (IIP), inflation rate and BSE SENSEX. That is macroeconomic variables fail to explain the changes in return but the return series has a positive impact on the growth rate of macroeconomic variables except for money supply and interest rate. It is important

that in developing country like India the real sector variables have no impact on Sensex return which is representative of financial sector. So we can conclude by the word of Azarmi et al.(2005) that Indian stock market behave like a Casino where financial events are not associated with real economic growth. This result is also relevant with the present scenario of India where we find in the situation of slow-down of the economy from 2018-19 due to pandemic and other economic issues India's market capitalisation hits $3 trillion where the last $1 trillion is achieved within the period of 2017-2021 (Mascarenhas, 2021).

But there is unilateral relation between real sector economy and financial sector. It is clear from the result of VAR model that stock return has a positive impact on industrial growth which is a significant result. Increase in stock return is associated with increase in stock price. An increase in stock price always reflects the good will of a company and the stock market increases its real economic production by channelizing appropriate investment. So in India we find the argument that "the economics of the real sector implies that the resulting relations between stock returns and anticipated growth rates of real activity are positive" by Fama(1981) holds true. Also it can be stated that changes in stock return reflects changes in wealth, and this can affect the demand for consumption and investment goods (Schwert, 1942). Also it is evident from the result that stock return has positive influence on exchange rate and inflation rate. In case of India, increasing stock return attract foreign investment and as there is inflow of FDI which increases the demand for the home currency i.e. INR so the exchange rate increases. In case of inflation as the return from stock increases there will be more investment accumulated in real sector by financial market so there will be more innovation and betterment of goods and services in real economy which will lead to more inflation by increasing the price level. As a

concluding remark it must be taken into consideration that the present analysis has not considered a major determinant of stock return that is Foreign Institutional Investment (FII) and also Gross domestic product (GDP). Usually, there happens to be a strong linkage between real and financial sector. When the level of aggregate demand is high, then investors become optimistic about their future and invest more in the share market which results in gdp growth and fewer financial uncertainties. When GDP is rising, the economy is doing well the companies raise additional funds through bonds. Investors buy bonds and funds are used for expansion and growth which in turn induces GDP growth. When stock prices are rising, investors have more wealth and the spill over mechanism works resulting in increased spending which leads to increased sales and profits for corporations boost in GDP. But in developing countries the capital markets are not transparent enough to reflect this relationship.

According to Krugman stock market is about one piece of the economy-corporate profits. So there is no influence of macroeconomic factors on stock market return. The stock market is often viewed as a rational indicator of the economy and it is believed to be closely linked to the real economy. But the nature of the stock market and economy is different. Stock market is forward looking that is it is seen as a leading indicator of future economic activity. But economic indicators are backward looking. In other words, the future real activity may be reflected in stock prices well before it occurs. Stock market is constantly soaring when the economy is actually going down. It is mostly myth that financial market and real economy are closely linked. Stock market is not about the entire economy. In reality in developing country like India real economy is sluggish. Though there is a short fall in real economy stock markets are in boom as India's financial market cannot explain

everything. India has been following the policy of liberalization, privatization and globalization from 1991, the positive movement of Indian stock market is an indication of better performance of the economy. A reflection of the movement of the world economy is influenced by movement of the Indian economy in this period, as markets are integrated. As a result, some significant relation is observed between Indian stock market and macroeconomic variables. And the direction is from the Indian stock market to some real sector variables but not the other way round.

Appendix of Chapter 3

Table – 3.1: Hegy test for macroeconomic variables with Sensex return

	Sensex Return	ln(Call money)	ln (M3)	ln(IIP)	ln(REER_TR)	Inflation
t[0]	-2.589	-3.162*	-1.225	-0.009	-3.884***	-4.154***
t[Pi]	-3.173	-4.258***	-2.668	-4.475***	-5.463***	-4.708***
F[Pi/6]	12.439***	14.910***	7.485*	13.274***	50.696***	19.881***
F[Pi/3]	12.554***	14.777***	10.261***	10.869***	23.866***	12.969***
F[Pi/2]	12.791***	22.223***	7.287*	11.170***	26.331***	21.094***
F[2*Pi/3]	10.326***	12.965***	13.974***	21.054***	30.737***	11.509***
F[5*Pi/6]	11.459***	22.597***	10.434***	26.528***	30.532***	14.556***
F[All seas]	12.269***	22.502***	10.136***	34.017***	320.799***	18.330***
F[All]	11.967***	22.701***	9.389***	32.059***	295.481***	18.520***

*** p<.01, ** p<.05, * p<.1

Source: Authors' estimate with monthly series taken from (RBI, 2021)

Table 3.3: Linear Regression

return_BSE_Close~e	Coef.	Std. Err.	t	P>t	[95%	Conf. Interval]
ln_Call_money_rate	-0.0367	0.01083	-3.39	0.001	-0.058	-0.0154
ln_M3	0.00901	0.01837	0.49	0.624	-0.0271	0.04516
ln_IIP	-0.0173	0.0422	-0.41	0.682	-0.1004	0.06571
ln_REER_Ex	0.14806	0.29347	0.5	0.614	-0.4294	0.72551
ln_REER_Tr	-0.231	0.32702	-0.71	0.48	-0.8745	0.41243
inflation	-0.3902	0.57767	-0.68	0.5	-1.5268	0.74647
_cons	0.44208	0.38209	1.16	0.248	-0.3098	1.19391

Source	SS	df	MS	Number of obs	=	316
				F(6,309)	=	2.21
Model	0.06082	6	0.01014	Prob > F	=	0.0417
Residual	1.41516	309	0.00458	R-squared	=	0.0412
				Adj R-squared	=	0.0226
Total	1.47598	315	0.00469	Root MSE	=	0.06767

Source: Authors' estimate with monthly series taken from (RBI, 2021)

CHAPTER 4: Volatility in Stock Return

4.1 Introduction

On the path of development, fundamental values of stock market evolve gradually. An efficient stock market always provides opportunity for savings and investments. Changes in stock returns causes growth in real economic activity. For improving the quality of life, economic growth has been taken as one of the important indicators. Standard classical and neo-classical economics suggest the role of investment as a main factor behind economic growth. Monetary and financial sector play an important role in channelizing funds from savers to investors. And in this regard, financial stability is crucial for promoting investment. To the before of 1991, India was predominantly state controlled economy. With the adoption of New Economic Policy (NEP) in 1991, India started integrating with the global economy. And this shift in the structure from state controlled to market determined economy started resulting in fluctuations. The period around 1991 BOP crisis and subsequent initiation of economic reform in India is the most volatile period in Indian stock market (Batra, 2004). Improved financial instruments, change in trading pattern attracted huge Foreign Institutional Investment (FII) inflows. The country started experiencing trade balance surplus which was mostly attributed to this huge influx of foreign funds. Entry of FIIs and at the domestic level spectacular growth of corporate sector and mutual funds further added to the depth and width of Indian stock market (Ali, 2016). In simple words, volatility refers to the ups and downs in the stock prices or the stock returns. Volatility is unavoidable and it is desirable up to a certain degree as without volatility superior returns can't be generated. Bubbles and crashes in the stock market led to boom and recessionary situation in the real economy and

thus affect National Income (NI). The purpose of this study is to analyse how the volatility in macroeconomic variables affect the volatility in stock return. Macroeconomic volatility has emerged as a key issue in analysing the determinants of economic growth during this global crisis. There are several costs and consequences of macroeconomic volatility. Indeed, under certain conditions the positive relationship between risk and capital return can explain a positive relationship between economic volatility and growth, according to many researchers this phenomenon has a negative impact on long-term growth and well-being. Over the long term, volatility results in a reduction in consumption levels, investment and factor productivity, bad institutional environment, unpredictability of economic policy. The developing countries are more affected by this because they are often subjected to more significant external shocks but are not able to absorb them easily due to inefficient conditions. (Hnatkovska and Loayza (2005), Aizenman and Pinto (2005) and Loayza et al (2007)). All this emphasises the importance of measuring volatility. There are few studies attempting to link underlying macroeconomic fundamentals to stock return volatility, in a classic and well-known contribution using monthly data from 1857 to 1987, Schwert (1989) attempts to link stock market volatility to real and nominal macroeconomic volatility, economic activity, financial leverage, and stock trading activity which was negligible. Although it has also been found that stock market volatility is higher in recessions, as found by Officer (1973) and echoed in Schwert (1989), and Hamilton and Lin (1996), among others. The inclusion of macroeconomic variables in the modeling of the volatility of stock return has therefore been investigated to further explain the volatility of stock return. The present study therefore tries to explore the causal relationship between volatility in BSE Sensex return and the volatility of major macro determinants such as

exchange rate, inflation rate, money supply, Industrial growth and interest rate over the period of 1991-2021 using monthly time series data in the context of India. For convenience, REER (Trade Based) is proxying for exchange rate; log difference of Wholesale Price Index (WPI) is taken the proxy for inflation rate; M3 for money supply; Call money rate fir interest rate and lastly Index of Industrial Production (IIP) for industrial growth. Now, in asset pricing literature, volatility refers to asset price volatility. It can be measured as the standard deviation of monthly stock price changes. Now conventionally, the close price schedule behaves like an integrated series while the return series is purely stationary. Although return is stationary, the squared return is not stationary. Classical Econometric Theory assumes the homoscedastic error, but in reality, this assumption rarely holds. Now if the error becomes heteroscedastic, i.e., if the variance of error becomes time dependent, then it will be supposed to have a distribution like AR or MA or ARMA. Now if square of the return follows AR/ARMA process then the return may follow ARCH or GARCH model. Now ARCH is a class of model that analyses risk and uncertainty it was developed by Engle (1986) but later on this model was extended by Bollerslev (1986) and Taylor (1986) and they introduced GARCH model. Even though ARCH model was introduced earlier but GARCH process allows a wider range of behaviour of volatility clustering. This model asserts that best predictor of the variance in next period is weighted average of the variances of the past and past squared residuals. The GARCH, probably the most commonly used financial time series model, considers both autoregressive (AR) and moving average (MA) processes of the conditional variance. In a recent study conducted by kavita(2007) tried to whether previous day's Sensex returns has an explanatory power for today's Sensex returns by fitting GARCH (1,1) model. It is evident from the analysis that parameter is

statistically significant and positive which indicates that Past Sensex returns has GARCH effect in the today's Sensex returns. But in case of GARCH model it does not really tells us about the direction of the volatility, as the stock market return generally exhibits asymmetry in the sense that it behaves in different manner during positive and negative shocks. This asymmetric characteristic of market volatility is known as the "leverage effect". With the" leverage effect" the studies of Black (1976), Christie (1982), FSS (1987), Schwert (1990) and Pagan and Schwert (1989) also explain this volatility asymmetry. However, their models failed to capture this asymmetry. Engle and Ng (1993) has provided new diagnostic tests and models, which incorporate the asymmetry between the type of news and volatility, they give guidance to researchers to use enhanced models when studying volatility. At least there are four distinguishing features of emerging market returns: higher sample average returns, low correlations with developed market returns, more predictable returns, and higher volatility (Bekaert and Wu, 2000). Now to check for this asymmetry The Exponential GARCH model or EGARCH (Nelson (1991)) model is being used in this study. In EGARCH model, the conditional variance is an asymmetric function of lagged residual terms. These models can be used in financial decisions concerning risk analysis, portfolio selection and derivative pricing. This type of econometric analysis is crucial in analyzing the behavior of investments, option pricing, the term structure of interest rates, general dynamic asset pricing relationships and in our study BSE Sensex Return. The behavior of conditional variance of residuals of macro parameters (after making the series stationary) are also analyzed to check correlation of variances of residuals of macro parameters with conditional variance Sensex Return. This will help us to study the behavioral pattern of conditional variance of Sensex return, i.e. volatility of Sensex return. Volatility in

India is more likely to be a consequence of major policy changes and any further incremental policy changes. And because of this a little attention has been paid towards an extensive study of the volatility of the emerging stock market of India along with how volatility of macroeconomic variable affects stock return variables, while the volatility and its relationship with stock price in developed financial markets has been well analysed.

4.2 Methodology

We consider simple model of Sensex Return over the period 1991-01 to 2021-04. In order to check the pattern of volatility the study considers the stationary variables. We have looked first the autocorrelation function and fit an OLS regression model with constant and check Engle's Lagrange multiplier test for ARCH effect. After that we applied ARCH/GARCH process accordingly. The previous chapter of the study found that the Return series is stationary as the long term mean was found to be time independent (Fig: 4.4). The fig-4.1 shows autocorrelation function of squared Sensex return and fig:4.2 shows autocorrelation function of Sensex Return. From the autocorrelation function of return series and return square series it can be presumed that since the autocorrelation function of stock return does not follow any particular pattern it is a stationary series; whereas the autocorrelation function of the square of return indicates it follows AR (Autoregressive) process. SBIC Criterion is used to find optimum lag length. σ_t^2 is conditional variance of Sensex return which is time dependent. The focus of the model is on conditional variance function of random error. Engle (1982) defined ARCH model by assuming –

$$\varepsilon_t \sim N(0, \sigma_t^2)$$

Where, $\sigma_t^2 = \theta_0 + \theta_1 \varepsilon_{t-1}^2 + \theta_2 \varepsilon_{t-2}^2 + \cdots \ldots + \theta_p \varepsilon_{t-p}^2$ (4.1)

In this process we analyse σ_t^2 which depends on ε_t^2. If ε_t^2 follows AR (p) then we can say ε_t will follow ARCH (p) process. ARCH models are mainly used for measuring changes in variances and volatility.

This model was generalized by Bollerslev (1986) and popularly known as GARCH model where, the conditional variance function is specified in the following format –

$$\sigma_t^2 = \beta_0 + \sum_{i=1}^{p} \theta_i \varepsilon_{t-i}^2 + \sum_{j=1}^{q} \beta_j \sigma_{t-j}^2 \quad (4.2)$$

The fig:4.3 shows that there is much volatility in the entire span of samples considering the lagged values of variances. So, this claims that BSE return series is following ARCH (Engle, 1982) of order 2. In other words, the behaviour of the squared return series depicts AR of order 2 which actually implies the return series is following ARCH Model.

The Sensex return is denoted by $\varepsilon_{R,t}$. So, we find $\varepsilon_{R,t}^2$. In the model, the conditional variance of Sensex return $\varepsilon_{R,t}$ i.e. $\sigma_{R,t}^2$ depends on conditional variance of squared Sensex return in 1st period lag .i.e. $\varepsilon_{R,t-1}^2$ and squared Sensex return in 2nd period lag.i.e. $\varepsilon_{R,t-2}^2$.

$$\sigma_{R,t}^2 = \theta_0 + \theta_1 \varepsilon_{R,t-1}^2 + \theta_2 \varepsilon_{R,t-2}^2 \quad (4.3)$$

or, $$\sigma_R = \sqrt{\theta_0 + \theta_1 \varepsilon_{R,t-1}^2 + \theta_2 \varepsilon_{R,t-2}^2} \quad (4.4)$$

The squared Sensex return, $\varepsilon_{R,t}^2$ contains conditional expected mean of squared Sensex return, $E(\varepsilon_{R,t}^2 | \sum \varepsilon_{R,t-i})$ and weak white noise process v_t. This proves that variance of Sensex return is time dependent and follows stochastic trend.

$$\varepsilon_{R,t}^2 = E(\varepsilon_{R,t}^2 | \sum \varepsilon_{R,t-i}) + v_t \quad , \quad i = 1,2 \qquad (4.5)$$

The fitted ARCH model is

$$y_t = 0.009 + \varepsilon_t$$

$$\sigma_{R,t}^2 = 0.003 + 0.200\varepsilon_{R,t-1}^2 + 0.117\varepsilon_{R,t-2}^2$$

The GARCH(p,q) process disturbance term is equivalent to ARMA process followed by squared disturbance term. The GARCH model has some benefits. It takes small number of iterations and shows better result than higher order ARCH model. In case of Call money rate, GARCH of order 1 is the best suited model which actually captures the ARMA behaviour of squared return series. First difference of call money rate is denoted by $\varepsilon_{r,t}$. So, we first find $\varepsilon_{r,t}^2$. It is found that residual series follows GARCH(1,1) process. So it claims that first difference of call money rate follows GARCH(1,1) process and squared term of call money rate follows ARMA(1,1) process. The conditional variance function of first difference of call money rate series is

$$\sigma_{r,t}^2 = 0.784\varepsilon_{r,t-1}^2 + 0.575\sigma_{r,t-1}^2$$

The EGARCH (p, q) equation is:

$$log\sigma_t^2 = \omega + \sum_{t=1}^{p}(\alpha_1|z_{t-1}| + \gamma_1 z_{t-1}) + \sum_{t=1}^{p}\beta_1 log\sigma_{t-1}^2 \qquad (4.6)$$

EGARCH (1,1) equality is given as follows:

$$log\sigma_t^2 = \omega + \alpha_1|z_{t-1}| + \gamma_1 z_{t-1} + \beta_1 log\sigma_{t-1}^2 \qquad (4.7)$$

Now z_{t-1} term shows the asymmetric impact of positive and negative Shocks. If $\gamma > 0$ then volatility is said to rise when lagged standardized shock $z_{t-1} =$

$\epsilon_{t-1}|\alpha_{t-1}$ are positive. While if $\gamma < 0$ then volatility is said to fall and standardized shocks have negative impact. For positive shock the eq. (4.7) becomes:

$$log\sigma_t^2 = \omega + (\alpha_1 + \gamma_1)z_{t-1} + \beta_1 log\sigma_{t-1}^2 \qquad (4.8)$$

For negative shocks the equation (4.7) becomes:

$$log\sigma_t^2 = \omega + (\alpha_1 - \gamma_1)z_{t-1} + \beta_1 log\sigma_{t-1}^2 \qquad (4.9)$$

Various benefits of applying the EGARCH test are that the log value of volatility is considered as explained variable. It needs not any non-negative constraint for the parameters of variance dynamics and this EGARCH model may consider the asymmetric result of volatility.

Inflation is denoted by $\varepsilon_{I,t}$. So, we first find $\varepsilon_{I,t}^2$. The optimal lag length is 1. It is found that the model follows EGARCH process since the p value is significant for EGARCH model. So it claims that growth rate of Inflation follows EGARCH (1,1) process and squared growth rate of inflation follows ARMA(1,1) process. The EGARCH model of inflation growth rate is written as:

$$\ln \sigma_{I,t} = \theta_0 + \theta_1 \frac{\varepsilon_{I,t-1}}{\sqrt{(\sigma_{I,t-1})}} + \mu|\frac{\varepsilon_{I,t-1}}{\sqrt{\sigma_{I,t-1}}}| + \beta_1 \ln \sigma_{I,t-1} \qquad (4.10)$$

Where θ_0 is a constant, θ_1 show ARCH effects, μ show asymmetric effects and β_1 show the GARCH effects. The log of conditional variance of inflation $\sigma_{I,t}$ makes leverage effect exponential rather than quadratic. The conditional variance asymmetric function of the growth rate of inflation series is

$$\ln \sigma_{I,t} = -5.600 - 0.108\frac{\varepsilon_{I,t-1}}{\sqrt{\sigma_{I,t-1}}} + 0.492|\frac{\varepsilon_{I,t-1}}{\sqrt{\sigma_{I,t-1}}}| + 0.441 \ln \sigma_{I,t-1}$$

Similar method is applied for testing pattern of volatility for growth rates of trade based exchange rate, money supply and industrial productivity. One of the benefits of applying the EGARCH test is that here the log value of volatility is used as regressor and the model can capture the asymmetric power of volatility. In this study we will utilise the three different models according to the univariate structure. Then the models are estimated on the basis of maximum likelihood method. Then predict the value of volatility and estimate the VAR model as mentioned in chapter 2 for detailed interpretation among conditional variances of these variables.

4.3 Empirical Findings

Although the return series is stationary but fluctuations are not uniform throughout the period. There is variation involved in the fluctuation i.e. clustering of volatility can be observed in this time series representation of return. Behaviour of volatility can be analyzed by examining the conditional variance of this series since here the variance is time dependent. By plotting the autocorrelation function of return series and return square series it can be presumed that since the autocorrelation function of stock return does not follow any particular pattern it is a stationary series; whereas the autocorrelation function of the square of return indicates it follows AR (Autoregressive) process. The univariate analysis shows the variation along different time. The study first look at the Engle's Lagrange multiplier test after estimating a univariate regression with the constant term only and find that for each of the stationary variable there is presence of ARCH effect. To look at leverage effect i.e. good and bad situation risk behaviour we first look at the ACF and PACF and find the presence of autocorrelation. We fitted 2^{nd} order EGARCH model and also looked at the coefficient to AR (2) and MA (2) which we find significant (Table-4.1). As

stock market works on speculation in bad situation it is expected that the risk parameter would increase. But here in this estimation the model fails to explain this behaviour instead the positive news have impact on volatility though it cannot dominate the symmetric effect. So we fitted the equations with volatility pattern of Sensex return and as we find there is no GARCH effect. To analyse the variance of the return, this study first examines the ARCH (Autoregressive conditional heteroscedasticity) model after estimating the model considering the return series as dependant variable. The study performs the LM test for presence of ARCH with the null hypothesis that ARCH effect is not affecting the current time series data against the alternative that ARCH effect is present in the series. In case of the Sensex return we reject the null hypothesis which indicates that the variance is influenced by the ARCH effect. In the next step the study finds the optimal lag length for performing the estimation of the return series. Estimating the series henceforth, the result suggests that it follows ARCH (2) model and the conditional variance term is generated. The findings suggest that Sensex return follows Autoregressive Heteroscedastic (ARCH) process, which means that squared Sensex return follows bot Autoregressive process. This means that the conditional variance of the return is affected by past squared return terms of two periods which is the Autoregressive part. This shows how volatile BSE Sensex return series is. From the conditional variance function of Sensex Return it is claimed that current volatility is because of past volatility of two periods lag.

Now the macroeconomic variables are interconnected. Change in one variable affects other and this overall results volatility in the economy of a country. These have impact over working of equity market. Their linkage is mostly short in nature and get volatile early. So to analyze the volatility of macroeconomic factors,

GARCH model is used. The monthly data have seasonal variation. The call money rate, whole sale price index, industrial growth we found that after taking the first difference of respective log values the series become stationary (Table 4.2). Whereas broad based money supply becomes stationary after taking the second difference of log value of M3. In the similar way this process is followed for the macroeconomic series i.e. Real Effective Exchange Rate (trade based), growth rate of call money rate, growth rate of IIP, growth rate of WPI and changes in growth rate of broad money supply. For all of these variables the null hypothesis of the LM test for presence of ARCH effect is rejected. So using SBIC criteria and after plotting the ACF and PACF functions for residuals, the models selected are ARMA(1,1)–GARCH(1,1) for call money rate, ARMA(2,2)-EGARCH(2,2) for money supply, ARMA(2,2)-EGARCH(2,2) for IIP and ARMA(1,1)-EGARCH(1,1) for Inflation , ARMA(1,1) -EGARCH(1,1) for trade based exchange rate and finally AR(2)-ARCH(2) for Sensex return. In case of stationary call money rate, it denotes the volatility pattern has GARCH (1,1) affect that is the present periods volatility and the conditional heteroscedasticity of the random error become inherited. For the remaining variables, the EGARCH model according to the optimum lag value is fitted. For M3 we find that there is presence of leverage effect, where any good news affects the change in growth of money supply than bad news at lag 1. But past period's volatility have no impact on present period's volatility. For growth rate of IIP there also any positive shocks affect the growth more than any negative shock which is true in real scenario. But the symmetric effect at both lags dominates over leverage effect. For REER trade based we find that the leverage coefficient is not significant but symmetric coefficient and the garch coefficient is significant. The

same result holds for inflation. In both of the cases we estimate the EGARCH (1, 1) model and predicted the conditional variance.

Table-4.3 VAR model of Financial and Macroeconomic volatility

Equation	Parms	RMSE	R-sq	chi2	P>chi2
v_re	13	.002418	0.4203	254.4882	0.0000
v_call	13	.257765	0.6136	557.4542	0.0000
v_m3	13	.000252	0.0122	4.347345	0.9763
v_iip	13	1948.12	0.0921	35.59909	0.0004
v_reer	13	.001237	0.9444	5958.396	0.0000
v_inflation	13	.000019	0.2955	147.2397	0.0000

Variable	v_return	v_call	v_m3	v_iip	v_reer	v_inflation
v_return						
L1.	.72494794***	6.4411225	-0.00144979	-92734.808*	-0.03294321	.00104989*
L2.	-.19770284***	-4.1854126	-0.00141881	165801.13***	0.01812373	-0.00049759
v_call						
L1.	0.00002407	.90645225***	6.88E-06	-26.728776	2.48E-06	-5.82E-07
L2.	0.00028126	-.17844623***	2.28E-06	0.86614783	0.0000665	-2.53E-06
v_m3						
L1.	-0.39543472	29.216013	-0.06775981	-80763.516	-0.02342434	0.00539352
L2.	0.01100169	6.1701423	-0.05291742	-134339.01	0.30864546	-0.0056392
v_iip						
L1.	2.09E-08	-1.62E-07	-8.34E-10	-0.02359482	1.80E-08	-4.04E-11
L2.	-1.34E-08	6.75E-07	-7.06E-10	-0.0159534	-1.412e-07***	-4.16E-10
v_reer						
L1.	-0.13003569	8.9125909	-0.00266841	127696.87	.99500539***	0.00070723
L2.	0.09183546	-10.61329	0.00441498	-93765.683	-0.02086404	-0.00039075
v_inflation						
L1.	1.9277729	-680.48018	-0.65641008	13924279*	-10.125365**	.51588372***
L2.	-7.458928	242.07279	0.48930512	3700251.8	8.0173525*	-0.01482596
_cons	.00323623***	0.04698105	.00022716***	-1251.9097***	0.00027767	.00001934***

legend: * p<0.05; ** p<0.01; *** p<0.001

Source: Authors' estimate with monthly series taken from (RBI, 2021)

To check for causality in volatility of these series, the study has conducted VAR model. VAR model is included since the direction of dependency is not certain from the analysis till now. The initial assumption is that there should be a positive

correlation between the variables because macroeconomic volatility increases the uncertainty related to stocks returns which cause stock return more volatile. The conditional variances of all variables get effected by their own lagged values. From the estimated VAR model (Table 4.3) we find that past period's volatility affects presents periods volatility from each of the 7equations but only the equation where volatility of m3 treated as dependent variable is not a good fitted. In this case our result is consistent with the result we got in chapter 2. Here also macroeconomic volatility fails to explain financial volatility. The result shows that macro variables are not so good at explaining stock return volatility. One possible reason behind this can be that the conventional ARCH or GARCH model cannot differentiate between risks in good situation and bad situation. But in reality, the behaviour of risks depends on the respective situation. During the bad situation, the market volatility is high compared to the good situation. More elaborately, during the bad situation people are rushed to sell the shares as the returns are getting lower day by day and it would be riskier to hold the stocks leading to greater market volatility. In other words, the conventional ARCH or GARCH model fails to capture the leverage effect which may be a factor behind getting insignificant result. On other hand, a significant unidirectional causal relation has been found from stock return volatility to the volatility in the growth of IIP which once again establishes the strong causal effect of financial sector on real economy. This is because industrial growth is more volatile than the other variable i.e. industrial growth may have higher effect on stock return that any other variable. Bull phases in the stock market makes the investors much more optimistic about the future return leading to influx of investment which in turn raises the Aggregate Demand (AD) taking real economy to the inflationary situation. This result can be explained by stating the fact that a rise in stock prices

and hence an expected high return implies higher corporate sale and higher profit. This in turn indicates a high demand in the market and high industrial production and hence a strong IIP data as well. Also indicates a weak significant relation between inflation and stock return. The result reveals that the volatility on inflation rates is driven by the volatility in stock returns. In other words, if the stock market becomes more volatile, then there will be volatility in inflation rates too. And it further indicates the positive relation between stock return and inflation which is evident from the previous results. This result indicates that fluctuation in industrial growth and inflation is as a result of fluctuation of stock return. This way one can answer that why financial sector is the indicator of real sector. Or in other words one can answer that why BSE Sensex is the indicator of India's Economy.

4.4 Conclusions

The study examines the association between the variation that timely occurs between stock return and economic variables. The main focus of this study was to look at how the volatility of each series is related with each other over the study period. The secondary data has been employed to analyse the relationship by using EGARCH/ARCH to observe the volatility among the variables, and VAR model to analyse causal relationship between volatility in BSE Sensex return and volatility of major macro determinants. The study finds that in the long run leverage effect on financial market cannot play a dominating role over symmetric effect. But in case of change in growth of the money supply there is strong positive leverage effect i.e., positive innovation is more destabilizing and it also found that the volatility patterns of most of the concerned macroeconomic variables are somewhat same but that is different from the pattern followed by the BSE stock return. This study also analysed

the influence of volatility in macroeconomic factors upon volatility of stock market and showed the direction of relationship, as a result this study finds that volatility of some macroeconomic factors has relationship with variations in stock returns. Some macroeconomic factors give a deterministic role for future returns in stock market but some have no such effect. So macroeconomic volatility fails to predict financial volatility, which is consistent with the real-world scenario of India. In India due to the pandemic 2020 gives a sluggish macroeconomic condition where lockdown resulted in a 23.9 per cent contraction in GDP in Q1 in FY 2020-21, the S&P BSE SENSEX 2-Month Realized Volatility Index showed a sharp drop from 74.51 in April 7 2020 to 19.80 in June 30 2020. The study reveals that impact of volatility in return on growth of industrial production is time dependent. It is said the stock market is forward looking so an increase in volatility in return from stock may induce volatility in industrial growth later. Also there is no significant relation between Stock return volatility and exchange rate volatility which explains lack of transparency between markets. The negative innovation (news) has a greater impact on volatility than a positive innovation (news) due to the presence of the leverage effect. This specifies that the sign of the innovation has a notable influence on the volatility of returns. Bad news in the market would result in the volatility to rise more than that of good news. But interestingly this study concludes that the bad news in the Indian stock market does not increase volatility more than good news. Leverage effect is insignificant here in Sensex return. Hence symmetric volatility models turn out to be superior in this study as first period innovations equally affecting its own current period volatility. The presence of asymmetric volatility is most obvious during stock market crashes when a large dwindles in stock price are linked with a significance increase in market volatility (Wu.G, 2001). Past value of

stock return can affect its own volatility but macroeconomic variables fail to do so. The R^2 shows that percent of the variation in the stock return are totally explained by its own past period lag value, but not the real sector variables. Other lag values of bse return volatility is not affected by volatility of real sector variables. The reason is same as depicted in chapter 2 conclusion part that the in a large country like Indian stock market is not the only thing to be focused on by Krugman statement. So it's again also clear from this section that financial market volatility is not affected by real sector variables. Corradi, Distaso and Mele (2012) have discovered that industrial production and inflation are the main notable sources of market instability. And the authors have advised that a rigorous analysis of market volatility can't be performed using merely fundamentals. In this study volatility BSE return has significant effect on volatility of growth of industrial production and inflation. There is unilateral relationship between growth of industrial production which is equivalent to GDP and stock return volatility. Growth of industrial production affects market volatility, whereas market volatility does not alter GDP volatility. And the result is same for inflation. So volatility is present in both real sector and financial sector. The volatility in financial sector can influence the volatility in real sector highly. This means greater fluctuation in financial sector will result in greater fluctuation in real sector. This way one can answer that why financial sector is the indicator of real sector. But one should note that it is not vice versa. The volatility in real sector has no effect on volatility of financial sector.

Appendix of Chapter 4

Table- 4.1: 2nd order EGARCH model of Sensex return

ARCH family regression -- ARMA disturbances

Sample: 1991m2 - 2021m4 — Number of obs = 363
Distribution: Gaussian — Wald chi2(2) = 46.80
Log likelihood = 429.6491 — Prob > chi2 = 0.0000

SENSEX_RETURN	Coef.	OPG Std. Err.	z	P>|z|	[95% Conf.	Interval]
SENSEX_RETURN						
_cons	.0102572	.0042349	2.42	0.015	.0019569	.0185575
ARMA						
ar						
L2.	-.6941691	.2495963	-2.78	0.005	-1.183369	-.2049693
ma						
L2.	.7750282	.2159294	3.59	0.000	.3518144	1.198242
ARCH						
earch						
L2.	.2352952	.0601875	3.91	0.000	.1173298	.3532606
earch_a						
L2.	.2707348	.1138306	2.38	0.017	.047631	.4938387
egarch						
L2.	-.2986245	.2066959	-1.44	0.149	-.7037409	.1064919
_cons	-6.7358	1.07948	-6.24	0.000	-8.851542	-4.620058

Source: As for Table 2.1

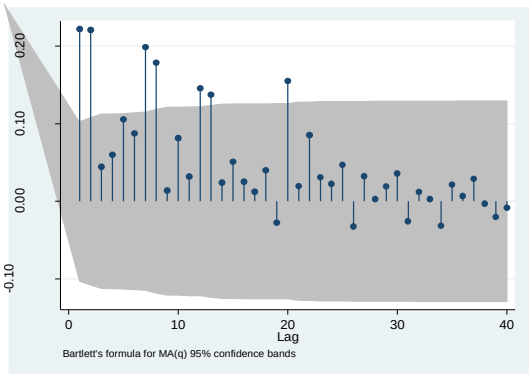
Table- 4.2: Volatility modelling of Sensex and macroeconomic factors

Variable	Sensex_Return	d.ln_call_money	d2.ln_M3	d.ln_IIP	ln_reer_tr	inflation
SENSEX_RETURN						
_cons	.00939787*					
ARCH						
arch						
L1.	.20037764***	.78441392***				
L2.	0.11707512					
garch						
L1.		.57540311***				
earch						
L1.			.68931272***	.15532882***	0.19587115	-0.10820168
L2.			0.04193961	-0.00134642		
earch_a						
L1.			0.27020379	.51068262***	1.1911375***	.49288313***
L2.			-.36511295*	.2770368***		
egarch						
L1.			0.44114649	-.19968359***	.74454183***	.44204745**
L2.			-0.03734654	-.91166899***		
_cons	.00399702***	.00030173***	-5.2074242*	-12.298848***	1.7183534*	-5.5991322***
ln_Call_mo~e						
_cons		-.01114891***				
ln_M3						
_cons			.00372855***			
ln_IIP						
_cons				.00770047***		
ln_REER_Tr						
_cons					4.6192191***	
Inflation						
_cons						.00463437***
Statistics						
N	363	354	350	320	328	362

legend: * p<0.05; ** p<0.01; *** p<0.001

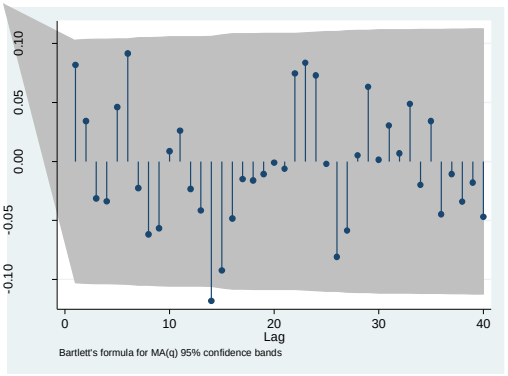
Source: Authors' estimate with monthly series taken from (RBI, 2021)

FIG: 4.1- Autocorrelation of square of Sensex Return Series.



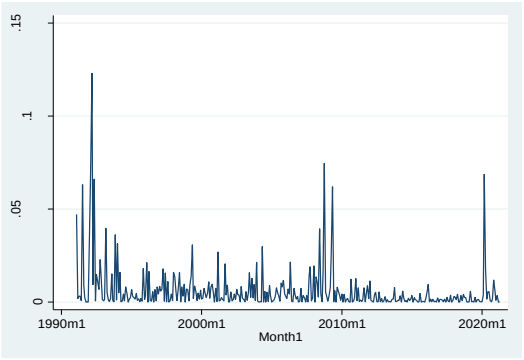
Source: BSE data collected in January, 2021

FIG:4.2- Autocorrelation of Sensex Return Series.



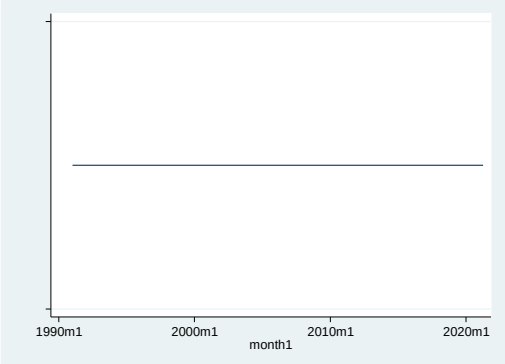
Source: BSE data collected in January, 2021

FIG :4.3 Trend of BSE square Return Series.



Source: BSE data collected in January, 2021

FIG: 4.4 Trend of Mean of Sensex return.



Source: BSE data collected in January,2021

CHAPTER 5: Summary and Conclusions

5.1. Introduction

Stock market, being one of the most versatile sectors in the financial system, plays an important role in the process of economic development. Indian capital market has undergone tremendous changes in terms of financial sector reforms since 1991, after the government has adopted liberalization and globalization polices. Today stock market has become a key driver of modern market based economy. In present analysis BSE Sensex is taken as the aggregative measure for the stock price movement of the top 10 companies : Reliance Industries Ltd.(market capitalisation 1228330.03), Tata Consultancy Services Ltd. (market capitalisation 1213371.12), HDFC Bank Ltd.(market capitalisation 807615.27), Infosys Ltd.(market capitalisation 572957.16), Hindustan Unilever Ltd.(market capitalisation 552592.14), Housing Development Finance Corp. Ltd. (market capitalisation 473801.61), ICICI Bank Ltd. (market capitalisation 374745.94), Kotak Mahindra Bank Ltd. (market capitalisation 369082.01), Bharti Airtel Ltd. (market capitalisation 328697.33), Bajaj Finance Limited(market capitalisation 294156.020), chosen according to their market capitalization in BSE. Stock prices are affected by supply and demand for securities. But the demand and supply of the securities, in turn, depend on several company specific factors like releasing new products, amounts of dividend that they pay, a change of management, earnings of the company, profits etc. When a company is doing well then everyone would want to buy the share of that company and like the usual demand-supply mechanism, stock prices would increase due to shortages and so returns. Most of the studies discussed so far are either focused on the company specific factors affecting the stock price of

different companies or the effect of sectoral indices on BSE but has yet to analyse the direct effect of the major companies on BSE. The present tries to fill this gap by analysing how the behaviour of top 10 companies listed in BSE on the basis of market capitalisation, affect market volatility by looking at whether the individual stock price behaviour of different companies and behaviour of Sensex are cointegrated or not by carrying out unit root test and co-integration. Under this analysis BSE Sensex has been taken as a function of stock price of different companies and analyse volatility of stock returns for individual companies and whether there is any long run association between them. It is well established in financial economics that apart from the fundamentals of firm, macroeconomic variables play significant role in determining stock return. According to the Arbitrage Price Theory (Ross, 1976) the random returns from a subset of assets depends on market factor return which can be represented by "GNP" factor. This provides a link between macro factors and stock price. Many empirical findings shows that stock price can be affected by macroeconomic variables. Fama(1981) works on the causes behind negative stock return-inflation relation in post 1953. It is evidence from the study that real stock returns are positively related to measure of real variable. The study concludes that this negative relation are somewhat resulted by unexpected characteristic of money supply in that period. Also the study of Schwert(1989) based on New York Stock Exchange concludes that financial volatility helped to predict future macroeconomic volatility. For this purpose the study analyses the behavioural pattern or trend behaviour for each of the selected macroeconomic series and after observing trend behaviour, to find out the nature of transmission of the shocks between stock return and Macroeconomic variables the study applied a vector auto regressive process. The selected macro variables for the

study are call money rate as a proxy for interest rate, M3(broad money supply), Real effective exchange rate in terms of trade (REER_Tr), Index of industrial production (IIP) and Whole sale price index (WPI) as a proxy for inflation rate. Monthly data of five macroeconomic variables has been taken such as exchange rate, inflation rate, money supply, Industrial growth and interest rate over the period of 1991-2020 in the context of India. For convenience, REER (Trade Based) is proxying for exchange rate; log difference of Wholesale Price Index (WPI) is taken the proxy for inflation rate; M3 for money supply; Call money rate fir interest rate and lastly Index of Industrial Production (IIP) for industrial growth. For the analysis this study uses vector autoregressive model to explore the relationship between stock market index and these macroeconomic variables. An efficient stock market always provides opportunity for savings and investments. A stock market not only transforms savings into investment by facilitating savers and borrowers but also helpful in reallocating funds in different sectors of the economy. It is basically a platform where many factors jointly work together to drive the wheel of the economy of any country. Now stock prices are volatile in nature. Volatility in stock prices is nothing but ups and downs in a stock price. The more the volatility the greater the risk associated. Investors always want to reduce the risk associated in particular asset, but sometimes high risk also yields high return and because of this analysing volatility estimation and forecasting has become very crucial for risk management. After the financial sector reform in India during 1991 due to larger volume of international flows into the country there was a lot of fluctuations. Volatility has appeared as one of the important issues. It will increase vulnerability to global shocks because now any crisis can be transmitted across the global markets. The purpose of this study is to analyse how the volatility in macroeconomic variables affect the volatility in stock

return. Macroeconomic volatility has emerged as a key issue in analysing the determinants of economic growth during this global crisis. There are several costs and consequences of macroeconomic volatility. Indeed under certain conditions the positive relationship between risk and capital return can explain a positive relationship between economic volatility and growth, according to many researchers this phenomenon has a negative impact on long-term growth and well-being. Over the long term, volatility results in a reduction in consumption levels, investment and factor productivity, bad institutional environment, unpredictability of economic policy. The developing countries are more affected by this because they are often subjected to more significant external shocks but are not able to absorb them easily due to inefficient conditions (Hnatkovska et al. 2005). All this emphasises the importance of measuring volatility in a developing country like India. Volatility is unavoidable and it is desirable up to a certain degree as without volatility superior returns can't be generated. Bubbles and crashes in the stock market lead to boom and recessionary situation in the real economy and thus affect National Income (NI). The purpose of this study is to analyse how the volatility in macroeconomic variables affect the volatility in stock return. The present study therefore tries to explore the causal relationship between volatility in BSE Sensex return and the volatility of previous mentioned major macro determinants.

5.2 Major Findings

Second chapter analyses the trending pattern of individual stock prices and depicts whether there exits any long run association between individual behaviours of top 10 companies trending pattern of BSE Sensex return. As per the findings this study incorporates by HEGY test that there exists long run unit root for all the companies

along with Sensex. The results suggest that unit root is present at seasonal frequency for some companies among selected top 10 companies and for Sensex. The reason behind this can be the share price changes if selling patterns of a company changes. Dividends and demand for share rely on this. There are some external and internal factors which affects to the system as shocks. There also some fundamental factors as determinants of stock price includes , the Earning per Share, Net Asset Value per Share and Price Earnings, while the technical factors are the Gross Domestic Product, Consumer Price Index and Interest Rate. Now by Johansen cointegration test this study finds that trending behaviour of companies is different. This can be a spurious result because of presence of seasonal unit root. The season can be all the top 10 companies are not belong to same sectors, so it should not be the case that all series are following each other trending pattern. Next by calculating the return series with VAR framework it can be shown that for some company's model is good fitted. There is no significant relationship between Sensex return and the major companies return. Demand sides are ignored in this study and this can be possible reason for this as investors are influenced more to buy a stock which has greater dividend. The possible reason behind this unexpected behaviour of return schedule may be the presence of structural break in system. Due to presence of seasonality in close price there may be exits spurious result as the returns are calculated from close price, which violates that efficient market hypothesis. Due to shift from state control economy to a market determined economy and after the economic reforms and great depression results fluctuations in the return series. Lack of capital inflows can also be the reason .The outbreak of coronavirus (COVID-19) can be one of the important factors which led to ups and downs in the return series. By applying the simple OLS regression model it can be find that except IL's return, the 9 major companies' return

influence the overall market return. This is done to see the impact of the return of 10 major companies on the Sensex return.

Next from chapter 3 the study finds that previous period call money rate influences its present period value negatively. According to kumar et.al, (2017) liquidity conditions, viz., deficit, distribution and uncertainty impact the call money rate spread adversely. Again exchange rate was found to contribute in the next period value of interest rate. The study also delineates that change in the growth of money supply can be affected by its own lag values. Although the change in industrial growth is positively related with change in the growth of money supply, the change in inflation rate negatively affects change in growth of money supply. In other words an increase in inflation rate provokes to control money supply. One popular method of controlling inflation is through a contractionary monetary policy. Reducing spending is important during inflation because it helps halt economic growth and, in turn, the rate of inflation.

Another significant result is the influence of SENSEX return on growth rate of IIP. There exists a uni-directional causal relation between the growth in IIP and Sensex return. Although the real sector is not affecting the financial sector, BSE stock return do have a positive influence of real sector of the economy. A rise in stock prices and hence an expected high return implies higher corporate sale and higher profit. This in turn indicates a high demand in the market and high industrial production and hence a strong IIP data as well. Another uni-directional causal linkage has been found in case of exchange rate and stock return. The present study has noticed that REER doesn't have any significant impact on stock return, but stock returns has caused exchange rate positively. A positive relationship between stock prices and exchange rates exists when local currency depreciates and local firms become more

competitive which leads to an increase in their exports. This will result in an ultimate increase in stock prices.

And lastly from chapter 4 this study finds that autocorrelation of return series is stationary but square return series follows AR process. This means that the conditional variance of the return is affected by past squared return terms of two periods which is the Autoregressive part. Fluctuations of return series are not uniform throughout the period. So, the volatility clustering can be observed in this time series representation of return. Result of Engle's Lagrange multiplier test after estimating a univariate regression with the constant term only shows the presence of ARCH effect for each of the stationary macroeconomic variable. As stock market works on speculation in bad situation it is expected that the risk parameter would increase. But here in this estimation the model fails to explain this behaviour. The findings shows that variance of call money rate follows GARCH, variance of money supply and variance of IIP follows EGARCH and variance of inflation and trade-based exchange rate follows EGARCH and finally variance of SENSEX return follows ARCH. Study finds that in case of M3 leverage effect is present. But past period's volatility has no impact on present period's volatility. For growth rate of IIP there also any positive shocks affect the growth more than any negative shock. For REER trade based and inflation we find that the leverage coefficient is not significant. From VAR model we find that past period's volatility affects presents periods volatility but in case of volatility of M3 where it is treated as dependent variable is not a good fitted. One possible reason behind it can be that the conventional ARCH or GARCH model fails to capture the leverage effect. Study indicates a significant unidirectional causal relation from stock return volatility to the volatility in the growth of IIP, the reason may be because industrial growth may have

higher effect on stock return that any other variable and also a weak significant relationship has found between inflation and stock return. The result implies that the volatility on inflation rates is driven by the volatility in stock returns. The above results once again establish the strong causal effect of financial sector on real economy.

5.3 Overall Inferences

The motivations of this study are to look into the trending pattern of Sensex along with top 10 major companies selected on the basis of market capitalization; to examine the relation between the financial sector and real sector; and finally, to analyse the pattern of volatility of stock return schedules, using monthly time series data in Indian context during the period of post liberalisation and incorporating the seasonal behaviour in to the time series analysis for monthly data.

The study observes that BSE SENSEX close price exhibit persistent stochastic behaviour at 2.4 months and 4 months cycles during a year. Along with close price of BSE the major companies also show presence of stochastic trend at seasonal frequency. Presence of seasonality reflects the series has intra – year movement due to changes in seasonal factors. Seasonality may occur due to different selling pattern of different companies. Selling patterns may change depending on the seasonal demand for products of respective companies. Again a company may also enjoy higher profit due to increase in seasonal demand and as a result it can provide higher dividend which may also regulate the selling pattern of that company by increasing the demand for that company's share. Institutional factors like management system of different companies to improve their functioning and to exist in the growing

competitive market may also be responsible for seasonality. Another reason for non-stationarity may be the presence of structural break in the system. As the study period is quite a long, there may be structural break present in the seasonal time series and in that case the HEGY test approach of testing the seasonal unit root is biased towards non-rejection of unit root null. The study also finds that the trending pattern of the 10 major companies is different. Like Tata Consultancy Services Ltd., Infosys Ltd etc are the representative of multinational Information Technology (IT) firms, while Hindustan Unilever Ltd belongs to consumer goods industry, Reliance Industries Ltd is representative of energy sector and ICICI Bank Ltd, Kotak Mahindra Bank Ltd etc are representative of banking sector. So the trending patterns are likely to be different and this can also imply lower covariances between them, meaning any bad news for one of the company may not have a negative impact on others. Thus lesser risk through diversification is possible as stated by Markowitz (1952). Again there are some factors which cannot be observed as a result are not incorporated in the analysis but can impact the stock market. For example if a new government comes into power, political unrest in the economy, war situation, border tension, breakdown of the government, demonetization all of these can be probable reason for persistent behaviour of SENSEX. Another set of important factors are Macroeconomic policies, investor's incentive and perception regarding the market and several industry specific factors. Higher investments are associated with fiscal incentives and tax incentives. They are used to exploit investment opportunities. Behavioural factors like investor perceptions are another important factor driving individual stock price because the investors are the participants of the stock markets and they are humans, led by emotions and attitudes. Incentives strengthen investor confidence in the stock exchange and foster investor participation (IOSCO,

2002). As a result differences in trending pattern of stock price can be observed as a result of investors incentive, as trading stock were driven by investors incentive. This study also observes that the stock return series exhibits no unit root at zero frequency suggesting that the series has no pure trend. This is consistent with the market efficiency hypothesis. The empirical analysis also suggests that the stock return of 10 major players selected on the basis of their market capitalisation on BSE has no significant impact on BSE return. One possible reason can be simply that the major companies selected for our analysis are ranked as top 10 during the period of our estimation that is 2019 but as stock prices vary over time and have fluctuations, the market capitalisation of these companies is likely to change and so their rank in BSE. Again as this study mainly deals with the supply side issues, the other demand side factors determining stock returns that are several industry specific factors are ignored. Companies' profit, goodwill, dividend these can lead to a change in stock price of a company; dividend, earnings per stock, return on equity , net profit , book value of stocks, number of stock outstanding positively impacts stock prices and retention ratio has a negative effect on stock prices.

In order to examine the relation between return from the financial assets and growth in real sector variables the conventional unrestricted Vector Autoregression Model is used. The findings suggest there is no bilateral relationship between the growth rates of macroeconomic variables and BSE Sensex. In other words, macroeconomic variables fail to explain the changes in return but the return series has a positive impact on the growth rate of macroeconomic variables except for money supply and interest rate. In developing country like India the real sector variables have no impact on Sensex return which is one major representative of financial sector. Indian stock market behaves like a Casino where financial events

are not associated with real economic growth (Azarmi et al., 2005). Even in the present scenario of India in the situation of slow-down of the economy from 2018-19 due to pandemic and other economic issues India's market capitalisation hits $3 trillion where the last $1 trillion is achieved within the period of 2017-2021(Mascarenhas, 2021). Stock return has a significantly positive impact on industrial growth, but this causal relation is not true from the opposite way round. As stock market offers unexpected high gains compared to the returns from other alternatives such as bank deposits, deposits in post office etc, domestic investors are much more interested to invest in stocks either directly or through mutual funds. As a result, demand for stocks rises and so the stock returns which in turn sets a virtuous circle in motion augmenting economic growth. Bubble and crashes in stock market instigate boom and recessionary situation in the real sector (Ahmed, 2008). Study also finds that stock return has positive influence on exchange rate and inflation rate. In case of India, increasing stock return attract foreign investment and as there is inflow of FDI which increases the demand for the home currency i.e. INR so the exchange rate increases. Two period lag value of stock return has a significant positive impact on inflation. As the return from stock increases there will be more investment accumulated in real sector by financial market so there will be more innovation and betterment of goods and services in real economy which will lead to more inflation by increasing the price level. According to Krugman stock market is about one piece of the economy-corporate profits. So there is no influence of macroeconomic factors on stock market return. The stock market is often viewed as a rational indicator of the economy and it is believed to be closely linked to the real economy. But the nature of the stock market and economy is different. Stock market

is forward looking but economic indicators are backward looking. Stock market is constantly soaring when the economy is actually going down.

Lastly the analysis of the volatility of each of the series suggests that in the long run leverage effect on financial market cannot play a dominating role over symmetric effect whereas for change in growth of the money supply strong positive leverage effects exist. Additionally the outcome showed that the volatility patterns of most of the concerned macroeconomic variables are somewhat same but that is different from the pattern followed by the BSE stock return. The study concludes some of these macroeconomic factors play a deterministic role for future returns in stock market and some do not. Hence macroeconomic volatility fails to predict financial volatility and that is consistent with the real-world scenario specially, for India. Due to the pandemic 2020 India faced a sluggish macroeconomic condition where lockdown resulted in a 23.9 per cent contraction in GDP in Q1 in FY 2020-21, the S&P BSE SENSEX 2-Month Realized Volatility Index showed a sharp drop from 74.51 in April 7 2020 to 19.80 in June 30 2020. The study also reveals that impact of volatility in return on growth of industrial production is time dependent, since; stock market is forward looking so an increase in volatility in return from stock may induce future volatility in industrial growth. No significant relation between Stock return volatility and exchange rate volatility was observed, which explains lack of transparency between markets. For the presence of the leverage effect negative news has a greater impact on volatility than positive news. Bad news in the market would result in the volatility to rise more than that of good news. To a contrary, this study concludes that the bad news in the Indian stock market does not increase volatility more than good news. Leverage effect is insignificant in sensex return. Hence symmetric volatility models turn out to be superior in this study as first period

innovations equally affects its own current period volatility. The presence of asymmetric volatility is most obvious during stock market crashes when a large dwindles in stock price are linked with a significance increase in market volatility (Wu.G, 2001). Past value of stock return can affect its own volatility but macroeconomic variables fail to do so. Corradi, Distaso and Mele (2012) have discovered that industrial production and inflation are the main notable sources of market instability and advised that a rigorous analysis of market volatility can't be performed using merely fundamentals. In this study volatility BSE return has significant effect on volatility of growth of industrial production and inflation. There is unilateral relationship between growth of industrial production which is equivalent to GDP and stock return volatility. Growth of industrial production affects market volatility, but converse does not hold. This is true for inflation as well.

Finally the study concludes that volatility is present in both real sector and financial sector. The volatility in financial sector can influence the volatility in real sector highly. This implies greater fluctuation in financial sector will result in greater fluctuation in real sector. This can be the reason for financial sector being the indicator of real sector. But one should note that this is not a both-way relation. The volatility in real sector has no effect on volatility of financial sector.

5.4 Policy Implications

The study finds no bilateral relation between the growth rates of macro determinants and BSE Sensex return. The causal relationship between the volatility of financial and real sector is also uni-directional in the sense that the direction of causal pattern is from the volatility in the financial sector towards that in the real sector. The concerning macro variables cannot explain the movement in BSE Sensex. In other words, the real sector cannot influence growth in financial sector. The recent scenario also supports this result. Even though having a sluggish growth rates, India has experienced a surging market capitalization that crossed $3 trillion in the end of

May 2021, out of which the last $1 trillion is achieved within last 4 years. This also emphasizes the fact that unlike the developed nations, the linkage between real sectors to financial sector is not strong due to the less transparency in the stock market. But Sensex return has significant impact on macro variables except for interest rate and money supply. Most importantly, Sensex return has a positive effect on the growth rates of Industrial Production. Actually stock market is forward looking while economic indicators are backward looking. Stock market is constantly roaring while the economy has been shrinking. So policies should be designed in such a way that in developing countries like India the market can become as transparent as it can so that it reflects the real economic situation, which in turn resulted in less occurrence of a market crash taking care of the fact that positive influence of the stock market can instigate real economic prosperity as we know that higher investment calls for higher economic growth. Development in the stock market can bolster our real economy by boosting industrial growth which can be also found in a developed country (Fama, 1981). The increase in stock return indicates a financial boom it also increases industrial growth as well as inflation. The study finds strong evidence that volatility in stock return has significant effects on volatility of industrial production growth as found in the U.S. economy during 1950s (Schwert, 1989) but the relationship is not true in the other way round. The results show that the past values of stock return (2nd period lag value) can augment inflationary situation. So while designing policies, it should taken into the consideration that stock market development may also cause inflationary situation in the country.

Apart from considering the effect of macro variables the study has also considered the impact of top 10 major companies on stock return. The close price series of BSE Sensex along with the top 10 major companies selected on the basis of market capitalization of 2019 have unit roots at long run as well as at seasonal frequencies. Except TCS and BAL, all the return series are conventionally stationary. Having unit root at seasonal frequencies can explain the various seasonal and institutional factors affecting the system. VAR analysis has suggested that any of these companies do not have any significant effect on the behaviour of BSE Sensex. It may be due to that the companies are selected considering a single year's market capitalization. And in this regard to get a more robust result one can consider the relevant companies for the

relevant years. The study has more focused on the seasonal trend of individual company series. But the demand side factors which are responsible for seasonality like price to earnings ratio, book value ratio, profits etc has been ignored while explaining the return. The study only considers the macro variables that can be related to stock return but it does not consider the cause behind the fluctuation in stock return. Though the study emphasizes the pattern of seasonality in this context it avoids the reason behinds the seasonality as well as volatility in stock return i.e. dividends, company size, price to earnings ratio, etc. And in this way, it opens up the scope for future study by incorporating the demand side factors to explain the Sensex return.

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