Correlation and Causality between Stock Market and Macro Economic Variables in India: An Empirical Study

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To

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CERTIFICATE

I hereby certify that the work which is being presented in this thesis entitled **"Correlation and Causality between Stock Market and Macro Economic Variables in India: An Empirical Study"** in partial fulfillment of the requirements for award of the Degree of Masters of Philosophy in Economics, submitted in School of Management and Social Sciences, Thapar University, Patiala, is an authentic record of my own work carried out under the supervision of Mr. Naresh Chandra Sahu, Lecturer, School of Management and Social Sciences.

The matter presented in this thesis has not been submitted for the award of any degree of this or any other University.

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This is to certify that the above statement made by the candidate is correct to the best of my knowledge.

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"You have to Grow,
From the inside out,
None can teach you,
None can make you spiritual,
There is no other teacher,
But your own soul."

- Swami Vivekananda

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Deepinder Kaur

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ABBREVIATIONS

ADF	Augmented Dickey Fuller
BSE	Bombay Stock Exchange
EMH	Efficient Market Hypothesis
Forex	Foreign Exchange
GDCF	Gross Domestic Capital Formation
GDP	Gross Domestic Product
GDCF	Gross Domestic Capital Formation
GNP	Gross National Product
IMF	International Monetary Fund
IPO	Initial Public Offering
M3	Broad money / Money supply
PP	Phillips-Perron
RBI	Reserve Bank of India
SENSEX	Sensitive Index
WPI	Wholesale Price Index

ABSTRACT

The unusual rise and fall in of Bombay Stock Exchange (BSE) Sensitive Index (SENSEX) has received a lot of media attention over last couple of decades in India. Even some policy analyst has designated it as an "indicator" of India's inevitable growth and development. In this research thesis, attempt has been made to explore the relation especially the causal relation between BSE SENSEX and some macro economic variables by using correlation, descriptive statistics, unit root stationarity tests and Granger causality. Annual data has been used from 1950 to 2006 for all the variables, like, SENSEX, per capita gross national product (GNP), forex reserves, gross domestic product (GDP), bank rate, wholesale price index (WPI), gross domestic capital formation, domestic savings, broad money. Sophisticated econometric techniques like unit root tests have been done to check out the stationarity and finally Granger causality has been applied to study the causal relationship between them and results that have come out are mixed, i.e., there is do a causal relationship but unilateral which directs from SENSEX to some macro economic variables. The perusal of all the derived results in this research nullifies the notion of SENSEX being an "indicator" of the financial health of India.

CHAPTER – 1
INTRODUCTION

1.0 Introduction

"Even apart from the instability due to speculation, there is instability due to the characteristic of human nature that a large proportion of our positive activities depend on spontaneous optimism. . . . . Most probably of our decisions to do something positive . . . . . .can only be taken as a result of ***"animal spirits"****- of a spontaneous urge to action rather than inaction, and not as a outcome of a weighted average of qualitative benefits multiplied by quantitative probabilities."*

- J.M. Keynes ("The General Theory of Employment, Interest and Money").

This extract from Keynes' (1936) book explains the behavior followed generally by people while making investments, especially in the capital market. They are taken away usually by their "animal spirits" and "herd mentality". People work and invest on the basis of their "instinct" which is by and large formed by the economic and social and political environment around them. Hence one can't even rule out the role of the economic activities and information fed to the market completely. In the case of India undertaken here, this tendency of "animal spirits" is very much prominent, as first of all just about 2% of the total population participates in these markets and secondly, market awareness and accurate information are less available which is in a way an inducement for people to act as per there instincts and not rationally. Also as mentioned earlier regarding the importance of interrelation of macro economy and the stock markets which is also the central theme of this research, has gained a lot of gravity in the recent past mainly because of the roller-coaster ride of the SENSEX which according to some people in academia is not much supported by the economic fundamentals. Some

works have also been done which explain the role of these fundamentals in determining the stock prices. Amongst this line of thought, fundamentalists' approach is theory of Efficient Market Hypothesis (EMH) which has been put forward by Fama (1971) who further categorizes these markets on the basis of their reaction to the information fed to them in weak, semi-strong, or strong form of markets. But the Popular Model Theory shares a different view point altogether, it is nothing but the qualitative explanation of price which suggests that people act incongruously to the information that they receive and freely available information is not necessarily already incorporated into a stock price as EMH attests, which we can say is quite similar to Keynes view point. So a status quo has to be maintained before getting into this branch of research.

Finance (money) is the buzzword all around the world. It is the one which makes the wheel of this economy turn full circle as each and every economic activity that is being performed has money at its core. In ancient times barter system was there and to evade its complexities 'money'-unit of account was brought into existence and since then it has become the most legendary object in this world. Each and every individual needs it to establish and flourish its business. And the prime most source of this money in today's post liberalization era is stock markets. Even a common man today can evidently and very firmly admit the emergence and popularization of the stock markets in the era of Liberalization-Privatization-Globalization. It is regarded as a souvenir of the globalization era to the developing economies to expand and strengthen their fundamentals as their financial crunch problem is catered to a great extent by these capital markets. It is regarded as a lucrative place for companies to arrange for financing their upcoming ventures and also for individuals as an investment opportunity with although riskier but higher returns. The existence of such a market is a vital condition of the provision of finance on the scale needed in a modern mixed economy, since it provides a secondary market in which ownership of claims

created in raising of finance can be transferred. The existence of this facility encourages the holding of such claims created in the raising of finance can be transferred. The existence of this facility encourages the holding of such claims, and hence the provision of financial capital. Its importance and need thus could be called inevitable.

1.1 Current Scenario

"Thus if the 'animal spirits' are dimmed and the spontaneous optimism falters, leaving us to depend on nothing but a mathematical expectation, enterprise will fade and die;-though fears of loss may have basis no more reasonable than hopes of profit had before. . . . . But individual initiative will be adequate only when reasonable calculation is supplemented and supported by animal spirits. . . . . " *– Keynes (1936).*

Here Keynes (1936) has very accurately and audaciously defined the possible causes behind the current scenario and that the world is facing today way back in 1936 only in one of his pioneer works. It is admitted by the economists also in a very hushed manner that it is not that the real value of our output has gone down but just the "animal spirits" have been dimmed and our expectations that stock markets are overvalued compared to the historic period and consider further rise in real value unlikely. And any economy needs these "animal spirits" or the optimistic attitude along with the calculated risks and investments to come out and excel and progress.

In India, since independence the socialistic pattern of development was followed but in early 1990s due to the financial crunch that India faced, it had to afterwards follow on a strict economic reform package as dictated by World Bank. One of the important components of this package was financial liberalization. This financial liberalization paved a new way of growth and development and volatile atmosphere to the Indian economy especially in terms of BSE SENSEX which is

credited as one of the main indicators of India's financial health. Today stock market has been one of the prime most sources for mobilizing household savings into upcoming productive ventures and lends a helping hand in the country's development.

In India, only about 2% people are involved in these markets directly but it is 100% of all of them who get affected directly or indirectly if something happens in these markets, which in itself shows a strong correlation between these stock markets and real economy not just on the surface level but also deep inside at the core level. Even one can find newspapers today full of stock market news but despite the skepticism about the newspaper accounts of financial market behavior among academics, there seems to be little doubt that the release of macro economic news has a significant impact on prices of stocks. In the current scenario, it was pretty evident that it was stock markets world wide which crashed and now with a gap of a few months real economic fundamentals have started falling apart and ultimately all this led to recession. As a result, it even increases the importance of this research as the origin of this recession is believed to be stock markets and manipulation through it and if we go the other way round a country can even make its real economic fundamentals strong with the help of the stock market. Therefore one can clearly state that stock prices are forward looking and could form a class of potentially useful predictors of future values of macroeconomic indicators like output growth and inflation. Adding on to this thought two very important questions that usually go un-answered are that then what could be the possible reasons behind hyper boom in the market and integration of stock market with other markets.

Likely answer to the first one is that the information boom that has thronged the market, for example, business news channels. Also the IT revolution which had the advantage of lack of skilled manpower in US and made the most out of it and also became most sought after stocks due to their enormous dollar earning power

and the internet myth which gave whims and fancies to the stock market and danced to the NASDAQ tunes, feedback effect which is somewhat based on EMH and any rise (fall) leads to further rise (fall) of stock prices and leads to volatility in the stock prices, cultural changes also added to all this as people were carried away by the recent boom and many invested on the basis of the 'herd mentality', etc.

Next question that needs to be answered is about the interlinkage of these stock markets with the real economy. A few theories have also been put forward by various economists who talk about this interlinkage. The relationship between stock prices and real consumption expenditures, for instance is based on the life cycle theory, developed by Ando and Modigliani (1963), which states that individuals base their consumption decisions on their expected life time wealth, part of which might be held in stocks linking to stock price changes to changes in consumption expenditure. Similarly, the relationship between stock prices and investment spending is based on the q theory by James Tobin (1969), where q is ratio of total market value of firms to the replacement cost of their existing capital stock at current stock prices. Along with these theories EMH theories we have already discussed.

But none of these theories fit into the current scenario of stock markets perfectly and thus much work academically has yet to be done to understand their working in a better manner and the following lines convey it in an enhanced manner.

"We should not conclude from this that everything depends on the waves of irrational psychology. On the contrary, the state of long-term expectation is often steady, and, even when it is not, the other factors exert their compensating effects. We are merely reminding ourselves that human decisions affecting the future, whether personal or political or economic, can't depend on strict mathematical expectation, since the basis for making such calculation does not exist, and that it is not innate urge to activity which makes the wheels go round, our rational selves

choosing between the alternatives as best we are able, calculating where we can, but often falling back for our motive on whim or sentiment or chance."

- Keynes (1936).

The debate on the relation between stock market and macro economy is yet to be addressed properly and a consensus has to be reached by the intellectuals of the economics. In this study, an attempt has been made to

1.2 Chapterisation

The whole thesis has been classified in five chapters and an important notification is that the log values have been taken of all the variables in the study. In the introduction whole overview of the chapter has been explained along with the current situation. In the second chapter the existing literature pertaining to our study has been thoroughly reviewed. Third chapter outlines the set of objectives and data and methodology followed in this research thesis. In chapter four, estimation and result analysis have been discussed in the light of the objectives of the study. Chapter five illustrates the conclusion, policy implications and limitations of this research attempt.

CHAPTER - 2

LITERATURE REVIEW

2.0 Introduction

Finance is the buzz word all around the world. It is the one which makes the business go around and all aspects of the economy start and end at it. In today's competitive world the easiest way to accumulate wealth for new upcoming and promising ventures is to go public or turn towards masses through stock markets where small savings of these people can make miracles by investing wisely in reliable businesses and help managements of these companies to make them biggest companies in the world. In India, only about 2% of the total population is involved in these markets but it is 100% of the population which gets affected directly or indirectly if something happens in these markets, which in itself shows a strong correlation between Stock Markets and Real Economy not just on the surface level but deep inside also they are interlinked. Many studies have been done in this direction but results are usually ambiguous as many have found a strong bilateral relation between the two but on the other hand many studies have completely discarded this hypothesis that these markets are correlated.

We can divide various studies in three schools of thought on the basis of our literature review: one school of thought stands on the belief that there is no correlation between stock market and macro economic variables; another propounds a different theory altogether that there exists a significant causal relation between the two; and the third one provides with an ambiguous result that there do exists a relation but not certainly in both short and long run.

In this study, some existing literature has been reviewed pertaining to the above mentioned issues. The over all findings of different scholars related to these issues are discussed briefly below.

2.1 First School of Thought

Chowhan, P.K. et al. (2000) have tried to fetch reasons for turbulence in stock market in the short run in India taking into account SENSEX as the main index. As recently from 1998-2000 markets have shown extremely erratic movements, which are in no way tandem with the information that was fed to them. Stock price fluctuations were very wide and investor optimism had led to chaos in the markets. They have explained that what could be the possible reasons behind this volatility and how it can't be explained even with Efficient Market Hypothesis (EMH) put forward by Fama. They have tried to find that how SENSEX which stood at 2761 on 21st of October 1998 rose to 6000 in February 2000, i.e., 117% increment in just 15 months, which is not at all strongly supported by fundamental economic factors in these years as Indian economy grew by just 5.9% in 1999-2000, although corporate profits have increased by 32% for the year, and overall growth rate of industrial production in April-December 1999 was 6.2%, and also there was fall in inflation rate in 1999 and 2000 which had fallen to 2.9% from the peak 8.8% in September 1998. Exports for this period had also increased in dollar terms by 12.9% and imports increased by 9% in April-December 1999. As per the results of this paper, even long run economic factors don’t support such a spike in stock prices. A look at the gross domestic savings also did not show any dramatic increase in the last few years. Such a trend was noted not just in Indian stock markets but word wide. And possible reasons that they have found for the hyper boom in the markets are: (i) Information Boom; (ii) IT Revolution; (iii) Internet myth; (iv) Feedback effect; (v) Cultural changes. In addition these various stock market regulations like Dematerialization and Rolling Statement are equally responsible for the same.

Another study conducted by Sarkar, P. (2007) has examined that if any meaningful relation between growth and capital accumulation exists in case of India. They have used annual data on various variables like nominal and real share price, share market turnover ratio, number of listed firms in the stock market, fixed capital formation and growth of real GDP and industrial output. But all tell the same story that no positive relationship exists between real and stock market variables either in short run or long run during 1950-51 to 2005. Sarkar (2007) has also individually studied the trends over the period of time in all the said variables and found that most variables became volatile and had usually an upswing trend during and after mid 1970s.

The methodology that they have applied in this paper is Unit Root tests for the series to attain stationarity so that meaningful regression analysis can be carried forward. In addition, OLS and MLE are also used for ascertaining the order of autocorrelation of the residuals and tackling with it. All this along with ECM is used to estimate a long term relationship, if any, and Autoregressive Distributed Lag (ADRL) technique for the short run estimate.

A Yale University economist Shiller, R. (1990), had studied and compared the Standard & Poor Composite Stock Price Index from 1871 to January 2000 with the corresponding series of real S&P Composite earnings for the same years and found that stock price volatility is not matched by the earnings.

2.2 Second School of Thought

In an attempt by Black (2001), by using 54year quarterly data and a VAR model underpinned by a theoretical framework describing the relationship between U.S. stock prices and macro economic variables. It analyses the extent to which US stock prices deviate from economy wide fundamentals. Focusing on real output and using a present value approach, he has derived the fundamental price-output ratio and the fundamental stock price under various assumptions regarding the

time-variability of returns, and to compare these to actual data. Black (2001) considered three cases; starting by assuming that the return required by the wealth holders is constant and then relax this assumption by first, allowing the risk-free rate to vary over time and second the risk premium to be time varying, with time varying risk model producing a series for fundamental prices which is closest to actual. Despite the differences between models results, all imply that since 1996 the stock market has been relatively overvalued compared to its value warranted by the expected growth rates. In US, the ratio of stock market capitalization to GDP has tripled in last 25years, out of which less than 30% is contributed in the mid 1970s to over 80% in the late 1990s. It's not just that stock market has grown since 1990s but its inter-relation with the real economy also has seemed to become stronger and thus widely acknowledged. In literature, stock market has been related by real economic variables by various approaches, one of which is asset pricing perspective in which Arbitrage Pricing Theory is used as framework to study the effects of macro economic events on stock prices addressing the query that whether risk associated with some macro economic variables is reflected in expected asset returns. There is also consumption – CAPM analysis of consumption which concentrates on a single macro variable influence. Also many studies have been done to study the nature of relationship between stock prices and investment inquiring if stock prices are just a veil over the real part of the economy which can be dispensed with or do they have any significance.

More recently, many studies have come up studying the bilateral relationship between stock prices and macro economic variables using VAR models as the framework, without any specific theoretical structure.

Kanakaraj, A. et al. (2008) have examined the trend of stock prices and various macro economic variables between the time periods 1997-2007. They have tried to explore upon and answer that if the recent stock market boom can be explained in the terms of macro economic fundamentals and have concluded by recommending

a strong relationship between the two. As in the years under consideration in the study Indian stock market and macro economy on the whole is in boom phase, although many consider it a market bubble. The market capitalization in the stock market was 95% in March 2007, which is a clear evidence of strong positive attitude amongst the investors and a thriving business environment. Along with this the risk in the stock market have fallen and real returns have shown a positive upward trend mainly since July 2003 onwards, added to it are 30.5% growth in IPOs in the year 2006. This was the stock market part of the story, although real economy part also tells a similar tale. The GDP growth in India has grown consistently at high levels touching the highest average from 2003-04 to 2006-07 since Independence, and is strongly backed by manufacturing sector growth and services sector growth. Gross Domestic Investment and Gross Domestic Saving as percentage of GDP have also grown enormously with inflation remaining under control most of the time. Due to all this there was robust growth in India's external sector with Forex Reserves increasing steadily but sumptuously over the years. The authors with the help of EMH and other econometric tools have justified the role of macro economic fundamentals in the formation of stock prices and have concluded that Indian economy is undergoing semi-strong form of EMH. The authors have found a similar line of trend followed by the business cycle and the stock market. They have used a simple and restricted regression model to find out the relation between the real economic variables and the one time period lagged stock market growth, inflation, interest rate and bond return. In addition, standard control variables such as interest rate, inflation, bond return have been used. They have concluded that stock market can be called a leading indicator of an economy mainly because of its predictive capacity of real economic growth components.

They have shown that investors' rational expectations in the stock market predict real GDP. Further, the sector wise analysis shows that the stock market is a significant predictor of manufacturing sector growth, services sector growth,

investment growth and index of industrial production and IIP manufacturing. Regarding the control variables, inflation being one of them, the authors have observed that it does not influence the real macro economic growth variables significantly; and another control variable- bond return or cost of capital in terms of 5-year Government Bond shows a negative correlation with the real GDP growth and other many macro economic variables. Thus concluding that expectation about future macro economic growth is significantly explained through rising stock market returns.

In a very unique study of its own kind, Bulmash (2003) has explained the interaction of business investments and stock market and tried to show that how business investment reacts sooner than consumers in stock markets. Bulmash (2001, 2002) in his previous studies has shown that how due to difference in returns in the capital markets in various economies lead to migration of capital from one economy to another and ultimately convergence in these returns bring the capital into alignment in the long run. Thus proving that how these capital markets are predictors of the future cash flows in the economy but also affecting it in an effectual manner. It has been shown the interactive relation between stock markets and real economy through the mechanism that value of stock market will increase when:

*Companies raise more capital to increase their operations hence increase in GDP will be there.

*Due to increase in value of stocks and thus “financial wealth”, real wealth also increases as consumers increase their spending thus pushing up GDP.

*These factors will bring “value creation” which ultimately trickles down from stock market to real market, etc.

The data that the author has used for this study is monthly data about Wilshire 5000, from its initiation in December 1970 to December 1999 obtained from

Wilshire Corporation. Also daily market price information of SP500 index was obtained from CRSP tapes from Chicago based daily and used to calculate daily returns and volatility which was later on aggregated into monthly returns. Interest rates on BAA rated corporate bonds, 6 months T-bills, 30 year T-bonds, GDP and national income data was obtained from Federal Reserve monthly bulletins. Over 80 regressions were performed, using Auto-Regressive models. This paper thus basically concluded a strong correlation between stock market and the economy. It indicates that the delayed GDP wealth effect is about 2.5 cents in GDP for every dollar gained in previous stock market wealth. It also shows that consumers do increase their spending when their stock markets gains were sustainable and for longer the period these gains go on, the keener they were to view them as permanent gain in their wealth. Hence the author has presented the role of stock market's strength and weakness in Business sector investments.

2.3 Third School of Thought

Mustafa, K et al. (2007) have done a study to investigate the empirical relationship between the stock market and real economy in Pakistan economy by taking up various variables like per capita GDP, output growth to represent the Real economy and stock market liquidity, size of stock market representing the Stock Market. Cointegration and Error Correction Model Technique has been adopted to establish the empirical relation, if any between the two from the time period 1980-2004.

The estimated results indicate that stock market movements explain the per capita GDP and output growth in Pakistan in short run only, whereas economic growth variables explain stock market variables both in short run as well as long run which implies that the growth of stock market depends on the overall growth of the economy in Pakistan. High booms in Karachi Stock Exchange didn't reflect in real economy in Pakistan which indicates that the high volatility is not anomalous of the emerging markets. All other previous studies done on the subject have taken

stock prices as stock market activity indicator and consumption, inflation, industrial production, money supply, rate of interest as macro economic variables. This study is different from others as it has taken different variables. In their conclusion, they have also mentioned that their empirical findings infer that the stock market in Pakistan needs to develop further to play its due role in the economy in line with other financial institutions. Thus economic growth do helps and plays a pivotal role for the development of the stock market of the country, but stock market is passive in the development of a country until it is in its developing phase.

Husain, F. (2006) has examined the causal relationship between stock price and real sector variables of Pakistan economy, using annual data from 1959-60 to 2004-05. It has divided the data into two halves- pre and post liberalization and has studied the causal relationship between them using various econometric techniques like ECM, Engle-Granger co integrating regressions and Augmented Dickey Fuller (ADF) Unit Root tests. In all the cases lag lengths are decided on the basis of Minimum Final Prediction Error and Akaike Information Criteria (AIC). By using this data set and methodology, this analysis has indicated the presence of a long run relationship between the stock prices and real sector variables. Regarding the causal part, he has found unilateral causation from real sector to stock prices. This implies that stock exchanges in Pakistan are still not that developed to influence the real sector of the economy and also can't be taken as leading indicator of the economic activity. It implies that Government can use real sector variable to influence the stock market.

Nath, G.C., et al. (2004) in their paper examine the extent of integration between Foreign Exchange and Stock market in India during the liberalization era. The scholars have tried to find out whether any relation is there between the two based on "goods market approach" (Dornbusch and Fischer, 1980) and "portfolio balance approach" taking into account 10 year daily database on stock price index

and exchange rate of Indian Rupee. They have applied different econometric tests like Granger's causality test in VAR framework, in which they have used F-Test to test this hypothesis; and to test these series for stationarity, ADF Unit Root Test is applied. Another econometric technique used by them is Gweke's Measures for the extent of market integration. The results that they have derived from these techniques differ a lot. As per the former test it reveals the sign mild-to-strong causal relationship between returns in foreign exchange and capital markets during the study period. Whereas as per the latter test, there is a high degree of integration between the two and there is even bi-directional as well as contemporaneous causal relationship between them.

Humpe, A., et al. (2009) have tried to relate the macro economic variables with long term stock market movements in US and Japan within the framework of a standard discounted value model by using monthly data over 40years. A cointegration analysis has been applied to model the long term relationship between the industrial production, the consumer price index, money supply, long term interest rates and stock prices in US and Japan. Various techniques like Arbitrage Pricing Theory (APT), Present Value Model (PVM), and Granger (1986) and Engle Granger (1987) methods have been discussed in this study to relate the said variables. Further, the authors have used PVM and Cointegration methodology to find out if the same model can explain US and Japanese stock market while yielding consistent factor loadings. In the US data, they found that a single cointegration vector between stock prices, industrial production, inflation and the long-term interest rate. The coefficients from the cointegrating vector, normalized on the stock price, thus implying that the US stock prices were influenced, positively by industrial on the production and negatively by inflation and the long-term interest rate, but at the same time money supply was found to have an insignificant influence over the stock price. In the Japanese data, two cointegrating vectors were found. One of which normalized on the stock price thus

proving that stock price are positively related to industrial production and negatively related to the money supply. The second vector normalized on industrial production, that industrial production was negatively related to the interest rate and the rate of inflation. The reason for this difference in the behavior of both the stock markets could be Japan's slump after 1990 and its consequent liquidity trap of the late 1990s and the early twenty-first century. But whatever the outcome the authors have found a significant relation between the macro economic variables and stock market in the long run.

In a very different kind of paper by Brenner, M., et al. (2006) have examined the short-term anticipation and response of U.S. stock, treasury, and corporate bond markets to the first release of major macro economic news like employment, inflation, and interest news. They have addressed four basic set of questions in the study, firstly, whether the markets where these assets are traded more prone to volatility before the news or less volatile afterwards. Secondly, do these news releases affect the markets for different asset class differently; and thirdly, are these macro economic announcements affecting the existing degree of correlation between different assets. And lastly, is the impact of these news releases driven exclusively by their unexpected component or are they reacting to the anticipated information. To answer all these queries, they have taken up a variety of daily, continuously compounded excess holding-period returns on three asset classes, namely stocks, treasury bonds, and corporate bonds, whose prices are expected to be affected by four major macro economic news: Target Fed Fund rates, Consumer Price Index, Unemployment rate, and Non-farm Payroll Employment between 1986 and 2002. This research differs a lot from the previous research of its kinds as they have investigated the impact of the most important macro economic news on the joint distribution of the returns in the three financial markets. They have also used survey and futures data to extract the unexpected components of this news, and also analyzing the impact of these news releases on

both the returns from the three sets of assets, including their volatility and correlations.

Dynamic Conditional Correlation (DCC) model by Engle (2002) has been used as it has the flexibility of univariate GARCH model without having the complexity of the multivariate GARCH model. The basic conclusion that they have arrived on is that the macro economic news although has a statistically and economically significant impact on U.S. financial markets and also that this impact varies greatly across asset classes. Thus, estimating a complex picture of interaction between asset returns in proximity of news releases, i.e., there is strong interrelation between the macro economy and financial markets of U.S.

Sarkar, A., et al. (1999) have examined whether the conditional correlation between stock returns and consumption is positive, even if the unconditional correlation is not, using a bivariate GARCH framework in case of G7 countries. They have taken into consideration 40years of monthly statistics in case of US and quarterly data in case of other countries, and have found strong evidence that conditional correlation between innovations in consumption growth and stock returns is positive and significant. For 6 of the G7 countries, they have rejected the hypothesis that correlation is constant; and for 3 of them the correlation is statistically higher for positive stock return shocks relative to negative stock return shocks. But, the correlation is unaffected by large movements in stock returns for most of the G7 countries. They have concluded that policy response may need to be stronger than normal when the stock market is performing better than expected, but in case of extreme market conditions, either positive or negative, they should not have any additional effects on policy. In this way they have tried to relate real economy with stock market and effects of stock market on real economy.

Chauvet, M. (1999) has worked out the dynamic relationship between stock market fluctuations and business cycle. It is believed that the stock market movements reflect positions taken by market participants based on their

assessment about the current state of the economy. In this paper, the author has explored the possibility of predicting business cycle turning points using the available financial variables. Chauvet (1999) has proposed a model that generates the prediction of business cycle turning points using the business cycle factor, and anticipation of these predicted turns using the stock market factor. In this paper, the author has build a stock market indicator (SMI) which consists of several financial series and it anticipates business cycle turning points better than its individual components. On comparing the SMI with the unrevised Composite Leading Indicator (CLI) in real time, the author found its SMI to be better equipped as it is less noisy than CLI which makes it a better option to use as a tool for anticipating turning points. Moreover, SMI can be computed at the end of each month reflecting updated information for that month, contrary to CLI which reflects the information from the previous month. Hence, this whole framework is used to explore the ability of stock market movements in predicting business cycles, especially the onset of recession thus depicting a strong correlation and one way causal relationship from stock market to real economy. The author has used monthly data from 1954-1994 of 8 economic and financial variables. The economic variables consist of: manufacturing and trade sales in 1982$, total personal income less transfer payments in 1987$, non-agricultural civilian employment and industrial production. For the stock market factor, the author has used variables that reflect public information about the state of financial conditions, such as excess stock returns, 3-month Treasury bill rate, S&P 500 dividend yield, and changes in S&P 500 PE ratio. Each factor follows a two state Markov process, representing business cycle phases, and the factors are allowed to switch nonsynchronously over time.

Brenner, M., et al. (2006) through this paper looks deep inside into the links between financial markets and the real economy. They have studied the short term anticipation and response of US stock, Treasury and Corporate Bond markets to

the first release of US macro economic information. They have focused the impact of these announcements not only on the level, but also on the volatility and co movement of those asset returns. They have explored the functioning of the process of price formation in all three of the main markets – stocks, government bonds and corporate bonds – around important macro economic events. The main macro economic announcements on which they have focused are –CPI, non farm pay roll employment, civilian unemployment news and Fed funds target rate decisions. While studying these variables they have addressed to 4 main questions:

*Impact of these announcements on asset returns and asset return volatility in the proximity of their first release.

* Do these announcements affect the markets for different asset classes in different ways.

* Does this news affect the existing degree of correlation between different asset classes.

* Is the impact of these news releases driven exclusively by their unexpected component or are they reacting to anticipated information.

To find an answer to all this, they have used the Dynamic Conditional Correlation (DCC) model introduced by Engle (2002). As DCC has the flexibility of univariate GARCH models without the complexity of traditional multivariate GARCH specifications. Brenner (2006) has concluded that the macro economic announcements have significant impact on the US financial markets, but also that this impact varies greatly across asset classes.

2.4 Issues and Challenges

As dictated by the various studies done for this research we have come across very ambiguous results as shown by the three schools of thought. Thus we face new challenges first of which is to maintain status quo while undergoing this research work. Secondly, the limitations involved while studying Indian economic statistics

due to the lack of availability of the data. The issue that has to be catered to is that all the variables have to be chosen very carefully so that we can cover the widest possible arena of real economy and stock market, and at the same time should not deviate from the basic intention of this research to stick to just the correlation and causal relationship between the said variables. In the next chapter, we have to first to set a set of objectives and issues keeping in mind the above discussed issues pertaining to this area.

CHAPTER - 3

OBJECTIVES, AND DATA AND METHODOLOGY

3.0 Introduction

The objectives of this study have been decided after discussing the various issues and challenges faced by the stock market and real economy. The main objective of this research study is better understanding of the integration of stock market and real economy at the basic level. Due to less availability of the data and lesser time, the scope and objectives had to be kept in fewer but certainly with the purpose of fulfilling the basic rationale and motive of a research project.

3.1 Objectives

In this study the major objective is to find out the correlation and causal relationship, if any, between the stock market and real economic variables. It will shed light on the degree of integration of the two markets and how they affect each other. The specific sets of objectives of the study are as follows:

(1) To calculate correlation and causality, if any, between the stock market index SENSEX and real economic variables.

(2) To unravel out the nature of causal relationship that exists between the stock market and real economic variables, i.e., is it unilateral or bilateral.

(3) To explore that to what degree the two, stock market and real economic variables cause each other.

3.2 Data and variables in the study

In this study Annual data from 1950-51 onwards to 2007-08 has been used in case of all the variables like, GDP (Gross Domestic Product), SENSEX (Sensitive Index), per capita GNP (Gross National Product), bank rate, forex (foreign

exchange) reserves , wholesale price index (WPI), domestic savings, gross domestic capital formation (GDCF), and monetary ratio M3 (broad money). The major source of data of all the above macro economic variables is Handbook of Statistics on Indian Economy maintained by Reserve Bank of India (RBI) and for SENSEX is International Financial Statistics maintained by International Monetary Fund on-line data source. The major macro economic variables used in this study are briefly explained below.

The various variables undertaken in this study are in real prices form so as to do away with the affect of inflation over the period of time and one can understand and view the past and present economic scenario in a clearer and precise manner.

1. GDP at factor cost: The major macro economic variable in this study is GDP at factor cost which is nothing but the sum of all factor incomes which aggregates from the residents of a nation, corporate and individual, which derive directly from current production of goods and services giving the total domestic income which is further adjusted for stock appreciation.

2. Per capita GNP: If net property income from abroad is added to the above explained GDP at factor cost, one gets GNP, further if divided by the total population of the nation we get per capita GNP, which is also one of the variables in this study. It shows that how much share each member of population in the nation has on an average as his/her annual income.

3. Bank rate: The bank rate is defined as the rate at which Reserve Bank of India (RBI) lends to other banks. This rate is very significant in formulating the other monetary measures and also curtails the quantity of credit in the economy.

4. Forex reserves: Any country is marked as rich or poor country usually by having a look at its forex reserves which is nothing but the country's holdings of internationally acceptable means of payments for the purpose of covering short to medium term deficits on its external balance of payments, and the related purpose

of exerting control over the movement of the exchange rate of its currency. These reserves are principally held in gold and US dollars due to their world wide acceptance.

5. Wholesale Price Index (WPI): For any country's economy to grow low rate inflation serves as an inducing tonic. Slow rise in prices are supposed to induce the producers to increase the production which in turn ensure more and more employment opportunities in the country. But uncontrolled inflation or even deflation has serious repercussions for the economy. To measure this inflation Government of India (GoI) has various indices, amongst which WPI is the one which is believed to be a very comprehensible and lucid measure. It is the only general index capturing price movements in a comprehensive way. It is an indicator of movement in prices of commodities in all trade and transactions. The new series of WPI has about 435 items in its commodity basket. In its new series 'Primary Articles' contribute 98 items, 'Fuel, Power, Light and Lubricants' 19 items and 'Manufactured Products' provide 318 items.

6. Domestic savings: It is that part of the household and firms' income which they do not spend on goods and services for current consumption but save for future consumption. These savings if mobilized into some productive channel leads to very good results as they are collectively huge and usually available for long period of time.

7. Gross Domestic Capital Formation (GDCF): Instead of investment in itself, GDCF has been taken up in this study. It is the total investment that takes place in an economy within any specific time period. Or in other words it could be termed as net addition to capital stock after depreciation.

8. Broad money or M3: It is one of the important types of money with the help, there are different types likes M1, M2, M3 and M4. It's a monetary ratio which represents M3, i.e., broad money which consists of money with the public,

demand deposits of banks, other demand deposits with RBI, saving bank deposits with post-offices and term deposits with banks.

9. SENSEX: SENSEX is called "sensitive index" which is an indicator of the major thirty companies at Bombay Stock Exchange (BSE) market which are chosen from various sectors of the economy by a committee on the basis of a certain given criteria. In fact, it gives us a general idea about whether most of the stocks have gone up or down. It is taken to be an indicator of financial health of the capital market of India. BSE is the largest of 22 exchanges in India with over 6000 listed companies and is the 5th largest exchange in the world with market capitalization of US $4.66 billion. It is oldest in Asia as it traces its history back to 1850s.

3.3 Methodology Adopted

With a view to accomplish the stipulated set of objectives of our study, different methods have been adopted. First of all, to fulfill the research objectives, descriptive statistics like standard deviation, coefficient of determination, mean, etc. are carried to show the nature and basic characteristics of the variables used in the analysis. Correlation is the next step to move towards the objectives of this study and finding any relation between the stock market and macro economic variables. Then the formal investigation is carried out by examining the stochastic properties of the variables by using Unit Root Test to test the stationarity of the variables. In this context, the widely used techniques are Augmented Dickey Fuller (ADF) (1979) and Phillips-Perron (PP) (1988) test. If the variables don't have unit root problem then Granger causality can be estimated. Now let's briefly discuss these two techniques to test the stochastic properties of the variables.

Consider here two variables such as X and Y for methodological discussion relating to the study. If the calculated Augmented Dickey-Fuller (ADF) statistics is less than its critical value, then X is said to be stationary or integrated to order

zero, i.e., I (0). If this is not the case, then the ADF test is performed on the first difference of X (i.e., ΔX). If ΔX is found to stationary then X is integrated order one i.e., I (1). If two variables X and Y are both integrated to order one I (1), then the next step is to find out whether they are co integrated. This can be done by using Johansen's co-integration approach. If the two variables are not co-integrated then the best approach is to find out the causality between them by using Granger test, which only establishes short run relationship. In practice, however, a number of econometric packages can be used to perform these tests which also give the critical values of the ADF statistic. To discuss the ADF Test we have to estimate the equation:

$$\mathbf{Y_t = \gamma + \delta_t + \alpha Y_{t-1} + \sum \theta_f \Delta Y_{t-1} + e_t}$$

here ε_t is not white noise as in previous Dickey Fuller Tests. The purpose in adding the terms Δy_{t-1} is to allow for ARMA error processes. But if the MA parameter is large, the AR approximation would be poor unless k is large.

After estimating this augmented equation, the tests K (1), t (1), and F (0, 1) are used.

And Phillips-Perron use nonparametric statistical methods to take care of serial correlation in the error terms without adding lagged difference terms. And the asymptotic distribution of PP is same as ADF.

To decide that how much lag length is required for the model selection Akaike information criteria (AIC) and Schwarz information criteria (SIC) are used, and the model with lowest value of AIC and SIC is preferred.

Engle –Granger Causality:

Finally, Engle-Granger (1969) causality model is used to test the causality between the stock market and macro economic variables. The following is the model adopted in the study to empirically examine the above said hypothesis.

Let's start by defining Granger's concept of causality. X is said to be Granger cause Y if Y can be predicted with greater accuracy by using past values of X.

Consider the following equation:

$$\mathbf{Y_t = \alpha_0 + \alpha_1\, Y_{t-1} + \beta_1\, X_{t-1} + u_t}$$

If $\beta_1 = 0$, X does not Granger cause Y. If, on the other hand, any of the β coefficients is non-zero, then X does Granger cause Y. The null hypothesis that $\beta_1 = 0$ can be tested by using the standard F-test of joint significance. Note that it has been taken one period lag in the above equation. In practice, the choice of the lag is arbitrary. Varying the lag length may lead to different result. As a practical guide, one can include as many as are necessary to ensure non-auto correlated residuals.

In the next chapter, we have empirically estimated the relationship between stock market and real economic variables by adopting the above mentioned econometric techniques.

CHAPTER - 4

ESTIMATION AND RESULT ANALYSIS

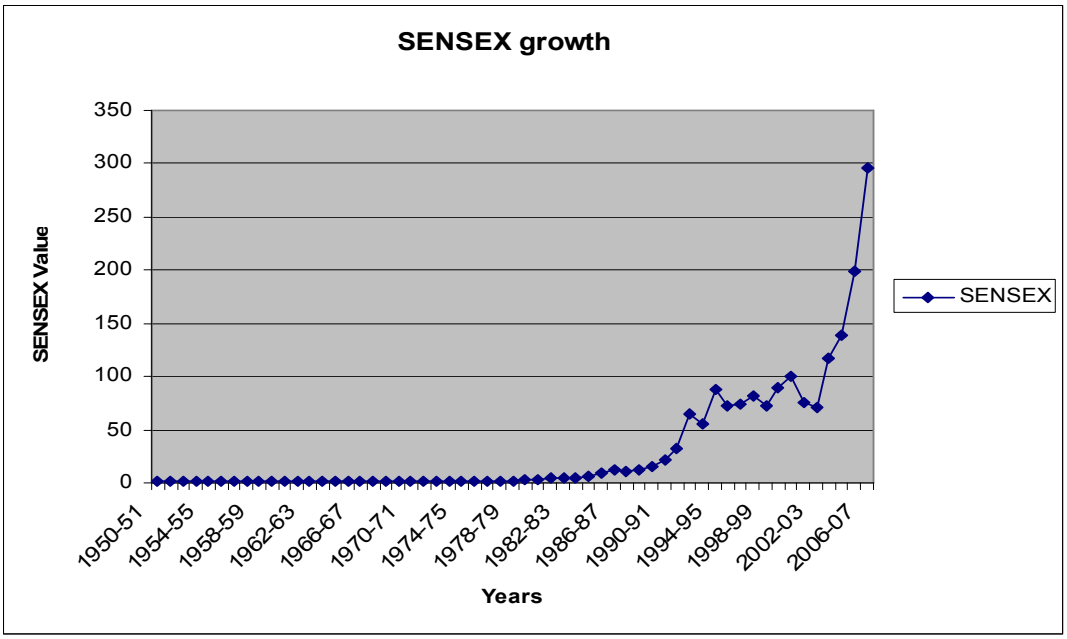
4.0 Introduction

Since the purpose of this research project is to study the class of relationship that exists between the stock market and real economy, so the detailed portrayal of variables taken up in the study and the relation between them has been done with the help of various statistical and econometric tools. It basically solves our purpose to represent a true sketch of all these variables which are regarded to be the "indicators" of an economy and to demonstrate that how they are interrelated and interlinked to each other and also the path of growth followed by them during the study years.

4.1 Trends of all Macroeconomic and Stock Market Variables

The in depth study of this analysis requires the basic understanding of the trend that has been followed by these variables over the period of study, so as to comprehend any noticeable variations, if any, in the variables.

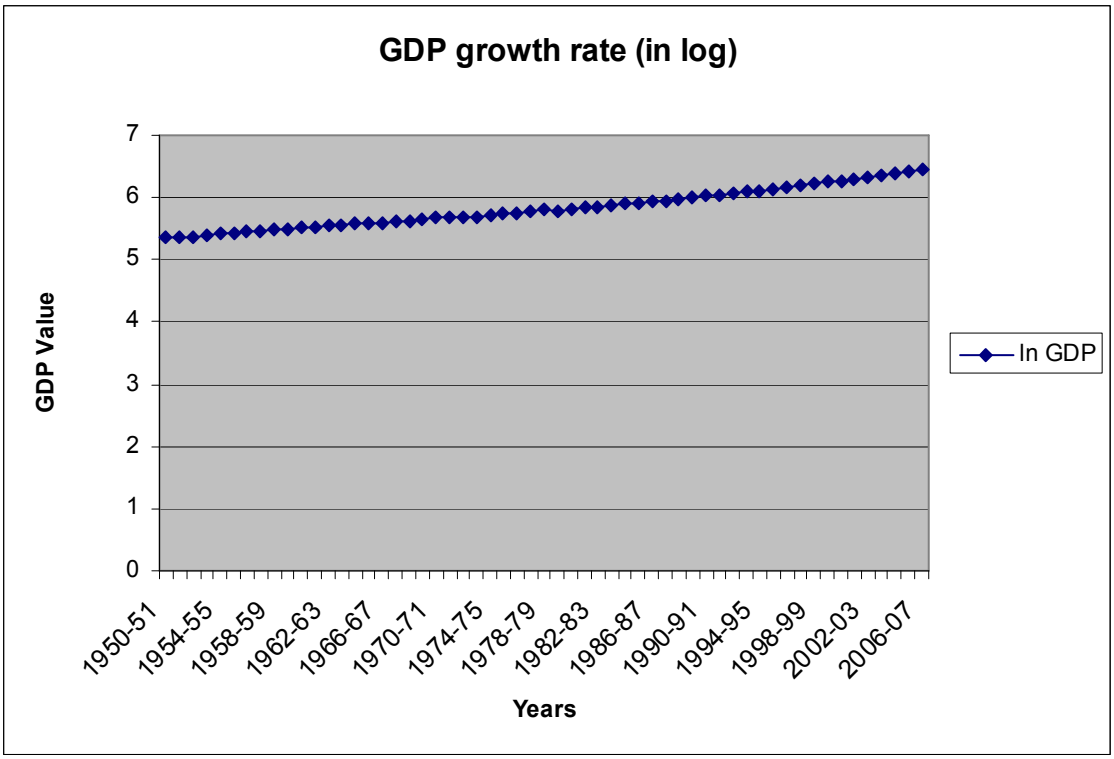
Figure 4.1: Trend of SENSEX



Capital is often defined as "wealth used in production of further wealth". And any business enterprise in order to exist and broaden its horizons needs capital which it can hire for long term from the capital market of a country. In India, BSE and NSE are the two main capital markets where trading takes place. BSE SENSEX which has gained a lot of media attention due to enormous growth and volatility in it has been taken up as the representative of India's financial market growth. It has gained momentum since economic reforms, i.e., 1990-91 onwards, but from the early twenty-first century there has been colossal growth and then ultimately it ruptured. The basic reason behind this precariousness is the IMF conditionality in the form of structural reforms that they had imposed on India while loaning it billions of dollars to evade bankruptcy in 1990-91. Also when SEBI the watch dog of the capital markets was established in 1988 and given a statutory recognition in 1992 and was mandated to create an environment which would facilitate mobilization of adequate resources through the securities market and its efficient allocation, all this along with growth in public confidence, underwriting business, credit rating agencies, and establishment of development banks and industrial

financing institutions, legislative measures, etc. contributed to the growth of capital market. From the perusal of the figure 4.1, one can notice that SENSEX had stood at just 122.32 in 1979-80, touched 1049.53 in 1990-91 and 2897.67 in 1992-93 and in early 2000s the growth in it became explosive as it had even touched 21,000 points on January 8, 2008. This pattern thus usually shows an erratic but mostly uphill movement during the period of study.

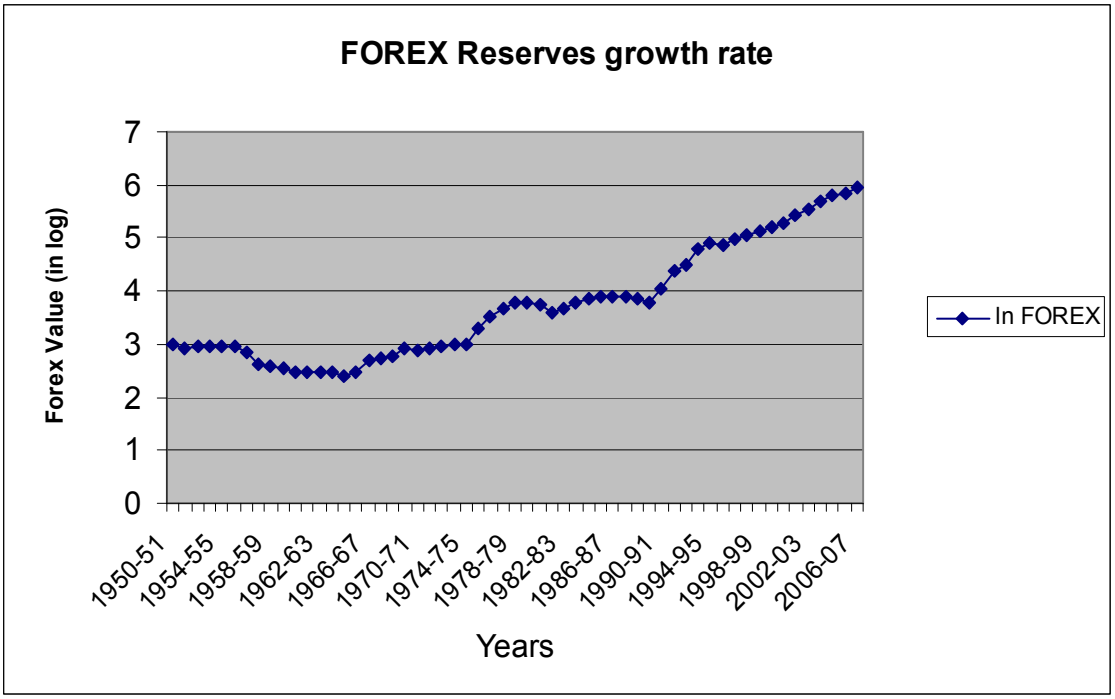
Figure 4.2: Trend of GDP



This was the stock market part of the story; turning to the real economy ahead of all is GDP of the country which is still considered as the best indicator of a country's growth by many economists as it depicts the value of goods of services produced in an economy. As per the figure 4.2, GDP of India has grown somewhat steadily over the years; opposite to what was noticed in SENSEX case much

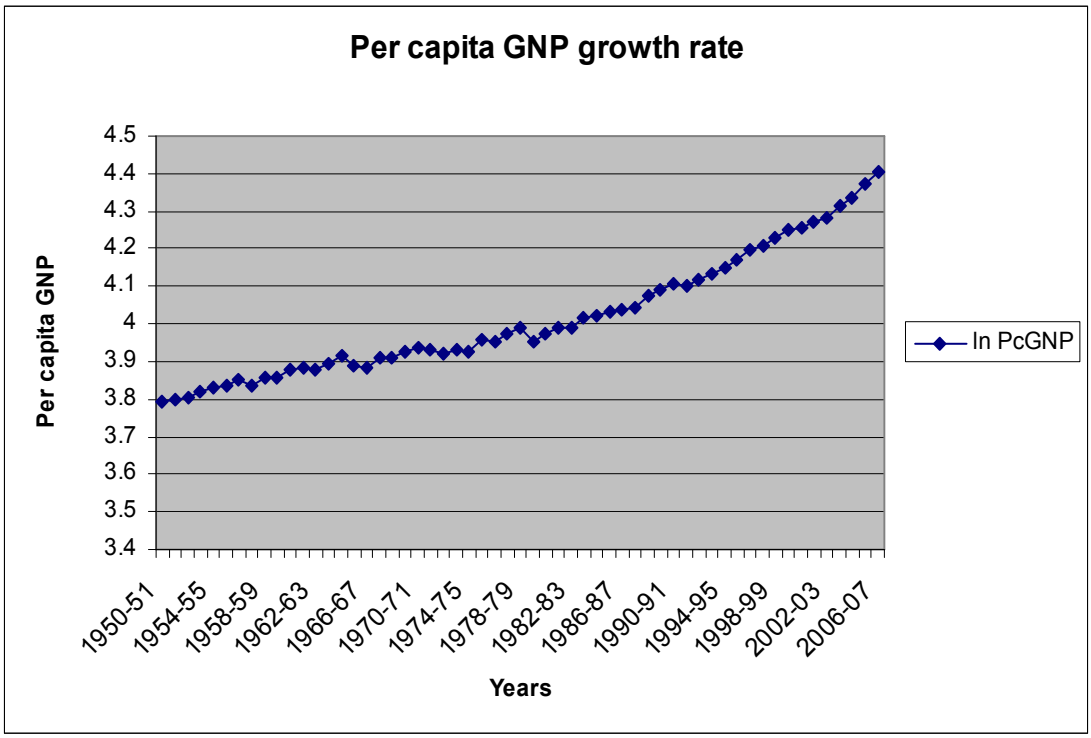
eruption has not been viewed in GDP even after the new economic policy of 1990-91. The primary reason for which remains lesser impact of implementation of economic reforms on the real sector. Thus implying that a lot still remains to be done in this sector and the stock market revolution is not much supported by the real sector. If one gets into the roots of this problem that why GDP has not grown at a significant rate then the basic reason remains lack of implementation of almost all the 5-year plans as they would have been great, if implemented. Also from the very beginning India has faced capital inadequacy problem apart from the lack of implementation of plans. This capital inadequacy trouble seems to be solved to some extent by the growth of the capital markets but an additional issue comes up here which is very less participation of Indian population in the stock markets comparative to the developed nations due to lack of education and awareness.

Figure 4.3: Trend of Forex reserves



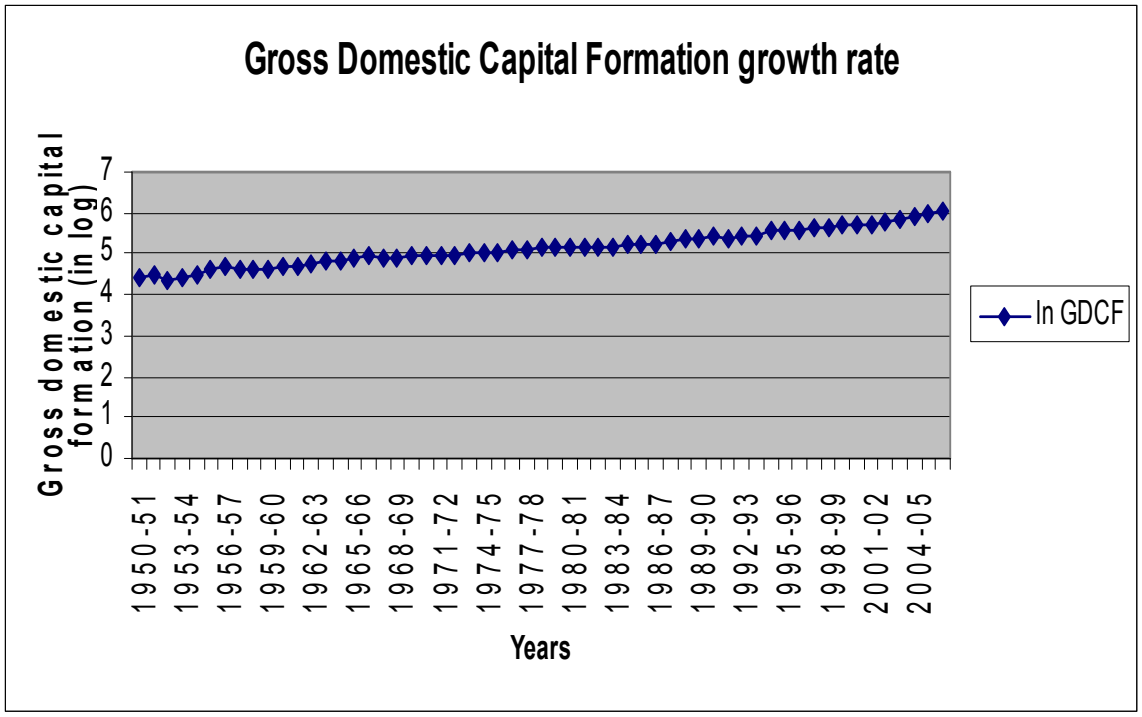
Any country's richness is usually measured by the foreign exchange reserves that it has with its Central Bank. The crisis that India had faced during 1990-91 was ultimately triggered by forex reserves only as they had dwindled to a very low and India could make just fifteen days of essential imports with the existing reserves. But over the years it has grown tremendously and now it has excess reserves. Moreover the reserve management policy followed by India is to cover the "liquidity of risk" on all accounts over a fairly long period hence it tries to keep ample reserves with it. These reserves have come mainly from the Non-Resident Indians (NRIs), FIIs (foreign institutional investors), FPIs (foreign portfolio investment) and lesser from FDIs (foreign direct investment), i.e., mainly routing through the stock markets basically because of difference between domestic and international rates. These reserves if come in the shape of long term investments, i.e., FDI then they really help an economy to grow and develop, if canalized into productive developments. India's forex reserves have increased from just Rs.865cr. in 1951-52 to Rs.868222cr. in 2006-07 which can be very well noticed from the figure 4.3.

Figure 4.4: Trend of Per capita GNP



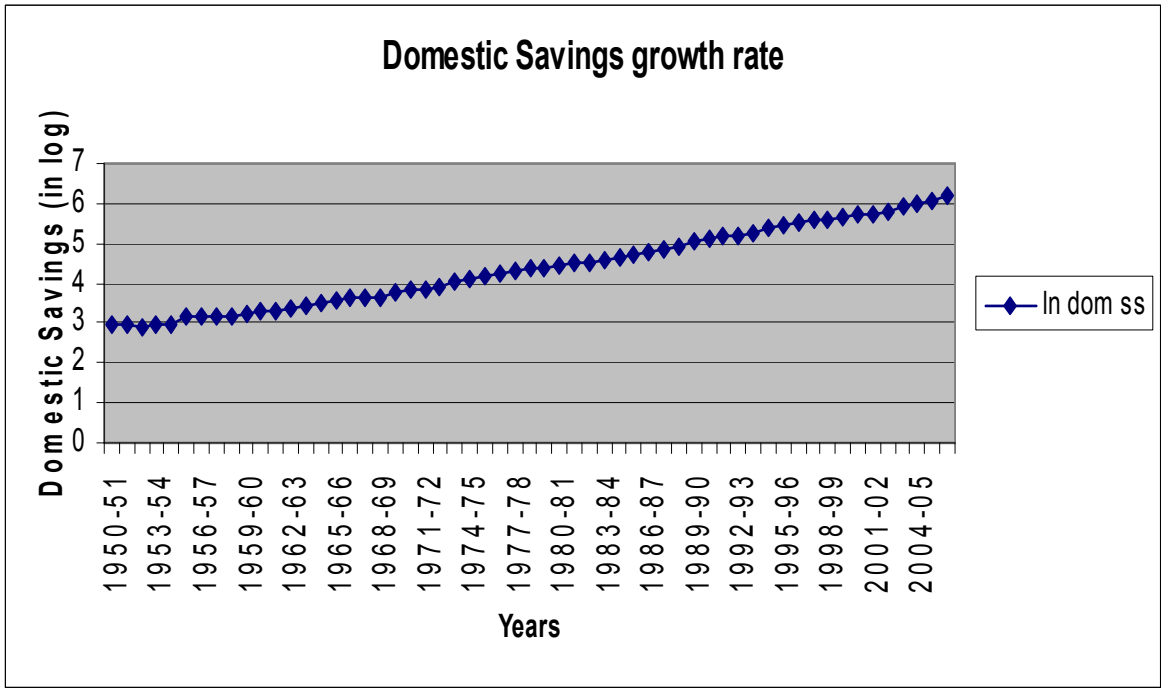
As comparative to GDP at factor cost as discussed earlier, one can make out from the figure 4.4 that per capita GNP has shown a better uptrend, thus implying that the main constituent of GNP, i.e., income from abroad or exports which is not included in GDP has shown a remarkable growth due to which our forex reserves have also increased. The per capita GNP has increased from meager Rs.6237 to Rs.25358 in 2006-07, i.e., a growth rate of about 306.6% over a period of fifty-seven years.

Figure 4.5: Trend of GDCF



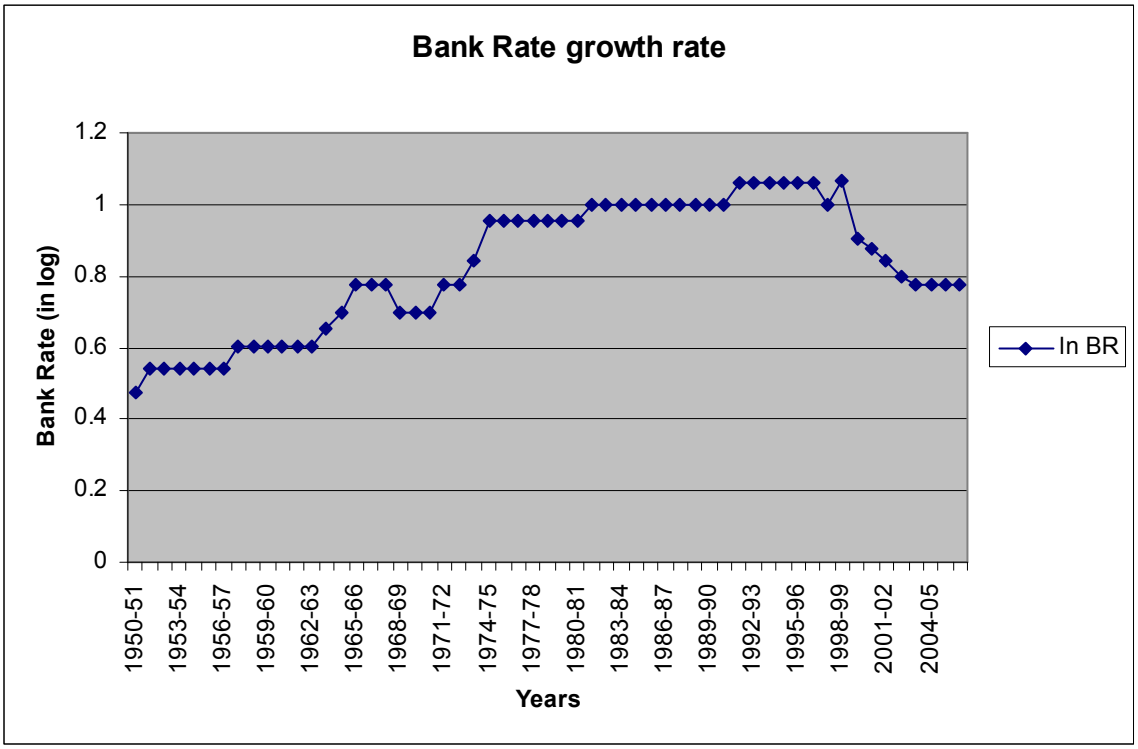
Another variable gross domestic capital formation in the figure 4.5 has revealed a stable but incremental growth during the study period thus implying the net investment done in the economy has increased but not considerably giving one more reason for lesser increase in GDP comparative to the stock market index SENSEX. If taken its growth rate during the period of study, then it comes out to be 4174.32% from 1950-51 to 2006-07.

Figure 4.6: Trend of Domestic savings



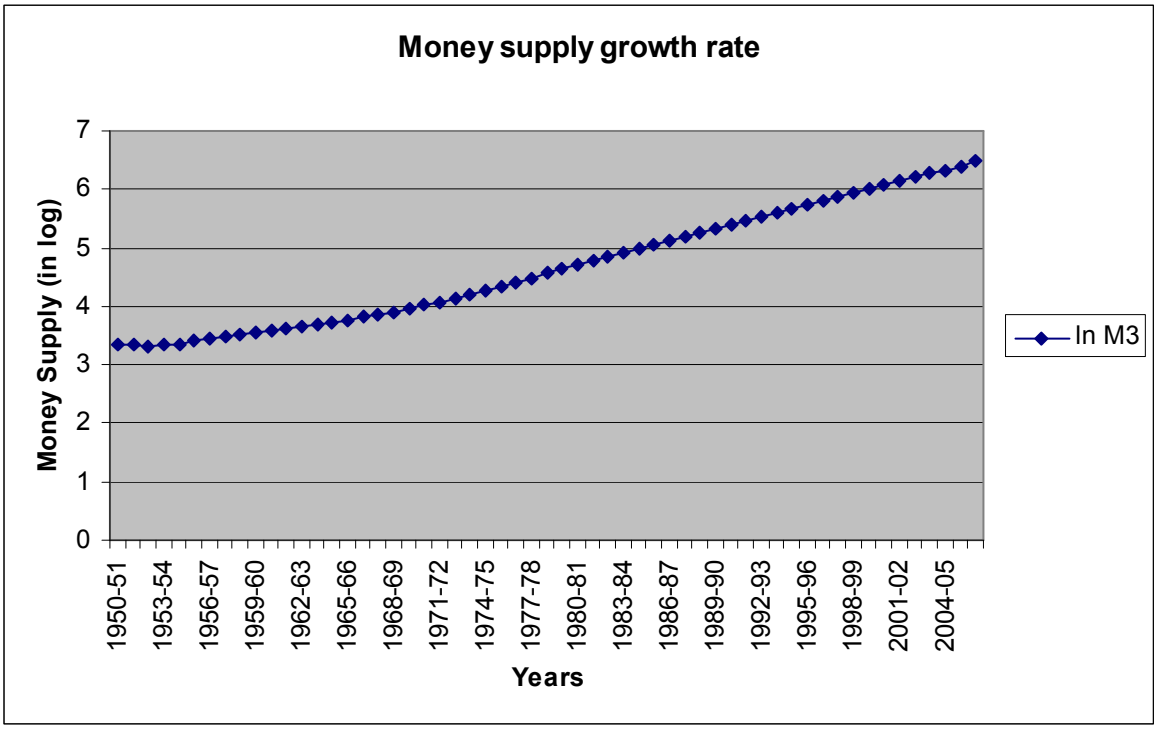
Any country's most important source of capital formation is the efficient mobilization and allocation of the household savings. A glance at the figure 4.6 shows that over the years it has increased manifold, but increase in it is more than the increase in gross domestic capital formation thus pointing towards the fact that still there is a room for increment in gross domestic capital formation and all the domestic savings are not being allocated efficiently. They witnessed growth rate of 165390.6% during the period 1950-51 to 2006-07, which is much more than the increment in gross domestic capital formation.

Figure 4.7: Trend of Bank rate



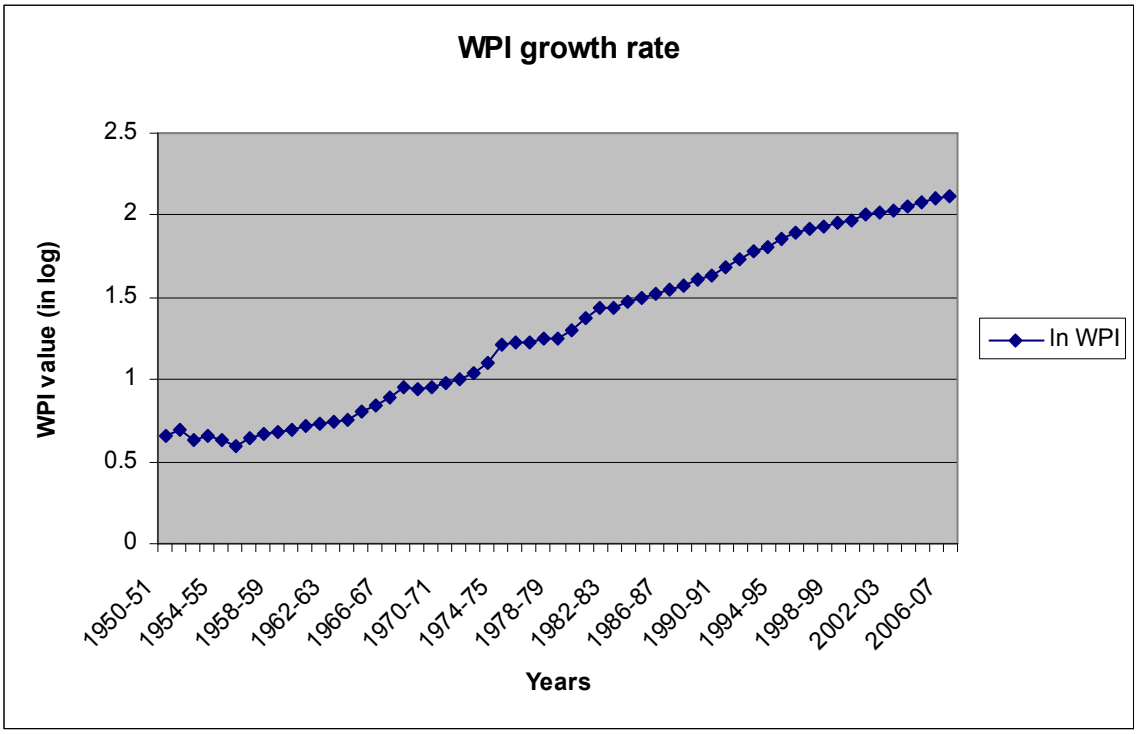
A country's financial sector consists of its money market and capital market. Both of them are not only highly correlated but also interdependent. Since the investors for both are same thus they look for the best opportunity wherever available, thus rates in one market do affect investments in another. An important rate which further acts as a barometer for determining other rates in the market is bank rate, the rate at which RBI lends to other banks. In the figure 4.7 one can observe that it changes very rarely and since 1950-51 it has doubled from 3% to 6% in 2006-07 with less volatility in it.

Figure 4.8: Trend of Money supply



In the case of money supply, i.e., M3 or broad money growth rate has been tremendous too as seen in the figure 4.8. It has increased from Rs.2201cr. in 1950-51 to Rs.2958427.86cr. in 2006-07 thus witnessing the growth of about 134312.86% in fifty-seven years as shown in figure 4.8. It is the money supply only which provides liquidity to the economy and increases the purchasing power of the people thus providing an impetus to the economy to grow further but excess liquidity also harms the economy as it at times unduly increases the purchasing power of the people which is not much supported by the fundamentals, i.e., supply side.

Figure 4.9: Trend of WPI



The last variable in this study is shown in figure 4.9 is WPI which is also taken as a measure of inflation in an economy. Inflation is often taken as bad, but somewhat inflation is very necessary for an economy to grow as it provides momentum to the economy by motivating the producers in form of increasing profits. Inflation also eats upon the income of a common man as it decreases the value of money that he holds as cash, thus inciting him to look into various investment options.

4.2 Descriptive Statistics and Correlation Matrix

Various descriptive statistics are calculated of the variables under study in order to describe the basic characteristics of these variables. In this table various statistics are calculated like mean, median, maximum and minimum value, standard deviation, skewness, kurtosis, jarque-bera and probability.

Table 4.1: Descriptive Statistics

Variables	Bank Rate	Domestic Savings	Forex Reserves	GDCF	GDP	M3	Per Capita GNP	WPI	SENSEX
Mean	0.827	4.374	3.726	5.139	5.826	4.663	4.015	1.307529	31.24158
Median	0.845	4.372	3.679	5.151	5.777	4.561	3.974	1.253	2.292
Max	1.065	6.158	5.938	6.022	6.457	6.471	4.404	2.122	295.321
Min	0.477	2.926	2.397	4.362	5.351	3.322	3.794	0.591	1.197
S.D.	0.182	0.989	1.064	0.427	0.312	1.01	0.162	0.508	55.566
Skewness	-0.309	0.157	0.611	0.133	0.32	0.25	0.703	0.109	2.659
Kurtosis	1.713	1.759	2.128	2.213	1.987	1.699	2.459	1.589	11.305
JB	4.841	3.889	5.359	1.638	3.408	4.612	5.397	4.837	231.019
Prob.	0.088	0.143	0.068	0.440	0.181	0.099	0.067	0.089	0.000

These statistics define various characteristics of the variables like, mean value represents the average of all the values of a variable; and median is the middle value of the series which divides the arranged series into two equal parts in such a

way that the number of observations smaller than the median is equal to the number greater than it. Rest maximum and minimum values of the group are also determined along with the standard deviation and skewness which expresses the degree to which a variable is dispersed around its mean value, and the degree of asymmetry of a distribution around its mean value respectively. Kurtosis is nothing but it characterizes the peakedness or flatness of a distribution compared with normal distribution, where positive kurtosis illustrates peakedness and negative kurtosis confirms flatness of a distribution. Then is Jarque-Bera (JB) Test of normality which is asymptotic, i.e., applied to large samples where it first computes skewness and kurtosis measures of OLS (ordinary least square) residuals and then calculates p value with the null hypothesis that the residuals are normally distributed. If the computed p value in JB statistic is low then the null hypothesis is rejected and vice versa. Last of all probability is calculated, which measures nothing but the chance with which an event will occur.

From the table above in which descriptive values of all the variables have been calculated shows that standard deviation is very high in case of SENSEX comparative to others which portrays nothing but that it is dispersed around its mean value by 55.566%, i.e., there is high volatility in its values. From the skewness measure we found that only bank rate is negatively skewed while stock market is more positively skewed compared to other variables. In case of kurtosis, all variables are positively skewed, thus illustrating that all have peaked distribution comparative with normal distribution and as almost in all cases it is highest in SENSEX. The computed values of JB statistic is very high which compels us to accept the null hypothesis but two obstacles in it are that firstly their probability is very low and even zero in case of SENSEX for obtaining such a statistic under the normality assumption, and secondly that the sample size is not enough to apply this test as we have just 57 observations in all.

Next step is to check out the correlation between the variables in consideration in this study.

Table 4.2: Correlation Matrix

Variables	Bank Rate	Domestic Savings	Forex Reserves	GDCF	GDP	M3	PCGNP	WPI	SENSEX
Bank Rate	1.000	0.715	0.544	0.683	0.661	0.694	0.555	0.740	0.189
Domestic Savings	0.715	1.000	0.949	0.990	0.995	0.997	0.975	0.995	0.748
Forex Reserves	0.544	0.949	1.000	0.923	0.952	0.960	0.961	0.950	0.824
GDCF	0.683	0.990	0.923	1.000	0.991	0.985	0.976	0.975	0.770
GDP	0.661	0.995	0.952	0.991	1.000	0.994	0.989	0.987	0.785
M3	0.694	0.997	0.960	0.982	0.994	1.000	0.977	0.990	0.755
PC GNP	0.555	0.975	0.961	0.976	0.989	0.977	1.000	0.961	0.848
WPI	0.740	0.995	0.950	0.976	0.987	0.996	0.961	1.000	0.721
SENSEX	0.189	0.748	0.824	0.975	0.785	0.755	0.848	0.721	1.000

This correlation is very important as it helps to know that the variables on which we wish to apply Granger causality are even related to each other. Hence a correlation matrix is worked out between them. In the following correlation matrix almost all the variables are highly correlated to each other apart from SENSEX and bank rate which are less correlated to each other. Since remarkable correlations have been found between the variables under consideration so further econometric tools would be applied to them. But one point is worth enough to bring into consideration that a high or low degree of correlation certainly doesn't signify or rules out causality. It simply points towards the positive or negative linear relationship that exists between the two variables.

4.3 Stationarity and Causality Analysis

After all these statistics stationarity tests are carried out on the variables because to apply Granger causality, first the series have to be made stationary. Augmented Dickey Fuller (ADF) test and Phillips-Perron (PP) test have been done and after the application of these tests all the series have been found stationary at various significance levels.

Table 4.3: Unit Root (ADF) Tests for variables

Variables	ADF Statistic
Bank Rate	3.820713*
Domestic Savings	7.300512*
Gross Domestic Capital Formation	5.587253*
Gross Domestic Product	3.454179**
Per capita Gross National Product	3.769338*
Wholesale Price Index	5.093995*
Money supply	3.807223*
Forex Reserves	3.653552*
SENSEX	3.981999*

Note: *and ** signify stationarity at 1% and 5% level of significance

In the ADF test that has been conducted on all the variables in the table 4.3 to check their stationarity in order to fulfill the precondition of Granger causality, all the variables were found stationary, i.e., their error term u_t is white noise and the hypothesis that coefficient $\delta=0$ is rejected as the computed absolute value of tau statistic ($|\tau|$) is greater than the DF or MacKinnon critical tau values. The lag

values were chosen on the basis of AIC and SIC criteria, the model with the minimum AIC and SIC value was chosen.

Table 4.4: Unit Root (PP) Tests for variables

Variables	Phillips-Perron Statistic
Bank Rate	7.027718*
Domestic Savings	6.474774*
Gross Domestic Capital Formation	8.714410*
Gross Domestic Product	3.496084**
Per capita Gross National Product	3.849725*
Wholesale Price Index	5.734517*
Money supply	4.786433*
Forex Reserves	4.391118*
SENSEX	5.267252*

Note: *and ** signify stationarity at 1% and 5% level of significance

Even when the stationarity is checked with the help of a different unit root test technique in the table 4.4, all the variables were found stationary at either 1% or 5% significance level. Meaning thereby that serial correlation in the error terms is taken care of here also but by the non parametric statistical methods without adding lagged difference terms. Rest of the asymptotic distribution remains same as in ADF test.

From the above unit root test, it is apparent that all the variables have no unit root problem. Now, to test causality between stock market and macro economic variables, we have estimated Granger causality. The estimated results are presented in the following table.

Table 4.5: Granger Causality Test

Direction of Causality (Null Hypothesis)	F-Statistic
ln GDP does not Granger cause ln Sensex	0.60315
ln Sensex does not Granger cause ln GDP	2.11918
ln GDCF does not Granger cause ln Sensex	0.26499
ln Sensex does not Granger cause ln GDCF	1.80146
ln bank rate does not Granger cause ln Sensex	1.45744
ln Sensex does not Granger cause ln bank rate	2.83378**
ln domestic savings does not Granger cause ln Sensex	0.71056
ln Sensex does not Granger cause ln domestic savings	0.52025
ln money supply does not Granger cause ln Sensex	0.86018
ln Sensex does not Granger cause money supply	13.3038*
ln per-capita GNP does not Granger cause ln Sensex	0.41515
ln Sensex does not Granger cause ln per-capita GNP	3.16125**
ln WPI does not Granger cause ln Sensex	1.12357
ln Sensex does not Granger cause ln WPI	2.85273**
ln forex reserves does not Granger cause ln Sensex	0.98779
ln Sensex does not Granger cause ln forex reserves	0.11064

Note: *and ** signifies rejection of the null hypothesis and acceptance of causality at 1% and5% level of significance

Perusal of the above table reveals that as SENSEX was bestowed with the throne of “financial development indicator” of India, the columnists and financial

analysts should give a re-thought to their baptism as their this “financial health indicator” is no doubt highly correlated with the GDP of India, but has no causal relations with it which is very contradictory to what is usually observed in the case of developed countries. Hence real activity in India is less influenced by the financial market fairy-tale.

An examination of the above table makes it clear that SENSEX has no causal relations with the Gross Domestic Capital Formation (GDCF). Implying that all the fixed net capital added to the economy every year neither influences nor is influenced by the SENSEX. Thus all the value addition that is done in stock market in the form of high stock prices doesn’t actually either comes from the capital formation in the economy nor causes or adds to its value.

SENSEX is found to Granger cause bank rate, which further affects all the rates in banks; for example, further lending and depository rates, etc. It can also be interpreted in this way that as people have various alternatives in financial market at their disposal for investment of their money, and what two reasons matters the most are rate of return and secondly risk associated; so the SENSEX which in itself shows the rate of return for capital market affects bank rate also as it is the indicator of lending and depository rates of banks as SENSEX is for capital markets. Hence RBI the one who determines bank rate keep on changing it as to make money market also a good enough option for people to invest, and Government also tries to provide it as a beneficiary for increase in real value when SENSEX rises and creates optimism in the market. Bank rate is a long term rate as it changes less often than other rates which are determined by the business cycle and monetary policy.

In case of domestic savings, it also doesn’t have any causal relationship with SENSEX. Connotation that comes out of this relation is that when SENSEX increases (decreases), it doesn’t have any impact on domestic savings which are

otherwise believed that are mobilized by the stock market and allocated in productive ventures in order to increase the real value in the economy.

SENSEX also Granger causes money supply in case of India meaning thereby that all the money (broad money-M3) present in the economy in various "most liquid" assets is determined to a great extent by BSE index SENSEX. This expected theory behind it might be that when SENSEX rises, people's expectations of prosperous future in economic terms also rise, i.e., there is an optimistic atmosphere in the economy due to which economic activity also rises and hence the money supply. Due to boom in the capital market, people even start investing their money in more liquid assets. In addition Government also follows a favorable monetary and fiscal policy to further augment to the real value and create more promising opportunities.

An extremely important point comes out here and that is that SENSEX does not Granger cause GDP but it do Granger cause per capita GNP, which indicates that the basic difference between GDP and per capita GNP is that of net income from abroad, hence SENSEX affects this part the most. Besides it as it is affecting the per capita GNP in India, so consequently SENSEX's effect on the real economy has started becoming visible and significant enough. Thus it could be well-used for bringing about changes in the real sector. The working of the chain that goes from SENSEX to per capita GNP is that high value of SENSEX indicates optimism in the financial market, meaning thereby that companies can raise more capital- hence more plants, increased inventories, increased employment, boosted output and exports and hence a rise in per capita GNP. One more way of interpreting could be that with increase in financial wealth (due to rise in stock value), consumers rise their spending thus pushing GNP up. Here real value formation rise has followed financial value formation increment.

From the analysis of the above table it specifies that SENSEX is Granger causing WPI, i.e., there is a unilateral directional relationship between them. SENSEX is

basically nothing but showing future expected occurrences of the real economy. With the rise in SENSEX then masses' expectations of a further rise in their profits is there and also due to this monetary gain in terms of their investments in stock markets, their demand for goods and services rises but there being a time-lag between the demand and supply, prices or WPI also increases.

The null hypothesis related to SENSEX and forex reserves has confirmed that neither SENSEX nor forex reserves cause each other, which denote that SENSEX does not has an effect on forex reserves in India. It is the real sector only which affects forex reserves and capital markets more or less remain out of the scene.

CHAPTER – 5

CONCLUSION AND POLICY IMPLICATIONS AND LIMITATIONS

5.0 Introduction

Stock markets and real economy are the two sides of the same coin or we can say that these two are like complementary goods which can't be called complete without each other and can't achieve the basic purpose of overall development of a country without each other. As written and reminded again and again by economists from Classicals to Keynesians and Post-Keynesians everyone has argued the importance of capital for the development of any industry and ultimately a country. But this integration and interrelation between the stock market and real economy is very evidently witnessed in the developed economies due to the basic reason that the common masses are very aware and educated about the stock markets and their these small initiatives of investment collectively help the industries and in due course a country to grow and develop into a prosperous and powerful economy. In this study, research has been done to navigate the correlation and causal relation between stock market and real economy in the context of Indian economy. The results that have been found are mixed and ambiguous as there is undoubtedly strong correlation between the two kinds of variables but Granger causality is prevalent amongst just a few variables. These findings point towards the developing phase that Indian economy is going through over the last six decades.

5.1 Conclusion

The aim of this research is to find out and study the causality, if any, between stock market and real economic variables. Although there is strong correlation between the two and even descriptive statistics indicate a much higher expansion

in stock market variable than real economic variables, i.e., stock market boom is not much supported by the real economic fundamentals. Even the causality that has come out is just amongst a few real economic variables and stock market variables which further concretizes the issue that stock markets in India are in their childhood phase as their impact on real economic variables is less as that in developed countries and moreover effect of real economic variables is almost nil on stock market index in case of causality.

To solve this basic purpose annual data was used from 1950 to 2006 and the basic and believed to be "indicator" variables were used and studied and analyzed by first applying the basic statistical tools like correlation and descriptive statistical tools and finally Granger causality.

The results that have been found are diversified and vague as correlation between almost all the variables was high, i.e., they are all moving in the same direction, but such a sequence was not followed by the causality analysis thus were not fundamentally supported by each other. Causality analysis pointed towards a different story where SENSEX undoubtedly Granger causes per capita GNP, bank rate, money supply and WPI. But none of these variables or even other real economic variables Granger causes SENSEX, thus implying that real sector is not causing the vibes in stock market and even the volatility in it is due to some other external factors and not these real economic factors. Adding to it, is one more reason that just 2% of the Indian population is involved in stock market investments which makes it not so good representative of the Indian financial health.

5.2 Policy Implications

As pointed out by this study that it is stock market index which is Granger causing some of the real economic variables and it is a unilateral relationship. Thus the most important implication turns out to be that if the government wants to bring

out some amendments in the real sector, it can always do so through the stock market index. This entails that stock market in India still cannot be symbolized as the "indicator" of financial health of the country. The study clearly indicates that since real economic variables are not affecting the stock market index hence certainly some exogenous variables are there which affects it and needs to be found and scrutinized to study this whole impact chain completely.

5.3 Limitations

The limitations of this research project also are innumerable, first of all is that due to time constraint more detailed research could not be done in this area, also because of lack of availability of data more variables are not taken into consideration especially stock market variables like, market capitalization ratio, number of firms listed on the exchange, etc.

5.4 Scope for Future Research

Since ambiguous results were found in this research analysis therefore it itself gives us a scope for further research where various other variables can also be worked out which affect the stock market index. The working of this integrated and interrelated mechanism needs to be known that how real economy and stock market works and shape up each other. If this working is discovered and explored, it could be of immense help to the policy makers as it would be easy for them to manipulate these markets through each other and also derive the expected results in these markets and curb unnecessary volatility in them.

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