# MACRO-ECONOMIC VARIABLES AND STOCK PRICES IN INDIA

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**CERTIFICATE OF AUTHORSHIP/ORIGINALITY**

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**Abstract**

This study investigates the effects of macroeconomic variables on stock prices in India using annual data
for the period from January 1979 to December 2011. The multivariate regression was run using thirteen macroeconomic variables on BSE Sensex using six different models. The null hypothesis which states that macroeconomic variables collectively do not accord any impact on the share prices is rejected at 0.05 level of significance in overall and post-liberalization case but is accepted in pre-liberalization case. The results indicate that out of six models in all the three cases the model with higher $R^2$. has been selected for further analysis which justifies higher explanatory power of macroeconomic variables in explaining stock prices.

Consistent with similar results of the developed as well as emerging market studies, inflation rate and exchange rate react mainly negatively to stock prices in the Indian Stock Exchange. The negative effect of Treasury bill rate implies that whenever the interest rate on Treasury securities rise, investors tend
to switch out of stocks causing stock prices to fall. However, lagged money supply variables do not appear to have a strong prediction of movements of stock prices while stocks do not provide effective hedge against inflation specially in Manufacturing, Trading and Diversified sectors in the CSE. These findings hold practical implications for policy makers, stock market regulators, investors and
stock market analysts.

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**ABBREVIATIONS**

| | |
|---|---|
| ATP | Arbitrage pricing Theory |
| CAPM | capital Asset Pricing Model |

# Chapter I

## Introduction

Indian stock market has a history of about 200 years. In India, trading in debt securities of private banks began before the trading in shares. In the first decade of 1800, principal business done was in the loan securities of East India Company share trading was not in vogue nor it was institutionalized. By around 1830′s trading in shares and stocks in (bank and cotton) was initiated in Bombay. As the trading volume increased tremendously by the end of 1839 the concept of broker business was started which picked up momentum in the mid 18th century, as in 1850,the Companies Act was enacted and the concept of joint stock companies was introduced, this made a significant difference to share trading. Till 1855 the brokers in Bombay used to trade under the widespread banyan tree in front of the Mumbai Town hall, the location of these meetings changed many times, as the number of brokers constantly increased, till they found a place in what is known as the Dalal street today. By 1860,the number of brokers who were dealing in trading of items goes up to 60 in number, further, the number of brokers increased from 60 to 250 in around 1862-1863 Kar,(2010). The huge amount of money coupled with lack of investment avenues at that time triggered large-scale speculation also known by “share mania’’. As people gambled on anything shares,cotton,silver etc “There were no share which did not commanded a premium” Kar(2010).

It was, around 1865-66 that this speculative boom busted, as the American civil war broke there is no supply of cotton from America to Europe. This had an ever lasting effect on market intermediaries, as it was realized by the brokers that share could no longer be traded in an informal way and that there was a need for establishing a liquid stock market. In 1875 “on or about the 9$^{th}$ July, few native brokers resolved to form an association to protect their character, status, interests and to provide a hall for their use”(BSE Training Module).The society was named as “The Native Share and Stock Broker Association”. later on renamed as” Bombay stock exchange (BSE) and presently housed in Jeejeebhoy towers-(construction started in1972). The establishment of stock exchange in Bombay was quickly followed by the other major

centres.Ahmadabad had gained importance next to Bombay as a fledgling centre for cotton textile industry and by 1800 there were a number of textile mills in Ahmadabad. Share trading in the city was also on the rise. In 1894,the brokers formed "The Ahmadabad Share and Stock Broker Association". As the cotton textile industry was to Bombay and Ahmadabad, the jute industry was to Calcutta subsequently it was in year 1908, that the stock exchange in Calcutta was formulated known as " The Calcutta Stock Exchange Association". This wind of stock exchange has also shown its pace in madras in 1920 resulting in the formation of the Madras Stock exchange which was started with around 100 brokers who are trading in the madras Stock exchange. It was in 1934 when the Lahore Stock exchange was established. The Uttar Pradesh stock exchange and the Nagpur stock Exchange was established in year 1940. In year 1944, the Hyderabad stock exchange was established. In Delhi there were two stock exchanges "Delhi Stock and Share Broker Association Limited" and "The Delhi stocks and Shares exchange Limited" .In June 1947,these were amalgamated into the Delhi Stock Exchange Association Limited. (T.Endo,"The Indian Securities Market",1998).

**Development of Indian Stock Market.**

In 1956,the Government of India enacted the Securities Contracts (Regulation) Act to regulate the business of dealing in securities and to grant recognition to stock exchanges. This was the first time that a formal regulation was in place to regulate the buying and selling of securities and the market in which trading took place. Only the well established stock exchanges like Bombay,Culcutta,Madras,Ahmedabad,Delhi,Hyderabad and Indore,were recognized under the Act. There are several other stock exchanges that were established post independence. Thus, the market of stock exchange in India is tremendous and is growing with leaps and bounds and is also getting diversified and specialized by establishing trading platform for new types to instruments and imparting liquidity to small scale industries.

**Growth Pattern of the Indian Stock market.**

The table 1.1 below portrays the overall growth patter of Indian stock market since independence. It is quite evident for the Table that Indian stock markets have not only grown just in number of exchanges, but in number of listed companies. The growth after 1985 can be clearly seen from the Table, and this was due to the favoring government policies towards security market industry.

*Table 1.1 Growth of Indian stock market.*

| As on 31st December | 1946 | 1961 | 1971 | 1975 | 1980 | 1985 | 1991 | 1998 | 2000 | 2011 |
|---|---|---|---|---|---|---|---|---|---|---|
| No.of Stock Exchanges | 7 | 7 | 8 | 8 | 9 | 14 | 19 | 22 | 23 | 23 |
| No.Of listed companies | 1125 | 1203 | 1599 | 1552 | 2265 | 4344 | 6480 | 9877 | 9954 | 9347 |
| Market Capitalization cr. | - | - | - | - | 6750 | 27572 | 354106 | 574064 | 768863 | 13541699 |

*Source: Indian Stock Market Review.*

**Regulation and Control of Indian Stock market.**

In wake of economic reforms government of India sets up a statutory regulatory body for the orderly development and regulation of securities market with a view to curb price rigging, frauds as the stock market in India functioned on trust of the brokers and the investors had little choice but to be at the mercy of the broker, all such practices had tarnished the image of Indian stock market since the “share mania” of 1865.In order to create confidence among small investors and foreign institutional investors, the Securities and Exchange Board of India (SEBI) was established as a regulator of Indian stock market in 1992.This was the first time that investor protection was recognized as the corner stone for the development of stock market. The establishment of SEBI changed everything from trading culture to structure of stock exchanges which includes dematerializing of securities and demutualization of stock exchanges in India and it is due to concerted and deliberate policy action of

SEBI that the stock market today bears little resemblance with the stock market before 1992.

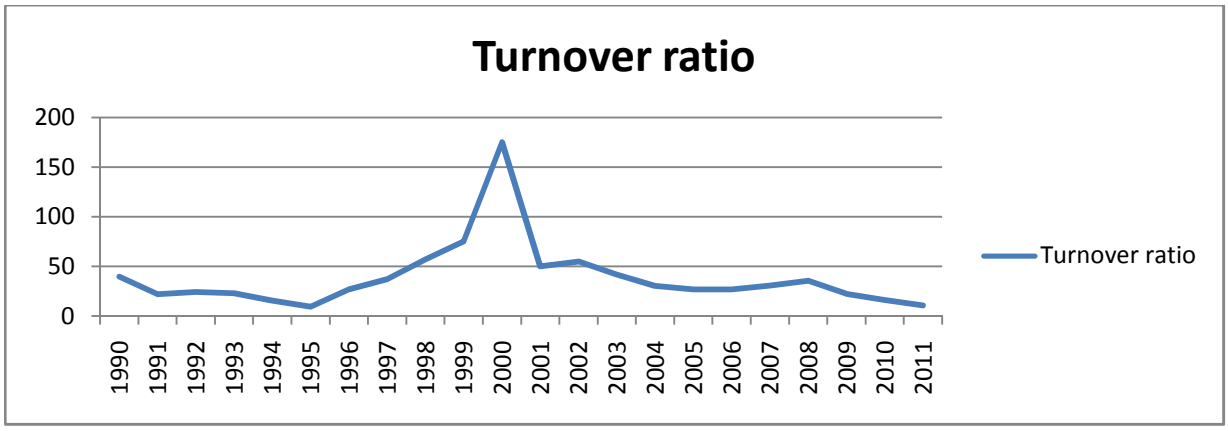
**National Stock Exchange, Mumbai (BSE)**

BSE has been selected as a representative sample of Indian stock market in this research study. As it is the first ever stock exchange in Asia established in 1875 & first in the country to be granted permanent recognition under securities contract Regulation act,1956.Today ,BSE is the worlds No.1 exchange in terms of the number of listed companies that is over 4900 (SEBI. Hand book of statistics). Historically an open outcry floor trading exchange, the Bombay Stock Exchange switched to an electronic trading system in 1995. This automated, screen-based trading platform called BSE On-line trading (BOLT) currently has a capacity of 8 million orders per day. The BSE has also introduced the world's first centralized exchange-based internet trading system. It is the worlds $5^{th}$ most active exchange in terms of No. of transactions handled through its electronic trading system (BOLT). Today, the stock exchange has been demutualised, and the voting and trading rights have been separated. The BSE is a dynamic and growing emerging share market with increasing number of publicly traded companies and strong foreign participation, it has facilitated the growth of the Indian corporate sector by providing it with an efficient capital raising platform.

**Indian stock market activity**

The activity of stock market can be fairly gauged by the ratio of its turnover to market capitalization, here it is calculated on the basis of average annual turnover to market capitalization of BSE.

*Figure 1.1*




*Source: Graphical analysis in Excel*

Based on Appendix-I & figure 1.1, the data suggest that Indian stock market had reached highest level of activity in the year 2000 as the turnover ratio touched the level of 174.96%, signifying robust investors confidence in that time period, then onwards Indian stock market failed to sustain such level of activity as the turnover ratio kept on declining with the drop in investors confidence in Indian stock market particularly retail investors.

**Indian stock market performance**

One can identify the booms and busts of Indian equity market through Sensex.As the oldest index in the country, it provides time series data over a fairly large period of time from (1979 onwards),since then the Sensex has become one of the most prominent brand in financial markets in India and abroad. The performance of Indian stock market during (1979-2011) has been analyzed in the Appendix-II. It is examined whether there has been a consistent increase in its performance on account of various policy initiatives taken by government of India like liberalization of the economy and allowing foreign institutional investors (FIIs), as it has broaden the investor base for Indian stock market.

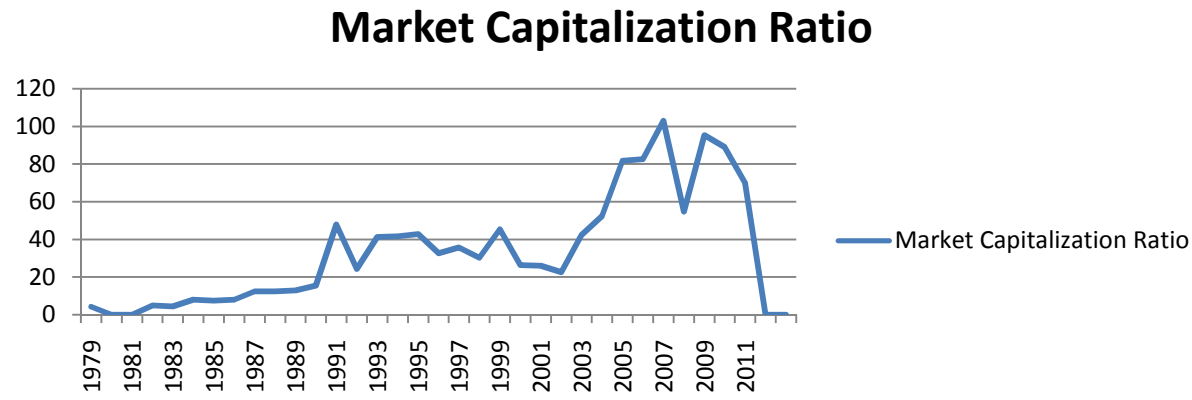
The figures in Appendix II reveals that the Indian stock market has very well reflected the changes in the structure of economy & any new policy initiative taken by touching new heights right form 1991 when Sensex touched 1879.51 points a change of 79.08% from the previous value then in 1994 Sensex gained 3974.91 points with a

gain of 37.13 % from previous value. In 1999 Sensex gained 4658.69 points amounting to an increase of 41.39 % from previous value thereafter showing a downward trend, from 2003 to 2007 growth in Sensex has consistent reflecting an increased participation & investor confidence. In 2008 due to global financial crises and flight of foreign institutional investors (FIIs) the Sensex has dropped to 12365.55 points a decrease of -25.37 % from the previous level, but has recovered from the crises well in 2009 by gaining 15585.21 points with an increase of 52.41% from the previous low of -25.37% thus reflecting rebuilding of faith & confidence of investors after financial turmoil of 2008.

**Indian stock market size**

The Indian stock market has grown in its size, as can be seen by the consistent increase in the market capitalization of BSE and measured by market capitalization ratio (MCR),the ratio is calculated by annual average stock market capitalization divided by GDP which measures the growth of market vis a vis to national income (Levine et.al ,1996),Berger (1995) stated that it is a measure of the extent of stock market development, i.e MCR represents total listed wealth of a country as a percentage of its GDP, as can be seen from the Appendix III.

*Figure 1.2*




*Source: Graphical analysis in Excel*

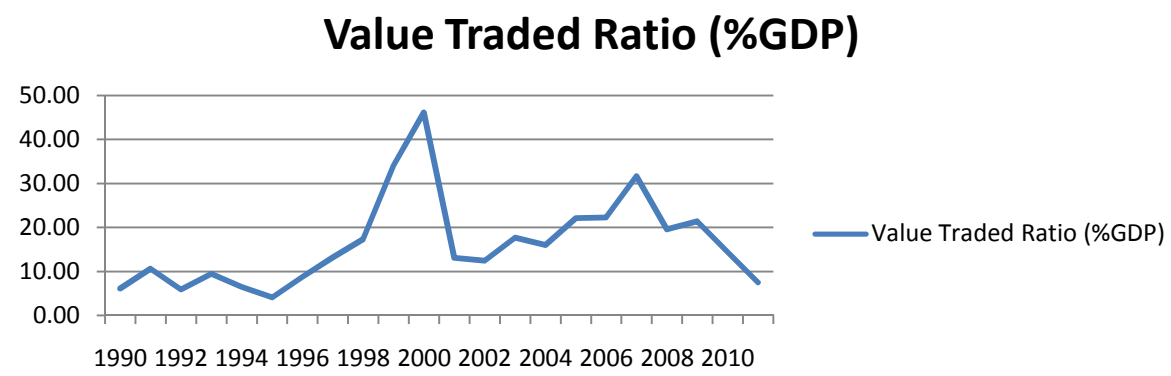
The data in Appendix III shows that stock market size as measured by market capitalization has grown by over 1000 times during the period of our study viz (1979-2011),whereas GDP has increased by less than 70 times over the same period. Market capitalization ratio has steadily increased up to over 47% in 1991 in early years of liberalization & declined to around 22.617 % in 2002 than again rose to 103% in 2007.The massive rise in 1990s in the activities of the stock market could be attributed to a larger participation by individuals, domestic and foreign institutional investors that were allowed to invest in the Indian stock market secondly more Indian companies started to access capital market through IPOs thirdly continuous rise in the valuation in the capital market due to bullish trend during 2001-2008.The figure 1.2 shows the trend and ups and downs along the path followed by market capitalization ratio that hasn't been smooth, specifically the financial crisis during 2008 has crashed the upward trend of market capitalization ratio & market capitalization of has become just above 54% of the country's GDP. upward trend of MCR & market capitalization of Indian stock market has crashed due to financial crisis of 2008

The significant impact of liberalization of Indian economy is apparent in the ratio of market capitalization to GDP which was upto 15% till 1990 and increased to 47% immediately after liberalization, remained around 50% in 2003.By the end of 2007 market capitalization has crossed the GDP by more than 100%.

**Indian stock Market Liquidity**

The success of any primary market can be assessed by the liquidity that the stock market provides to its investors, hence liquidity is always an important variable for the smooth functioning of stock market, a slight difference in the liquidity can translate into huge variation in pricing of securities, the indicator for measuring liquidity in any market is called value traded ratio, which is calculated as the ratio of the average annual turnover of shares to GDP. The turnover of Indian stock market as a percentage of GDP is given in the Appendix IV.

Figure 1.3




*Source: Graphical analysis in Excel*

The data in Appendix IV & figure 1.3 shows that value traded as a percentage of GDP increased from about 7% of GDP in 1990 to 46% of GDP in 2000,based on this the Indian stock market became much more liquid after 1997. initially it was very low after liberalization than 1997 onwards it has grown gradually as the new economic reforms were bearing results, the turnover in the market increased more than 17.522% from 1990 to 2011 due to increasing activities and participation in the market. The average value of value traded ratio during the study period viz.(1990-2011) is 16.372,thus liquidity of the stock market as an average has not increased consistently & it has remained less liquid in relation to the growth in market size.

**Comparative analysis between Value traded ratio & Turnover ratio**

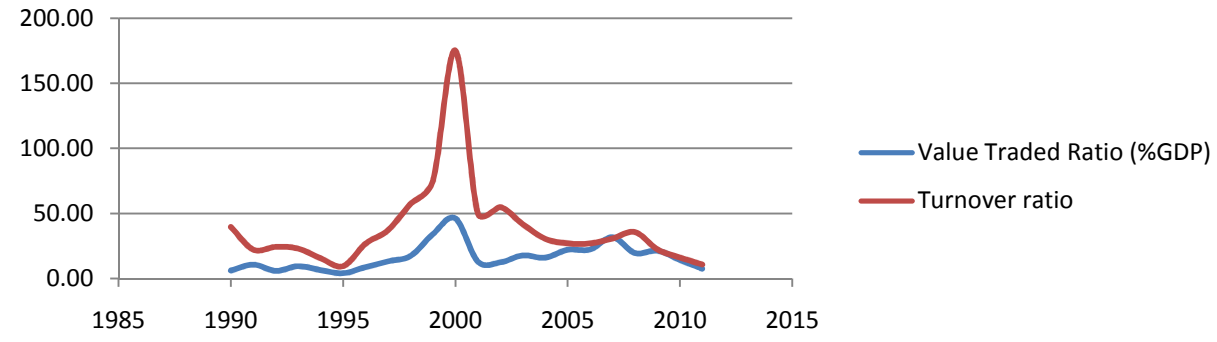
Table 1.2

| **Year** | **Value Traded Ratio (%GDP)** | **Turnover ratio** |
|---|---|---|
| 1990 | 6.14 | 39.64 |
| 1991 | 10.65 | 22.20 |
| 1992 | 5.90 | 24.29 |
| 1993 | 9.48 | 22.97 |

| | | |
|---|---|---|
| 1994 | 6.48 | 15.56 |
| 1995 | 4.08 | 9.51 |
| 1996 | 8.76 | 26.79 |
| 1997 | 13.21 | 37.06 |
| 1998 | 17.30 | 57.21 |
| 1999 | 34.04 | 75.04 |
| 2000 | 46.11 | 174.97 |
| 2001 | 13.09 | 50.19 |
| 2002 | 12.41 | 54.89 |
| 2003 | 17.71 | 41.84 |
| 2004 | 16.00 | 30.54 |
| 2005 | 22.10 | 27.00 |
| 2006 | 22.26 | 26.97 |
| 2007 | 31.66 | 30.73 |
| 2008 | 19.54 | 35.65 |
| 2009 | 21.35 | 22.37 |
| 2010 | 14.38 | 16.14 |
| 2011 | 7.53 | 10.74 |

*Source: Analysis in Excel*

Figure 1.4




*Source: Graphical analysis in Excel*

The table 1.2 & figure 1.4 shows the liquidity level vis a vis to stock market activity gauged by the turnover ratio, based on these ratios and graph, it can be said that as the Indian stock market became more and more liquid the market activity (Number of transactions) kept on increasing, which was highest in the year 2000 as the respective ratios for liquidity (46.1)% and for market activity it was (175)% .

**Macro Economic variables & Stock prices.**

The implementation of various reforms and regulatory measures including a number of structural and institutional changes in the different segments have brought about a dramatic change in architecture of the Indian economy, Correspondingly, researches are also being conducted to understand the interaction and relationship if any between the macro-economic variables that represent fundamentals of any economy and the stock market returns that reflect the soundness and efficiency of financial markets. The study on stock markets vis a vis to macroeconomic variables has come to the fore since this is the most sensitive segment of any developed and emerging economy and thus the financial analysts and policy makers in any country want to learn about the behavior of the stock market and more importantly, discover how the behavior of the stock markets is linked to the economy. In fact, this type of information can be used to predict the path of an economy's growth & to update market rules & regulation (Krainer,2002;Poon,2003).

Theoretically, the stock prices are generally believed to be determined by some fundamental macroeconomic variables. Among these theories are the Efficient market hypothesis and Asset pricing theories. Efficient Market Hypothesis suggest that all information known by market participants is already included in stock prices developed by Fama,(1965).Therefore, the current market price of an individual stock or for that matter market index portrays all information available at a point of time i.e the prices represent the properties of a random walk, which suggest that there is no predictable pattern in daily prices. Prices change depending on the daily social,economic,political news and happenings etc. In other words an efficient stock

market instantaneously reflects all available information about macroeconomic variables. As such, small investors and institutional investors are not able to develop trading strategies to beat market or may not consistently earn higher than normal returns. Therefore, it is said that, in an informationally efficient market, levels of economic activity are not useful in predicting stock prices. Than there are asset pricing theories, which deal in share pricing perspective in which few leading theories are Dividend Discount Model (DDM) that suggests macroeconomic variables have systematic influences on share prices through the impact on future dividends and the discount rate, based on this model Chen et al.(1986) have found that industrial production growth rates, term spread, yield spread expected and unexpected inflation rate, significantly impacted on US stock returns. Arbitrage Pricing Theory is used as framework to study the effects of macroeconomic factors on stock prices developed by Ross,(1976) there is also Shape's (1964) capital asset pricing model (CAPM) which concentrates on a single macroeconomic factor.

All this implies that stock markets have a significant relationship with the economy the knowledge of such relationship is now becoming more important in view of various economic reforms and economic crisis that are frequently taking place all around the world. Besides this, the markets have changed overtime earlier stock market participants were primarily individual investors, now participation is mostly by institutional investors (Yaes and Bechhoefer,1989).

Various macroeconomic variables have been included in models of stock market behavior, among which money supply,inflation,interest rates, exchanges rates, national income are mostly used. Interesting results are emerging particularly from the emerging economies where the markets are experiencing new relationships which were not perceived earlier as these are high beta financial markets with low level of integration with the economic activities compared to that of developed markets. The present study is an endeavor to analyses the relationship between stock prices and macroeconomic variables in India with implications on efficiency of stock markets, as is often being stated in technical terms, " if, lagged changes in some economic variables cause variations in stock prices and past fluctuations in stock prices cause

variations in the economic variable, then bi-directional causality in implied between the two series. This behavior indicates stock market inefficiency, In contrast, if changes in the economic variable neither influence nor are influenced by stock price fluctuations, then the two series are independent of each other and the market is informationally efficient" (Basabi et.al,2002).

The findings of these empirical analysis are important as informational inefficiency in stock market implies on the one hand, that market participants are able to develop profitable trading rules, and on the other hand, that the stock market is not likely to play an effective role in channeling financial resources to the most productive sectors of the economy.

As both macroeconomic variables and stock market prices are important indicators of economy-wide performance, much attention has been given to understand the operations and linkages between them. Specifically, several studies have focused on the relationship between them as macroeconomic factors as control variables of stock movement. Their results support both type of the evidences (a) that macroeconomic variables and stock prices are weakly correlated to each other, which implies that macroeconomic variables are not useful tools to predict stock market movements (b) macroeconomic variables and stock prices are strongly correlated to each other, implying that macroeconomic variables are useful tools to predict stock market movements. On the contrary, A few theories have also been put forward by various economists who suggest that stock markets cause macroeconomic variables movements based on the life cycle theory (Life Cycle Hypothesis),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 aggregate consumption. Similarly, the relationship between stock prices and investment spending is based on the Q theory by James Tobin (1969),where q is ration of total market value of firms to the replacement cost of their existing capital stock at current stock prices.).None of these theories seem to 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.

Keeping this in view, the present study has been conducted under the following chapter scheme:

1.Introduction
2.Review of Literature
3.Objecties & Methodology
4.Growth of Indian Stock Market
5.Relationship between Macroeconomic Variables & Stock Prices
6.Conclusion & Policy Implications.

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## Chapter II
## Literature Review

Studies on the relationship between macroeconomic variables and stock prices have been going on for quite sometime now, thereupon giving rise to a new subject namely financial economics. Amongst the various macroeconomic variables, the relationship between money supply and stock prices has been extensively studied because of the belief that changes in money supply have direct effects on economic activities, thereby casting indirect influence on stock prices. The significance of other macroeconomic variables apart for money supply has been pointed out by Fama (1981).His research revealed that there is a strong relationship between stock returns with other macroeconomic variables, like inflation and GDP as well as industrial production. Inspite of the exhaustive research in this subject, the exact nature of the relationship between macroeconomic variables and stock prices remain ambiguous. The main purpose of this research is to complement the existing literature on the stock market & macroeconomic factors empirically by analyzing whether the stock markets in India are informationally efficient or inefficient. The various researches conducted so far in India and abroad are broadly categorized as :

i. Studies related to Developed economies
ii. Studies related to Emerging economies

and the same are discussed as follows:-

### (i) Studies related to Developed Economies.

Chen, Roll and Ross (1986) was the first study to select macroeconomic variables to estimate U.S. stock returns and apply the APT models. They employed seven macroeconomic variables, namely: term structure, industrial production, risk premium, inflation, market return, consumption and oil prices in the period of Jan 1953-Nov 1984. In their research, they found a strong relationship between the macroeconomic variables and the expected stock returns during the tested period. They note that industrial production, changes in risk premium, twists in the yield curve, measure of unanticipated inflation of changes in expected inflation during periods when these variables are highly volatile, are significant explaining expected returns. They found that consumption, oil prices and market index are not priced by the financial market. They conclude asset prices react sensitively to economic news, especially to unanticipated news.

Burmeister and Wall (1986) continued down a similar path of research laid down by Chen, Roll and Ross (1986). Having conducted previous research suggest that the variability of stock returns could be explained by unanticipated changes in certain macroeconomic variables mainly: unanticipated change in term structure, unanticipated change in inflation, unanticipated change in the risk premium and unanticipated change in asset return but they suggest more research was needed.

For Japanese stock market, Hamao (1988) replicated the Chen, Roll and Ross (1986) study in the multi-factor Arbitrage Pricing Theory framework. He put on view that the stock returns are significantly influenced by the changes in expected inflation and the unexpected changes in both the risk premium and the slope of the term structure of interest rates.

Hashemzadeh and Taylor (1988) investigated the relationships between the S&P 500, the money supply (M1), and the return on U.S. Treasury bills. While conducting Granger-Sims's causality tests (1969; 1972) using weekly U.S. data covering the week ending January 2, 1980 to July 4, 1986, they concluded that U.S. Treasury bills and M1 are not highly successful in predicting U.S. stock prices. Thereby implying that U.S. stock prices incorporate all information available in the capital markets.

Schwert (1989) studied the relationship between the US stock market and macroeconomic volatility, stock trading activity using monthly data form 1857 to 1987.He concluded that macroeconomic volatility, as measured by changes in real output and inflation did not help to predict stock and bond return volatility.The study being one of the pioneering work supported the claim that the prices of financial assets should react quickly to new information about economic events.

Brown and Otsuki (1990) with the help of APT explore the effects of the money supply, a production index, crude oil price, exchange rates, call money rates, and a residual market error on the Japanese stock market. They observe that these factors are associated with significant risk premium in Japanese equities.

Darrat (1990) employed Akaike's final prediction error (FPE) criteria in conjunction with multivariate Granger causality tests to examine whether changes in Canadian stock returns are predicted by several economic variables including the money base, interest rates, interest rate volatility, real income, inflation, exchange rates, and fiscal deficits. The empirical study used monthly data from January 1972 to February 1987. Results indicated that current stock prices in Canada fully incorporate all available information from monetary policy instruments, and that stock returns are Granger-caused by lagged changes in fiscal deficits. This conclusion held even when interest rates, interest rate volatility, real income, inflation, monetary policy, and exchange rates are excluded from the estimation. Under the assumption of constant expected stock returns, such findings appear inconsistent with the stock market efficiency hypothesis.

Poon and Taylor (1991) parallel the Chen, Roll and Ross (1986) study on the United Kingdom market. Their results show that macroeconomic variables do not appear to affect share returns in the United Kingdom as they do in the U.S. They suggest that either different macroeconomic factor have an influence on share returns in the United Kingdom or the methodology employed by Chen, Roll and Ross (1986) is inefficient.

Malliaris and Urrutia (1991) explored the relationship between industrial production (IP), the money supply (M1), and the S&P 500, using U.S. monthly data from January 1970 to June 1989. Based on the Granger causality tests, the authors concluded that: (i) there is a causal relationship between M1 and the S&P 500 where M1 seems to lead the S&P 500, and (ii) the S&P 500 appears to affect IP. These findings confirmed that the stock return's fluctuations were a leading indicator of future real economic activity. However, the causal relationships among IP, M1, and the S&P 500 were not statistically significant.

Najand and Rahman (1991) used the GARCH model to examine the effect of the volatility of macroeconomic variables on stock return volatility for the U.S., Germany, UK, and Canada. The macroeconomic variables included in the analysis were the actual volatility of real output, the interest rate, inflation, and monetary base. From their empirical analyses of 309 monthly observations between January 1962 and September 1987, the authors provided support for existing relationships between the volatility of stock returns and the volatility of macroeconomic variables.

Abdullah and Hayworth (1993) studied seven macroeconomic variables to analyse monthly volatility of stock returns in the U.S. stock market using a vector Autoregressions, Granger causality tests, and impulse response analysis. The macroeconomic variables were M1, budget deficits, trade deficits, inflation, IP, short-term interest rates, and the S&P 500. The results indicated that money growth, budget deficits, trade deficits, inflation, and both short-term and long-term interest rates Granger-cause stock returns. Study also revealed that, stock returns were positively related to inflation and money growth, but, consistent with economic theory, stock returns were negatively related to budget deficits, trade deficits, and both short-term and long-term interest rates.

Dhakal, Kandil, and Subhash (1993) analysed the links between five macroeconomic variables: the money supply, the short-term interest rate, the price level, real output, and share prices in the U.S. stock market from 1973 to 1991. It was argued that this study was of particular interest to policymakers to understand share market volatility. The results of the VAR test indicated that changes in the money supply have direct significant impacts on share price changes, and indirect impacts on share prices through the effect on the interest rate and the inflation rate. The results also suggested that share price volatility causes real output fluctuations, which is a relationship that monetary policy had not previously considered.

Serletis (1993) explored the linkage between eight different measures of the money supply and the S&P 500 using monthly data from January 1970 to May 1988. The author concluded that the U.S. stock market satisfied the efficient market hypothesis (EMH) since the S&P 500 did not cointegrate with any of the eight money supplies during the sample period.

Thornton (1993) studied the linkage between stock prices in the UK, namely the Financial Times Stock Exchange 100 index (FTSE 100), and real GDP and two definitions of the money supply - the monetary base (M0) and the broadest definition

of the money supply (M5) - using quarterly data from 1963 to 1990. The results suggest that linkage among real and monetary variables in the UK was not statistically significant in contrast to the literature on the US economy.

Clare and Thomas (1994) investigate the effect of 18 macroeconomic factors on stock returns in the U.K. They find oil prices, retail price index, bank lending and corporate default risk to be important risk factors for the U.K. stock returns. Priestley (1996) prespecified the factors that may carry a risk premium in the U.K. stock market. Seven macroeconomic and financial factors; namely default risk, industrial production, exchange rate, retail sales, money supply unexpected inflation, change in expected inflation, terms structure of interest rates, commodity prices and market portfolio. For the APT model, with the factor generating from the rate of change approach all factors are significant.

Kim and Moreno (1994) investigated whether stock price movements contributed to fluctuations in bank lending in Japan over January 1970 to May 1993 using a VAR model. Three important results were found in their study. First, the response of Japanese bank lending to an increase in stock prices was positive in two subsamples (Jan. 1970 to Dec. 1983, and Jan. 1984 to May, 1993). Second, fluctuations in bank lending in Japan contributed significantly to fluctuations in the Nikkei stock price. In particular, the Nikkei stock price played an important role in accounting for the recent sluggish growth in lending in Japan. Lastly, the historical relationship between stock prices and bank lending was not steady over the whole period. That is, until the mid 1980s the relationship was weak but became significant after the mid-1980's for which the reasons were not studied.

Mukherjee and Naka (1995) examined the impact of six macroeconomic variables on the Japanese stock market by employing Johansen's (1991) vector error correction model (VECM). The six variables were the exchange rate, inflation, the money supply, IP, the long-term government bond rate, the call money rate, and the Tokyo Stock Exchange index. The results indicated that these variables were integrated with stock prices for the whole sample period spanning from January 1971 to December 1990.

Liljeblom and Stenius (1997) observed the linkage between stock market volatility and a set of macroeconomic variables in Finland's economy. Macroeconomic variables included in the analysis were industrial production, the money supply (M2), the CPI, and a trade variable(ratio of export price index divided by the import price index). They examined a 71 year time period from 1920 to 1991. With the exception of the growth of stock market trading volume, the authors concluded that the VAR estimates indicated predictive power in both directions: from stock market volatility to macroeconomic volatility and from macroeconomic volatility to stock market volatility.

Abdullah (1998) analyzed the effects of six macroeconomic variable changes on UK stock returns, The macroeconomic variables were M1, budget deficits and surpluses,

IP, the consumer price index (CPI), and a long term interest rate. The results suggested that money growth variability accounts for 23% (approx)of the variance in interest rates and 20% (approx).of the stock returns, respectively. Therefore, money growth variability contributed to the uncertainty associated with returns on investments in stocks and other financial assets. The other variables included in the model were statistically significant in explaining the variance of UK stock returns.

Thornton (1998) observed the long and short run dynamic relationships between real M1, real income, interest rates, and real stock prices in Germany for 1960 to 1989 by employing cointegration test and Granger-causality tests. The results of the study indicated that: real stock prices have a significant and positive wealth effect on the long-run demand for M1; and there was a unidirectional Granger-causality effect from interest rates to real stock prices.

Yin Wong et.al (1998) the study explores long-term stock co movements linked to similar co movements in macroeconomic variables. Including the money supply, dividends and industrial production. the analysis suggests that the long-term co movements in stock prices can be partly attributable to those in the macroeconomic variables among the EMS (European Monetary System) countries.

Li Li et.al (1998) employed the daily returns of the Dow Jones Industrial Index, The S&P 500 index, the Russell 1000 index and Russell 2000 index to examine stock market reactions to macroeconomic announcements, of money supply, inflation employment housing starts, trade balance etc all showed significant impact on stock prices.

Kapital (1998) employed the GARCH-X model to study the volatility in the U.S. stock market and a set of macroeconomic fundamentals such as the money supply, the exchange rate, income, consumer prices, and real oil prices. This study used monthly data from January 1978 to December 1996. Based on his findings, the macroeconomic variables had a significant and positive effect on the volatility of the U.S. stock market.

Darrat and Dickens (1999) employed multivariate cointegration and error-correction models. Consistent with theory, but contradicting Malliaris and Urrutia's (1991) findings, Darrat and Dickens found strong evidence that IP, M1, and the S&P 500 were integrated and found causal interrelationships between these variables. Darrat and Dickens' results indicated that the stock market was a key leading indicator of monetary policy and real economic activity. These interrelationships were strengthened when inflation and interest rates were included in the model.

Sadorsky (1999) examined the price of oil shocks, IP, and the interest rate on U.S. stock market returns using monthly data from January 1947 to April 1996. Results from the VAR approach suggested that positive oil shocks depress real stock returns, while stock returns have a positive impact on interest rates and IP. besides, this study revealed that the effect of the price of oil on U.S. stock market returns was not

constant over time, compared to the effect of interest rate changes, and that oil price movements explain a large portion of the forecast error variance in real stock returns, particularly after 1986.

Gjerde and Saettem (1999) investigated the relationship between stock market returns and a set of macroeconomic variables in the small open economy of Norway. The set of variables consisted of interest rates, inflation, IP, consumption, the OECD industrial production index, the foreign exchange rate, and the price of oil by using a VAR model and monthly data from 1974 to 1994.They found several significant links between stock market returns and the investigated macroeconomic variable, changes in the real interest rate affected both stock returns and inflation, and the stock market responded significantly to the price of oil changes.

Hondroyiannis and Papapetrou (2001) using a multivariate vector autoregressive VAR model to examine monthly data from January 1984 to September 1999 they investigated the dynamic relationships in the Greek economy between stock returns and a set of macroeconomic indicators consisting of IP, interest rates, exchange rates, real foreign stock returns as represented by the S&P 500, and real oil prices.the results from their study suggested that stock returns did not lead changes in real economic activity, and macroeconomic activity and foreign stock market changes only partially explained stock market movements. The price of oil changes, however, explained stock price movements and had a negative impact on macroeconomic activity.

Chaudhuri and Smiles (2004) there analysis used quarterly data from 1960 to 1998 and applying Johansen's (1990) methodology, impulse response function analysis and forecast error variance decomposition analysis to examine the relationship between the Australian real stock price index and broad money supply (M3), GDP, private personal consumption expenditures, and the world oil price index.. The study showed evidence of a long-run relationship between all variables. However, IRF and VDC analyses revealed weak evidence for the relationship between the Australian real stock price index and all variables included in the analysis.

Maysami et al. (2004) using monthly data from January 1989 to December 2001 to examine the relationship between Singapore's composite stock index, three Singapore sector indexes (the finance index, the property index, and the hotel index), and a set of macroeconomic variables. These variables are the CPI, IP, proxies for long and short-run interest rates, the money supply (M2), and exchange rates. Based on the results of Johansen's cointegration test,the Singapore stock market and property index showed a significant long-run relationship with all macroeconomic variables included in the analysis. On the other hand, the finance sector index indicated a significant relationship with all macroeconomic variables included in the analysis with the exception of real economic activity, and the money supply. Also, the hotel index showed no significant relationship with the money supply and short and long term interest rates but significant relationships with all macroeconomic variables included in the analysis. These results questioned the efficiency of Singapore's market in the

sense that stock prices do not incorporate all information available in the market promptly.

Gan et al. (2006) applying various tests like Johansen's (1990) cointegration approach, Granger causality tests, and impulse response analysis to determine whether the New Zealand Stock Index is a leading indicator for a set of seven macroeconomic variables that include M1, the short term interest rate, the long term interest rate, the inflation rate, the CPI, exchange rates, GDP, and the domestic retail the price of oil. This research was conducted using monthly data from January 1990 to January 2003. Results from the study suggested that a relationship exists between New Zealand's stock index and all seven examined macroeconomic variables.

Patra et al.(2006) while applying different econometric approaches and using monthly data from 1990 to 1999 to examine the relationship between the Greek price index and a set of macroeconomic variables including the money supply, inflation, the exchange rate, and trading volume. Based on the results from these different techniques, all of the investigated variables except the exchange rate consistently exhibit both short and long run relationships with stock prices. These findings suggested that the Greek stock market was informationally inefficient during this time period.

Humpe et.al (2007) examine whether a number of macroeconomic variables influence stock prices in the US and Japan. A co integration analysis was applied in order to model the long term relationship between industrial production, the consumer price index, money supply, long term interest rates and stock prices in the US and Japan. For the US the results were consistent with a single co integrating vector, where stock prices are positively related to industrial production and negatively related to both the consumer price index and a long term interest rate. They also find an insignificant (although positive) relationship exists between US stock prices and the money supply. However, for the Japanese data they have found two co integrating vectors. One vector was that stock prices are influenced positively by industrial production and negatively by the money supply. For the second co integrating vector it was found that industrial production to be negatively influenced by the consumer price index and a long term interest rate. These contrasting results were due to the slump in the Japanese economy during the 1990s.

Ratanapakorn and Sharma (2007) consistent with the findings of Abdullah et al (1993) investigated the long and short run relationships between the S&P 500 and six macroeconomic variables using monthly data from January 1975 to April 1999. The study observed that the stock prices were negatively related to the long-term interest rate, but were positively related to the money supply, IP, inflation, the exchange rate, and the short-term interest rate.

Malik and Hammoudeh (2007) examined the volatility and shock transmission mechanism among U.S. equities, global crude oil market, and the equity markets of

Saudi Arabia, Kuwait, and Bahrain. In this study, a multivariate-GARCH model was used to analyze daily data from February 14, 1994 to December 25, 2001. The results indicated that the equity markets of Saudi Arabia, Kuwait, and Bahrain were affected by the world oil market volatility. However, significant volatility spilled over from the Saudi market to the oil market. Additional findings indicated that shocks in the US equity market indirectly affected volatility in the three Gulf stock markets, emphasizing the important link between investments made by Gulf investors in the U.S. and in each of the three Gulf stock markets.

Rahman and Mustafa (2008) explored the impact of the broad money supply (M2) and the price of oil on the S&P 500 the using monthly data from January 1974 to April 2006. The results provided support in favor of the three variables being cointegrated. The vector error-correction model revealed no causal relationships in the long run.Besides this the results indicated that the current volatility of the U.S. stock market was fueled by its past volatility, and negative monetary and oil price shocks initially depressed the U.S. stock market.

Leon (2008) examined the effects of interest rate changes on stock market return volatility in the Korean economy using weekly return data from January 31, 1992 to October 16, 1998. By applying two GARCH (1,1) models: one without interest rates, and another one with interest rates in both the conditional mean and variance. Consistent with results for the U.S. stock market, the results indicated that the conditional market returns have a significantly negative relationship with the interest rates. In addition to this,the conditional variance had a positive, but insignificant relationship with the interest rates compared to the findings documented in the U.S. market. Results from the study indicate that interest rates have strong predictive power for stock returns in Korea, but weak predictive power for volatility. On the basis of these findings, investors in the Korean stock market should adjust their portfolios in response to changes in monetary policy.

Abdel mounaim (2009) examines the influence of US and Canadian macroeconomic fundamentals on Canadian stock prices allowing for different associations across the US business cycle. The study uses Johansen's multivariate co integration test and vector error correction model (VECM) to examine the long and short-run association. Results show evidence of a long run association between Canadian stock prices, US stock prices and Canadian as well as US fundamentals.

Chan et.al (2011) examine the relationship between tourism stock prices and macroeconomic factors in New Zealand using co integration analysis and Vector Error Correction Model (VECM). The former establishes the long run relationships between stock prices and macroeconomic factors and the latter identifies the short run dynamics between prices and macroeconomic variables. Interestingly, the specification of VECM in this context is also closely related to empirical models implied by the Asset Pricing Theory (APT).

### (ii) Studies Related to Emerging Economies

For the developing countries,Fung et.al (1990) showed that Taiwan's stock market is closely related with money supply which is further supported by Lin (1993) who found that the growth in money supply can be used to predict the Stock prices.Lin's work also pointed out that both the Korean and Singapore markets are closely related with money supply but with a different result. In another study Ho(1983) found that money supply is a useful information in predicting stock markets in Hong Kong, Philippines and Thailand.

Bailey and Chung (1996), examine the impact of macroeconomic risks on the equity market of the Philippines. Findings of the study show that, financial fluctuations, exchange rate movements and political changes on owners of Philippine equities cannot explain Philippine stock returns.

Abdalla and Murinde (1997) foud out that the results for India,Pakistan and Korea suggest that exchange rates influence stock prices, which is consistent with earlier study by Aggarwal (1981).This is also consistent with Smith's (1992) finding that stock returns have a significant influence on exchange rate in Germany,US and Japan.

Ibrahim (1999) investigated the linkages between Malaysian stock prices and seven macroeconomic variables, including the narrow and broad money supplies (M1 & M2), IP, the CPI, domestic credit, foreign reserves, and the exchange rate. Applying Cointegration and Granger causality tests with monthly data from January 1977 to June 1996 were used. The results revealed that the Malaysian stock market is informationally inefficient with respect to consumer prices, official reserves, and the domestic credit aggregates. This study also provided evidence that stock prices are Granger-caused by changes in official reserves and exchange rates in the short run. With respect to M2 and Malaysian stock price were cointegrated, and there was no long-run relationship between stock prices and M1.

Chowhad et.al (2000) have tried to fetch reasons for turbulence in stock market in india taking into account sensex .They have tried to find that how sensex which stood at 2761 on 21$^{st}$ oct 1998 rose to 6000 in Feburary 2000 (approx 117%) increase 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.As it hasn 't been found in the results of any study in India or abroad that economic factors can support such a spike in stock price.

Pethe and Karnik (2000) has investigated the inter-relationships between stock prices and variables viz, exchange rate,prime lending rate,narrow money,industrial production using data form 1992-1997 and employing error correction framework the study holds the view that the state of economy affects stock prices.

Niarchos and Alexakis (2000) investigated whether it is possible to predict stock market prices with the use of macroeconomic variables in the Athens Stock Exchange.

Macroeconomic variables include inflation, money supply and exchange rate. The time period under investigation was from January 1984 to December 1994 on a monthly basis. The statistical evidence suggests that monthly stock prices in the Athens Stock Exchange are positively correlated to those variables.

Maysami and Koh (2000) tested the relationships between the Singapore stock index and selected macroeconomic variables over a seven-year period from 1988 to 1995 and they found that there existed a positive relationship between stock returns and changes in money supply but negative relationships between stock returns with changes in price levels, short- and long-term interest rates and exchange rates. Furthermore, they noted that changes in interest and exchange rates contributed significantly to the co-integrating relationship while changes in price levels and money supply did not. They argued that such findings were consistent with the Singapore economy in which price stability was the ultimate macroeconomic objective. Their findings seemed to suggest that the Singapore stock market was different from large economies such as US and Japan where real economic activities were significant in explaining stock returns..

Chankradhara and Kamaiah (2001) investigated interaction among monetary policy,inflation,GDP and stock returns in post liberalization period,using VAR approach the findings reveal that inflation and real economic activity do affect stock returns while monetary policy and loses its explanatory power when inflation and real activity are present in the econometric model.

Muradoglu et al. (2000) considered 19 emerging markets from all over the world. The study investigated possible causality relationships between the 19 emerging stock markets returns and other macroeconomic variables; i.e., exchange rates, interest rates, inflation, and IP using monthly data from 1976 to 1997. The results revealed that the relationship between stock returns and the macroeconomic variables mainly depend on the size of the stock markets and their integration with world markets.

Muradoglu and Argac (2001) investigated the links between Turkish stock market returns and three variables viz, interest rate, the money supply, and the foreign exchange rate, during the period from 1988 to 1995. The three monetary variables were found to not be linked with stock prices during the sample period for the some exogenous factors.

Wongbangpo and Sharma (2002).analyzed monthly data from 1985 to 1996 in this study and few macroeconomic variables like GNP, the consumer price index, the money supply, the interest rate, and the exchange rate for the five countries. Their results showed that high inflation in Indonesia and Philippines influences the long-run negative relation between stock prices and the money supply, while the money growth in Malaysia, Singapore, and Thailand induces the positive effect for their stock markets. The exchange rate variable is positively related to stock prices in Indonesia, Malaysia, and Philippines, yet negatively related in Singapore and Thailand.

Wenshwo (2002) investigated the impact of currency depreciation on stock returns and its volatility in the five Far East Asian economies of Hong Kong, Singapore, South Korea, Taiwan, and Thailand during the Asian crisis (1997-1999). Based on the GARCH model, this study provided strong evidence indicating that currency depreciation adversely affected stock returns and/or increased market volatility during the Asian crisis. From his finding, Wenshwo suggested that international investors and fund managers planning to invest in Far East markets should evaluate the stability of foreign exchange markets before taking action.

Maghayereh (2003) examined the link between the Jordanian stock index and a set of macroeconomic variables: M1, interest rates, domestic exports, foreign reserves, inflation, and IP. The cointegration test and the vector error correction model that he employed indicated that the Jordanian stock price index was cointegrated with all the sample macroeconomic variables. Thereby concluding that, all the variables were significant in predicting changes in stock prices, which suggests that the Jordanian capital market violated the theory of market efficiency from January 1987 to December 2000.

Gunasekarage et al. (2004) investigated the relationship between a set of macroeconomic variables and the stock market index in the Sri Lanka. The money supply, the Treasury bill rate , the CPI, and the exchange rate were the macroeconomic variables. using monthly data from 1985 to 2001 and applying cointegration approach, IRFs analysis, and FEVD analysis yielded three results. First, the lagged values of the money supply and the Treasury bill rate had a significant influence on the stock market. Second, the All Share Price Index did not have any influence on the money supply, but it did influence the Treasury bill rate. Finally, both VDC and IRF explained only a little of the forecast variance error for the market index, and these effects did not persist for long period.

Wong et al. (2005) examined the short- and long-term equilibrium relationships between the major stock indices and selected macroeconomic variables of Singapore and US by employing co-integration and Granger causality over a period of twenty years from 1982 to 2002. They found that Singapore's stock prices generally display long-run equilibrium relationships with interest rates and money supply while the US stock market did not. However, when they examined the short-run equilibrium by dividing the entire time period into three sub-periods, they found that Singapore stock market was co-integrated with interest rates and money supply before 1997 Asian financial crisis. Interestingly, this relationship weakened after the crisis and they suggested that it could be due to the monetary authority's response to the asset price turbulence to maintain price stability. They also suggested that the market could have become more efficient after the Asian financial crisis, leading to reduced informational inefficiency.

Sarkar (2005) has examined the relation between growth and capital accumulation in case of India during 1950-2005 using stock prices and GDP,Industrial

production,number of listed companies in stock market the results reveal no positive relationship.

Ibrahim (2006) using quarterly data from January 1978 to February 1998, and employing VAR analysed the linkages between bank loans and stock prices in Malaysia. The VAR model included four other variables namely interest rates, output, the exchange rate, and the price level. The results revealed that bank loans reacted positively to an increase in stock prices, but the converse is not true. The results give an indication that the health of the banking sector may significantly depend on stock market stability. Hence, bank loans may be an inefficient way to boost stock market activities and expand real activities.

Tan, et.al (2006) examined the links between macroeconomic variables and the Malaysian stock indices (Kuala Lumpur Composite Index) during the period of 1996-2005. They found that the inflation rate, industrial production, crude oil price and Treasury Bills' rate have long-run relation with Malaysian stock market. Results indicate that consumer price index, industrial production index, crude oil price and treasury bills are significantly and negatively related to the Kuala Lumpur Composite Index in the long run, except industrial production index coupled with a positive coefficient.Similar results were found by Hussian (2006) by studying pre & post liberalization scenario in Pakistan form 1959-2005 while employing different techiniques.

Raman (2006) examine for India the causal relationships between the share price index and industrial production in a multivariate vector error correction model which involved certain other crucial macroeconomic variables namely money supply, credit to the private sector, exchange rate, wholesale price index, and money market rate for the reason of right and robust model specification. The study reports causality running from economic growth proxy by industrial production to share price index and not the other way round. It may therefore be stated that the state of the economy has a bearing on the share prices but the health of the stock market in the sense of a rising share price index is not reflective of an improvement in the health of the economy.

Hammoudeh and Choi (2006) investigated the linkages of three global factors, the price of oil, the S&P 500, and the U.S. T-bill rate, with the Gulf Cooperation Council's (GCC) stock markets. A VECM model as well as IRFs and VDC analyses were used in the study with weekly data from February 15, 1994 to December 28, 2004. Based on the results, the U.S. T-bill rate had a direct influence on some of the GCC markets. The S&P 500 and the Western Texas Intermediate (WTI), or the Brent oil price, did not have such a direct impact, implying that local factors such as liquidity, Financial soundness and profitability may be more important for explaining the behavior of GCC markets than the international factors. Besides this,the FVDC analysis indicated that the largest portion of total variations in the GCC index returns was attributed to their own domestic or other GCC shocks over the forecast horizon with only two exceptions: the Oman's and Saudi stock markets where the price of oil explained about 30% and 19% of the variations of the market, respectively.

Ahmed (2008) while using quarterly data investigated the nature of the long and short run relationships between Indian stock prices and a set of macroeconomic variables over the period March 1995 to March 2007. These variables were the money supply, interest rates, IP, exports, foreign direct investment, exchange rates, the primary stock index of the National Stock Exchange (NSE) in India, and the Bombay Stock Exchange (BSE) index. Employing various models like Johansen's (1990) approach, the causality test of Toda and Yamamoto (1995), FEVD analysis, and IRFs for analysis. The study revealed that a long run relationship between stock prices and money supply existed. However, the same relationship did not exist for the interest rate with stock prices.

Zafar et al. (2008) observed the effects of changes in the interest rate on the volatility of Karachi stock returns. Similar to Léon's (2008) approach, Zafar et al. estimated two distinct GARCH (1,1) models; one without interest rates and the other with interest rates to estimate the conditional mean and variance for monthly data for the period from January 2002 to June 2006. For both models, the conditional market returns and variance parameters were very similar to each other. They found that the, conditional market returns had a negative significant relationship with interest rates, indicating that it was easy to predict the stock returns by analyzing interest rates. However, the conditional variance had an insignificant negative relationship with interest rates and was a weak predictor for its volatility. These results, indicate that when interest rates increase, people tend to deposit their savings in bank accounts rather than investing in the stock market. That is, higher interest rates reduce the profitability of firms, and hence, stock prices go down. Zafar et al. suggested that policymakers should carefully consider these linkages when making any intervention in the stock market and overall investments policy in the economy.

Kandir (2008) examined the role of seven macroeconomic factors in explaining Turkish stock returns in the period from July 1997 to June 2005. Macroeconomic variables used in his study are growth rate of industrial production index, change in consumer price index, growth rate of narrowly defined money supply, change in exchange rate, interest rate, growth rate of international crude oil price and return on the MSCI World Equity Index and the analysis is based on stock portfolios rather than single stocks. Using ordinary least square technique the empirical findings reveal that exchange rate, interest rate and world market return seem to affect all of the portfolio returns, while inflation rate is significant for only three of the twelve portfolios. On the other hand, industrial production, money supply and oil prices do not appear to have any significant affect on stock returns. His findings also suggest that macroeconomic factors have a widespread effect on stock returns.

Similar to the above study Tursoy, et.al (2008) research is another example of the Arbitrage Pricing Theory test in Turkish stock market. They tested the APT in Istanbul Stock Exchange for the period of February 2001 up to September 2005 on monthly base. They tested 13 macroeconomic variables (money supply, industrial production, crude oil price, consumer price index, import, export, gold price,

exchange rate, interest rate, gross domestic product, foreign reserve, unemployment rate and market pressure index) against 11 industry portfolios of Istanbul Stock Exchange to observe the effects of those variables on stocks' returns. Using ordinary least square technique, they observed that there are some differences among the industry sector portfolios.

Kanakraj et.al (2008) have examined the trend of stock prices and varius macroeconomic variables between 1997-2007.They have tried to explore that if the recent stock market boom can be explained in the terms of macroeconomic variables and have concluded by recommending a storng relationship between the two.

Hasan and Javed (2009) investigated the long-term relationship between Pakistan equity prices and monetary variables from June 1998 to June 2008. The monetary variables included the money supply, Treasury bill rate, foreign exchange rates, and the CPI. The cointegration test provided evidence of a long run relationship between the equity market and the monetary variables. Unidirectional Granger causality was found between the monetary variables and the equity market. Impulse response analysis indicated that the interest rate shock and the exchange rate shocks both have a negative impact on equity returns, whereas the money supply has a positive impact on the equity market. With respect to inflation, authors found little impact on returns in the equity market. lastly, FEVD analysis suggested that interest rate, exchange rate, and money supply shocks were important sources of volatility for equity returns. They concluded that monetary policy has a direct impact on capital market.

Leong et.al (2009) aimed to examine the effects of macroeconomic and non-macroeconomic variables on Singapore hotel stock returns using hotel companies listed on the Singapore Stock Exchange (SGX). Results of stability and predictive power tests of the derived model inferred that the model was stable and reliable in explaining hotel stock returns and was also reliable for forecasting. Regression analyses indicated that changes in industrial production and money supply displayed positive relationships whilst exchange rates, inflation, short- and long-term interest rates showed negative relationships with Singapore hotel stock returns.

Khaled et.al (2009) investigate the effects of macroeconomic indicators (interest rate and industrial production) on Vietnamese stock prices also examine how US macroeconomic indicators affect Vietnamese stock prices. The empirical evidence suggest that there is a statistically significant associations between domestic production sector, money market and stock prices in Viet Nam. The finding also show that the US macroeconomic fundamentals significantly affect Vietnamese stock prices.

Mohammad, et.al (2009) examine the relationship between macroeconomics variables and Karachi Stock Exchange in Pakistan context. They have used quarterly data of foreign exchange rate, foreign exchange reserve, gross fixed capital formation, money

supply, interest rate, industrial production index and whole sales price index. The result shows that exchange rate and exchange reserve significantly affected the stock prices.

Mahmood et.al (2009) explored the linkage between stock prices and economic variables in six Asian-Pacific selected countries of Malaysia, Korea, Thailand, Hong Kong, Japan and Australia. The monthly data on stock price indices, foreign exchange rates, consumer price index and industrial production index that spans from January 1993 to December 2002 are used.They focused their analysis on the long run equilibrium and short run multivariate causality between these variables. The results indicate the existing of a long run equilibrium relationship between stock price indices and among variables in only four countries, i.e., Japan, Korea, Hong Kong and Australia. The Hong Kong shows relationship only between exchange rate and stock price while the Thailand reports significant interaction only between output and stock prices.

Maku (2010) examines the long-run and short-run effect of macroeconomic variables on the Nigerian capital market between1984and2007.The properties of the time series variables are examined using the Augmented Dickey-Fuller(ADF) test and most of the variables have a unit root at level. The Augmented Engle-Granger Cointegration test revealed that macroeconomic variables exert significant long-run effect on stock market performance in Nigeria. Also, the employed Error Correction Mode (ECM) showed that macroeconomic variables exert significant short-term shock on stock prices as a result of the stochastic error term mechanisms .However, the empirical analysis showed that the NSE all share index is more Responsive to changes in exchange rate, inflation rate, money supply and real output. While, all the incorporated variables which serve as proxies for external shock and other macroeconomic indicators have simultaneous significant impact on the Nigerian capital market both in the short and long-run.

Dharmendra singh (2010) explore the relation between stock market index i.e. BSE Sensex and three key macro economic variables of Indian economy by using correlation, unit root stationary tests and Granger causality test. Monthly data has been used from April,1995 to March, 2009 for all the variables, like, BSE Sensex, wholesale price index (WPI), index of industrial production(IIP) and exchange rate(Rs/$). Results showed that the stock market index, the industrial production index, exchange rate, and wholesale price index contained a unit root and were integrated of order one. Granger causality test was then employed. The Granger causality test indicated that IIP is the only variable having bilateral causal relationship with BSE Sensex. WPI is having strong correlation with Sensex but it is having unilateral causality with BSE Sensex. Therefore, it is concluded that, Indian stock market is approaching towards informational efficiency at least with respect to two macroeconomic variables, viz. exchange rate and inflation (WPI).

Xiufang (2010) This study investigates the time-series relationship between stock market volatility and macroeconomic variable volatility for China using exponential

generalized autoregressive conditional heteroskedasticity (EGARCH) and lag-augmented VAR (LA-VAR) models. Paper found evidence that there is a bilateral relationship between inflation and stock prices, while a unidirectional relationship exists between the interest rate and stock prices, with the direction from stock prices to the interest rate. However, a significant relationship between stock prices and real GDP was not found. The results suggest that China's stock market is likely to be less efficient than those in the U.S. and other developed countries and is somewhat separated from the real economy of China.

Asalolu et.al (2010) investigated the impact of macroeconomic variables on Average Share Price (ASP) and goes further to determine whether changes in macroeconomic variables explain movements in stock prices in Nigeria. Various econometric analysis such as Augmented Dickey Fuller (ADF) test, Granger Causality test, Co-integration and Error Correction Method (ECM) were employed on time series data from 1986-2007 and the results revealed that a weak relationship exists between ASP and macroeconomic variables in Nigeria. The findings further point that ASP is not a leading indicator of macroeconomic performance in Nigeria.

Ming-Chang Cheng et.al (2011) applied multiple regressions to estimate the impact of non-macroeconomic variables on Taiwan electronic stock returns. The first regression results shows that the non -macroeconomic events were significant except the second presidential election, SARS disease, 88 floods and the 21th Summer Deaf Olympics, but the effects were almost the same with predictions. The second regression results indicate that the macroeconomic variables of industrial production (∆IP), money supply (∆M2), and exchange rate (∆EXR) were significant and positive impact on stock returns. The third regression incorporated three significant macroeconomic variables into the first
regression as robust test, the results didn't change. According to the regression result, the power of prediction for non -macroeconomic events was better than macroeconomic variables. It seemed the non-macroeconomic events had a relatively obvious influence on Taiwan electronic stock returns than macroeconomic variables did.

Patrick (2011) this research investigated the link between macroeconomic variables viz,GDP,Inflation,Interest rates Exchange rate of Rand and Resource Index of the Johannesburg stock exchange the findings reveal that there is a positive correlation between GDP and share returns, a negative correlation between interest rates and share prices and a positive relationship between the Rand exchange rate and share returns. The relationship between the inflation and the resource share returns proved inconclusive.

Y essengali et.al (2011) investigates the causal relationship between macroeconomic indicators and Kazakhstan stock exchange (KASE) index. The results indicate the existence of co integrations between these series implying violation of market efficiency hypothesis. The results of the study are in

compliance not only with theory but also with the issues in practice. Using the bound testing approach, within the Autoregressive Distributed Lag (ARDL) model framework, we examine their long-run relationship. Johansen Co integration test, Engel-Granger two-step approach and Granger causality test reveal that the main determinants of KASE are income per capita, inflation and the exchange rate and dummy variable accounting for worldwide crisis impact. Other effect on stock index comes from oil price volatility.

Rizwan et.al (2011) examine the relationship between stock exchange market volatility and macroeconomic variables volatility with respect to Pakistan. To measure this time series relationship for Pakistan Exponential Generalized Autoregressive Conditional Heteroskedasticity (EGARCH) and lag-augmented VAR (LA-VAR) models were used. It was found that there is a positive relationship of CPI and FDI with stock market; however ER and TBR are inversely related to sock market volatility. On the other hand we found strong evidence that there is a bilateral relationship of FDI and ER with stock prices, while a unidirectional relationship found between TBR and stock market prices, with the direction from stock prices to treasury bills interest rate. However a significant causal relationship not found between CPI and stock prices

Owusu et.al (2011) investigates the relationship between macroeconomic variables and stock market returns using monthly data that spans from January 1992 to December, 2008. Macroeconomic variables used in this study are consumer price index (as a proxy for inflation), crude oil price, exchange rate and 91 day Treasury bill rate (as a proxy for interest rate). The ordinary least square estimation (OLS) model in the context of the Box-Jenkins time series methodology was used in establishing the relationship between macroeconomic variables and stock market returns. Empirical findings reveal that there is a significant relationship between stock market returns and consumer price index (inflation). On the other hand, crude oil prices, exchange rate and Treasury bill rate do not appear to have any significant effect on stock returns.

Yu Hsing (2011) Applying the EGARCH model, this research finds that Lithuania's stock market Index is positively impacted by real GDP,theM2/GDP ratio ,and the stock market indexes in the U.S. and Germany and negatively affected by the ratio of the government deficit to GDP, the LTL/USD exchange rate or depreciation of the litas (National Currency).

Yu Hsing (2011) this paper finds that the Bulgarian stock market index is positively associated with real GDP, the M2/GDP ratio and the U.S. stock market index and is negatively influenced by the ratio of the government deficit to GDP, the domestic real interest rate, the BGN/USD exchange rate, the expected inflation rate and the euro area government bond yield.

Ifuero et.al (2012) attempt to determine the relationship between macroeconomic variables and the Nigerian capital market index. It considers the yearly data of several

macroeconomic variables of interest rates, inflation rates, exchange rates, fiscal deficit, GDP and money supply from 1975 to 2005; and it tries to reveal the relative influence of these variables on the 'All Share Index' of the Nigerian capital market. In pursuance of this, the Vector Error Correction Model (VECM) was used to study the short-run dynamics as well as long-run relationship between the stock market index and the six selected macroeconomic variables from the Nigerian economy. The major finding is that macroeconomic variables influence stock market index in Nigeria.

Muhammed Monjurul (2012) investigates the effects of macroeconomic variables of treasury bill interest rate and industrial production on stock returns on Dhaka Stock Exchange for the period between January 2000 and February 2007 on the basis of monthly time series data using Autoregressive Integrated Moving Average (ARIMA) model and finds a positive relationship between Treasury bill interest rate and industrial production with market stock returns but the coefficients have turned out to be statistically insignificant.

**Research Gap and need for the Present study.**

After thoroughly reviewing the above studies, it has been found that very limited literature is available on the Indian stock market so far as relationship between macroeconomic variables and stock prices behavior is concerned. It is against this backdrop that a study on the subject needs to be undertaken. The proposed study shall try to fill up this gap by exploring relationship and influence frequently quoted macroeconomic variables in Govt and Business communications while discussing the state of economic activities in India.This will allow small investors and financial institutions to have a clear picture of how macroeconomic variables are tied to the stock prices and make a modest contribution in the field.Thus to gain an insight into the complexities of the stock market,one needs to develop a sound economic understanding & be able to interpret the impact of important economic indicators on stock markets (Yasaswy,1994). This dissertation is expected to add several primary contributions to the existing literature. First, it will extend the literature by examining the relationship of the stock market with a set of macroeconomic variables in a unique emerging market, the Indian economy. Second, this study is expected to offer some insights for Indian policymakers, shareholders, and portfolio managers. Policymakers are mainly interested in exploring the determinants of the stock market, and how stock market shocks spillover to real economic activity. The efficient market hypothesis (EMH) implies that portfolio diversification benefits from a low correlation between stock market indexes and all relevant information that is publicly available. In that sense, this study is also significant to shareholders and portfolio managers.

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# CHAPTER III

## Objectives and Methodology

As mentioned in preceding pages, the Efficient Market Hypothesis and various Asset pricing theories are silent about which precise events or economic factors likely influence stock prices. This silence opens the door to investigating a wide range of relevant events at the macroeconomic levels of a stock market, due to less availability of the data and lesser time, the scope had to be kept in fewer but certainly with the purpose of fulfilling the basic rationale and motive of this research.

**Objectives**

The Present study is aimed to achieve the following objectives:-

i. To study the growth & development of stock market in India;

ii. to study the relationship between stock prices and macro-economic variables in India in pre-reform, post-reform & over all from the formation of index to 2011 at the basic level; and

iii. to give suggestions, on the basis of study results, for policy formulation at the country level.

**Hypothesis**

(i) $H_0$:-Changes in macro-economic variables are not correlated with stock prices in India.

(ii) $H_1$:-Changes in macro-economic variables are correlated with stock prices in India.

**Data Base**

The data used in this study consists of annual average of stock market index and macroeconomic variables of India. The data were obtained from three different sources viz; the Reserve bank of India, Economic survey, Economy watch. The period under study begins January 1,1979-80 and ends December 31,2011-2012.This time

period was chosen because within this time frame many important events happened such as liberalization of various sectors of economy, regime changes, stock market crashes and scams, the establishment of various other stock exchanges & indices etc.The sample period is split into two separate periods: first, the pre-liberalization period starting January 1.1979 to December 31,1991 second the post-liberalization period starting January 1,1991 to December 31,2011 and then the over all effect is observed.

This study investigates thirteen macroeconomic variables that all have a significant impact on the general share price index of the Indian stock market and these are described as.

**Selection of Variables**

As stated earlier ,the aim of this study is to explain the effects of macroeconomic variables on the stock prices using annual average data from January 1979-80 to December 2011-2012. BSE Sensex is used as a proxy for the performance of the Indian stock market. Thirteen macroeconomic variables, that are hypothesized to influence stock returns, are examined. These macroeconomic variables are industrial production index, inflation, broad money supply ($M_3$), market borrowing of govt, Gross domestic product, foreign exchange rate, Expenditure of central govt, interest rate, gold price, Balance of payments, international crude oil price, Agricultural production index and forex reserves. These variables have been selected because of the earlier studies conducted abroad choosing these variables. These studies are (Chen et al., 1986; Asprem, 1989; Bulmash and Trivoli, 1991; Mukherjee and Naka, 1995; Maysami and Koh, 2000). Chen et al. (1986) supported the use of IP and Interest rate. Asprem (1989) supported the use of money supply, inflation and interest rates. These earlier studies were further supported by various other studies (Mukherjee and Naka, 1995; Maysami and Koh, 2000) conducted in recent years.

**Dependent variable.**

***Stock Prices:***

Sensex is employed as a proxy for stock prices in India. Till the eighties, there was no scale to measure the ups and downs in the Indian stock market. The Bombay Stock Exchange Ltd. (BSE) in 1986 came out with a stock index 'SENSEX' that subsequently became the standard for measuring the daily trade in the Indian stock market. SENSEX is not only scientifically designed but also based on globally accepted construction and review methodology. First compiled in 1986, SENSEX is a basket of 30 constituent stocks representing a sample of large, liquid and representative companies. The base year of SENSEX is 1978-79 and the base value is 100. The index is widely reported in both domestic and international markets through print as well as electronic media. The SENSEX was initially calculated based on the "Full Market Capitalization"methodology but was shifted to the free-float methodology with effect from September 1, 2003. The "Free-float Market Capitalization" methodology of index construction is regarded as an industry best practice globally. Due to is wide acceptance amongst the Indian investors; SENSEX is regarded to be the pulse of the Indian stock market. Since SENSEX comprises of leading companies in all the significant sectors in the economy and given its long history and its wide acceptance, no other index matches the SENSEX in reflecting market movements and sentiments. SENSEX is widely used to describe the mood in the Indian stock markets

**Independent variables:**

***(i) Index of Industrial Production***

The industrial production index is typically used as a proxy for the level of real economic activity. It is theoretically shown that the industrial production increases during economic expansion and decreases during a recession, and thus a change in industrial production would signal a change in economy. The productive capacity of an economy indeed rises during economic growth, which in turn contributes to the ability of firms to generate cash flows. That is why the industrial production would be expected to act beneficially on expected future cash flows, hence a positive relationship between real economy and stock prices exist. Fama (1981) indicates that the growth rate of industrial production had a strong contemporaneous relation with

stock returns. Many studies show that large fractions (often more than 50%) of annual stock-return variances can be traced to forecasts of variables such as real GNP, industrial production, and investment that are important determinants of the cash flows to firms (Fama, 1990). Al-Sharkas (2004) for Jordan and Maysami et al. (2004) for Singapore indicate that industrial production is positively and significantly related to the stock returns. Thus it is expected that an change in industrial production index is positively related to stock returns in India.

***(ii) Inflation Rate.***

WPI is used as proxy for it, as it is a broad base. Measure to calculate average change in prices of goods and services during a specific period. Inflation is ultimately translated into nominal interest rate, Barr & Campbell (1997) concluded that "almost 80% of the movement in long-term nominal rates appears to be due to changes in expected long-term inflation". and an increase in nominal interest rates increase discount rate which results in reduction of present value of cash flows, implying stocks are extremely poor inflationary hedges for investors. An empirical studies by Chen, Roll and Ross (1986) for US, Humpe and Macmillan (2007) for US and Japan, Sunders et.al,(1981) for Australia,Naka et.al,(1998) for India and Nishat et.al (2004) for Pakistan indicate that inflation is the largest negative determinant of stock prices. so it is hypothesized that change in inflation is negatively related to equity prices in India.

***(iii) Money Supply***

Broad Money ($M_3$) is used as a proxy of money supply. Monetary policy influences the general economy through a transmission mechanism. In case of expansionary monetary policy, the government creates excess liquidity by engaging in open market operation, which results in lower interest rates. The lower interest rate would lead to the lower required rate of return and thus, the higher stock price. Additionally, an increase in monetary growth indicates excess liquidity available for buying stocks, eventually resulting in higher stock prices due to an increase of demand. In case of a restrictive monetary policy, the decrease in the supply of funds leads to increase in interest rate thus raising the cost of capital for all economic activities. The higher interest rate would lead to the higher required rate of return and

thus, lowering the stock prices in addition to this a decrease in monetary growth indicates inadequate liquidity available for buying stocks, eventually resulting in lower stock prices due to a decrease in demand.Humpe and Macmillian (2007) report that Japan stock prices are influenced negatively by the money supply. while there is an insignificant (although) positive relationship between US stock prices and money supply, the results from emerging economies are contradictory, too.For Amman stock exchange Magheyerah (2002) indicate the coefficient of money supply is negative but not statistically significant. Whereas for Jordan Al-Sharkas (2004) shows that money supply has positive effect on stock returns. Tursoy et al.(2008) indicate that there is no significant pricing relationship between the stock return and money supply. As the result of studies are conflicting, the actual relationship between money supply and stock prices is an empirical question and the effect varies over countries and time of research.

***(iv) Market Borrowings.***

This activity substantially absorbs the liquidity from market when govt aims to decrease its fiscal deficit, it translates into decrease in the liquidity in secondary market thereby reducing prices of shares, as the private sector is being unable to access funds resulting in the "crowding out" of private investment (Fisher & Easterly,1990) hence has a negative impact of stock prices and the same is expected.

***(v) Gross Domestic Product.***

GDP is the measure of national income from all sources of production of goods and services in a given year. Researcher have observed positive effect of GDP so we expect the same.

***(vi) Foreign Exchange Rate***

In this study US Dollars/INR exchange rate is employed as foreign exchange rate. There is no theoretical consensus neither on the existence of relationship between stock prices and exchange rates nor on the direction of the relationship. However, Dornbusch and Fisher (1980) while focusing on the association between the current account and the exchange rate developed a model for exchange rate determination namely flow-oriented model that emphasize the relationship between the behavior of the exchange rate and the current account or trade performance, This model suggests

that changes in exchange rates affect the competitiveness of a firm, which in turn influence the firm‟s earnings or its cost of funds and hence its stock price.Thus,flow-oriented model represent a positive relationship between stock prices and exchanges rates. As is also noticed that a depreciation in INR lead to an increase in exports & thereby increase in cash flows,profits of domestic companies and this attract investments that push up the stock market level,suggesting that exchange rate do positively influence share prices. Mukherjee et.al (1995) found a positive sign. Maysami et al. (2004) for Singapore support the hypothesis of a positive relationship between exchange rate and stock returns. Thus, a positive relationship is expected between foreign exchange rate and stock returns.

***(vii) Expenditure of Central Govt.***

It is composed of Govt consumption expenditure, Gross Capital formation and Financial investments & loans to rest of economy. As these has an multiplier effect thereby increase liquidity in the market and influence aggregate demand in the economy which gets translated into increased corporate earnings hence have a positive impact on stock prices. David Allan (1986) suggests the important role of govt expenditure on economy.

***(viii) Interest rate.***

The rate at which people keep money at the Scheduled Banks, is considered. Money switching from the bank to share market happens if stock return is high and the exact opposite case may occur if deposit rate is high, in addition interest rate has impact on a companies operations an increase in interest rate will rise cost of capital that will eat away its profits. The lower profit, lower cash in flows translate into depressed fair value of companies stocks,Maysami et.al (2004) reveal that short and long term interest rate respectively have significant positive and negative relationship with Singapore stock market,Humpe et.al (2007) indicate both US and Japan stock price are negatively influenced by interest rate Therefore, it is hypothesized that a change in interest rate is negatively related to equity prices.

***(ix) Gold Price (GLD)***

Bullion price is used as a proxy of gold price. Gold is an alternative investment tools for investors. As the gold price rises, investors tend to invest less in stocks, causing

stock prices to fall. Therefore, a negative relationship is expected between gold price and stock returns.

***(x) Balance of payments.***

Favorable trade balance has an domino effect of countries other macroeconomic factors like exchange rate, aggregate production, reserves so a positive impact is expected.

***(xi) Oil Prices***

Crude Oil (Petroleum) Price Index ,a proxy for oil prices denotes an equally weighted average of three crude oil spot prices viz; Brent oil, West Texas Intermediate, and Dubai Fateh. Increase in oil prices increase the cost of production and decrease the earning of the corporate sector due to decrease in profit margins or decrease in demand of product so oil prices are negatively related to equity prices. It is hypothesized that a change in oil rates is negatively related to equity market returns.

***(xii) Agricultural production Index***

As agriculture sector is complementary to many other sectors in an economy, agricultural production directly influences disposal incomes of individuals as well as cost of raw material. Hence a positive relationship is expected.

***(xiii) Forex reserves.***

Constitutes wealth of a nation in terms of foreign currency reserves, gold and SDR at IMF it enables a nation to maintain value of its currency in international market and its sovereign credit rating. As it sends positive signals to investors and businesses, so a positive relationship is expected between forex reserves.

**Tools of Analysis**

The fundamental variables were studied and analyzed by applying the basic statistical tools like descriptive statistics which reports the measures of central tendency and measures of dispersion in the data , Jerque-Bera test of normality which tests with joint hypothesis the skewness and excess kurtosis equal to zero, in the time series,Moving averages with the interval 3 to study the trends in the variables as well as their deviation from the forecast if any, Compound Annual Growth Rate (CAGR)

which consider growth on growth & growth after all ups and downs in the variables, Comparative trend analysis for the studying interaction if any between 2 variables in period under study graphically and Pearsons correlation matrix which is used to select macroeconomic variables in order to reduce multicollinerity among the variables, afterwards OLS models were applied to measure the influence of variables on stock prices thereafter F-test was conducted in order to measure the goodness of fit of the regression line in each model afterwards the Durbin-Watson test of autocorrelation was performed to estimate the independence of errors, finally Whites General test of Heterocadasticity was employed to measure the reliability of OLS models whether they are Best Linear Unbiased Estimates (BLUE) or not.

The multiple OLS model adopted for the studying the effects of macroeconomic variables on Sensex was useful and suitable because the research focus lied in examining the contemporaneous relationships between stock returns and changes in macroeconomic variables. Based on past research and financial theories, this study hypothesized the model between Sensex and thirteen macroeconomic variables , namely industrial production index (IPI),inflation(WIP), money supply ($M_3$), market borrowings(MB) gross domestic product (GDP), foreign exchange rate (EXR), expenditure of central govt (ECG), interest rate, gold price (GP), balance of payment (BOP) , international crude oil price (OIL),agricultural production index (API), and forex reserves (FR).

The model is represented as follows:

***Stock Prices = f (IIP, WPI, $M_3$, MB, GDP, EXR , ECG, IR, GP, BOP , OIL, API, FR,)***

In order to see whether the above identified macroeconomic factors could explain stock prices in India, the first multiple regression model is formed:

$$Sensex = \beta_0 = \beta_0 + \beta_1 \Delta IIP_t + \beta_2 INF_t + \beta_3 \Delta M_3 + \beta_4 \Delta MB_t + \beta_5 \Delta GDP_t + \beta_6 \Delta EXR_t + \beta_7 \Delta ECG + \beta_8 \Delta IR +$$

$$\beta_9 \Delta GP + \beta_{10} \Delta BOP + \beta_{11} \Delta OIL + \beta_{12} \Delta API + \beta_{13} \Delta FR + \varepsilon$$

In the above equation $\beta_0$ is constant and $\beta$ is coefficient of variables while $\varepsilon$ is the residual error of the regression and $\Delta$ stands for the growth rate of the specified variables. All estimations have been performed in the econometrical software program SPSS 2.0, whereas the ordinary calculations in *Excel*.

**Measure of Variables:**

**Stock Market Return**

From the daily closing price index, the annual average price index is calculated. Then, the stock market return is calculated by the following formula (Pearce & Roley, 1985).

$R= \{(A_t-A_{t-1})/A_{t-1}\}*100$

Where, At = Average annual Closing price index of t time

$A_{t-1}$= Average annual Closing price index of t-1 time

Thus the dependent variable is the annual percentage change of closing values of the BSE

all general share price index.

**Index of Industrial Production**

Percentage change in annual index of production has been used and calculated by the following formula (Pearce & Roley, 1985).

$IIP= \{(IIP_t-IIP_{t-1})/IIP_{t-1}\}*100$

Where $IP_t$: annual index of production in time t

$IIP_{t-1}$: annual index of production in time t-1

**Inflation Rate**

Inflation rate has been calculated from Wholesale Price Index as per the following formula

(Pearce & Roley, 1985).

$Inf = \{(WPI_t-WPI_{t-1})/WPI_{t-1}\}*100$

Where $WPI_t$ : annual WPI in time t

$WPI_{t-1}$: annual WPI in time t-1

**Money Supply**

Changes in annual money supply have been used and calculated by the following formula

(Flannery & Propakandis, 2002; Pearce & Roley, 1985).

$M_3 = (M3_t - M3_{t-1})$

Where $M3_t$: annual money supply (M3) in time t

$M3_{t-1}$: Quarterly money supply (M3) in time t-1

**Market Borrowing**

Changes in annual Market Borrowing have been used and calculated by the following formula

$MB = (MB_t - MB_{t-1})$

Where $MB_t$: annual average Market borrowing in time t

$M3_{t-1}$: annual average market borrowing in time t-1

**Gross Domestic Product**

Changes in annual GDP have been used and calculated by the following formula

$GDP = (GDP_t - GDP_{t-1})$

Where $GDP_t$: annual Gross domestic product in time t

$GDP_{t-1}$: annual Gross domestic product in time t-1

**Exchange Rate**

Annual change in average exchange rate (the buying rate of the US dollar) is used and calculated by the below-mentioned formula (Joseph & Vezos, 2006).

$ExR = (ExR_t - ExR_{t-1})$

Where $ExR_t$: annual average exchange rate in time t

$ExR_{t-1}$: annual average exchange rate in time t-1

**Expenditure of Central Govt.**

Changes in annual Expenditure of Central Govt have been used and calculated by the following formula

$ECG = (ECG_t - ECG_{t-1})$

Where $ECG_t$: annual expenditure in time t

$ECG_{t-1}$: annual expenditure in time t-1

**Interest Rate**

Annual change in interest rate is used. The following formula is as follows (Joseph & Vezos, 2006).

$IR = (IR_t - IR_{t-1})$

Where $IR_t$: Annual interest rate in time t

$IR_{t-1}$: Annual interest rate in time t-1

**Gold Price**

Annual change in average gold price is used and calculated by the below-mentioned

$GP = (GP_t - GP_{t-1})$

Where $GP_t$: annual average exchange rate in time t

$GP_{t-1}$: annual average exchange rate in time t-1

**Balance of Payment**

Annual changes in overall balance on current account and capital account of Balance of Payment have been used and calculated by the following formula

$BoP = (BoP_t – BoP_{t-1})$

Where $BoP_t$: annual Surplus or Deficit in time t

$BoP_{t-1}$: annual Surplus or Deficit in time t-1

**Crude Oil Price Index**

Percentage change in annual oil price index has been used and calculated by the following formula.

$Oil = (Oil_t - Oil_{t-1})/Oil_{t-1}\}*100$

Where $Oil_t$ : annual Oil in time t

$Oil_{t-1}$: annual Oil in time t-1

**Agricultural Production Index**

Percentage change in annual index of production has been used and calculated by the following formula.

$API = (API_t - API_{t-1})/API_{t-1}\}*100$

Where $API_t$ : annual API in time t

$API_{t-1}$: annual API in time t-1

**Forex Reserve**

Changes in annual forex reserves have been used and calculated by the following formula

$FR = (FR_t – FR_{t-1})$

Where $FR_t$: total annual in time t

$FR_{t-1}$: total annual in time t-1.

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# CHAPTER IV

## Growth of Indian Stock Market & Macroeconomic Variables

The result of several academic studies investigating the effects of macroeconomic variables on stock prices have supported the idea that in addition to individual quality and industry performance, it is also taken into account that the macroeconomic environment influence the price of a security (Reilly & Brown 2006).Hence 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 by employing moving averages with 3 year interval methodology, As it measures the trend by smoothing out the fluctuations of the data so as to comprehend any noticeable variations, if any, in the variables and to estimate their growth by employing CAGR methodology as it consider every rise and fall and growth on growth in the variable.

### Individual Trends of Macroeconomic Variables and Stock Index:

***Trend of SENSEX***

One can notice that SENSEX had stood at just 122.32 in 1979-80, touched 1049.53 in 1990-91 and 1897.67 in 2010 (see table 4.1).This pattern thus usually shows an erratic but mostly uphill movement during the period of study.

**Table 4.1**
**SENSEX Moving Average (3)**

| Year | Sensex | MV (3) |
|---|---|---|
| 1979 | 122.32 | |
| 1980 | 138.87 | |
| 1981 | 207.91 | 156.3667 |
| 1982 | 221.51 | 189.43 |
| 1983 | 238.33 | 222.5833 |
| 1984 | 266.19 | 242.01 |
| 1985 | 492.23 | 332.25 |
| 1986 | 567.39 | 441.9367 |
| 1987 | 454.46 | 504.6933 |
| 1988 | 613.66 | 545.17 |
| 1989 | 729.49 | 599.2033 |
| 1990 | 1049.53 | 797.56 |
| 1991 | 1879.51 | 1219.51 |
| 1992 | 2895.67 | 1941.57 |
| 1993 | 2898.69 | 2557.957 |
| 1994 | 3974.91 | 3256.423 |
| 1995 | 3288.68 | 3387.427 |
| 1996 | 3469.24 | 3577.61 |
| 1997 | 3812.86 | 3523.593 |

| | | |
|---|---|---|
| 1998 | 3294.78 | 3525.627 |
| 1999 | 4658.63 | 3922.09 |
| 2000 | 4269.69 | 4074.367 |
| 2001 | 3331.95 | 4086.757 |
| 2002 | 3206.29 | 3602.643 |
| 2003 | 4492.19 | 3676.81 |
| 2004 | 5740.99 | 4479.823 |
| 2005 | 8278.55 | 6170.577 |
| 2006 | 12277.33 | 8765.623 |
| 2007 | 16568.89 | 12374.92 |
| 2008 | 12365.55 | 13737.26 |
| 2009 | 15585.21 | 14839.88 |
| 2010 | 18605.18 | 15518.65 |
| 2011 | 17422.88 | 17204.42 |

*Source: Statistical analysis in excel.*

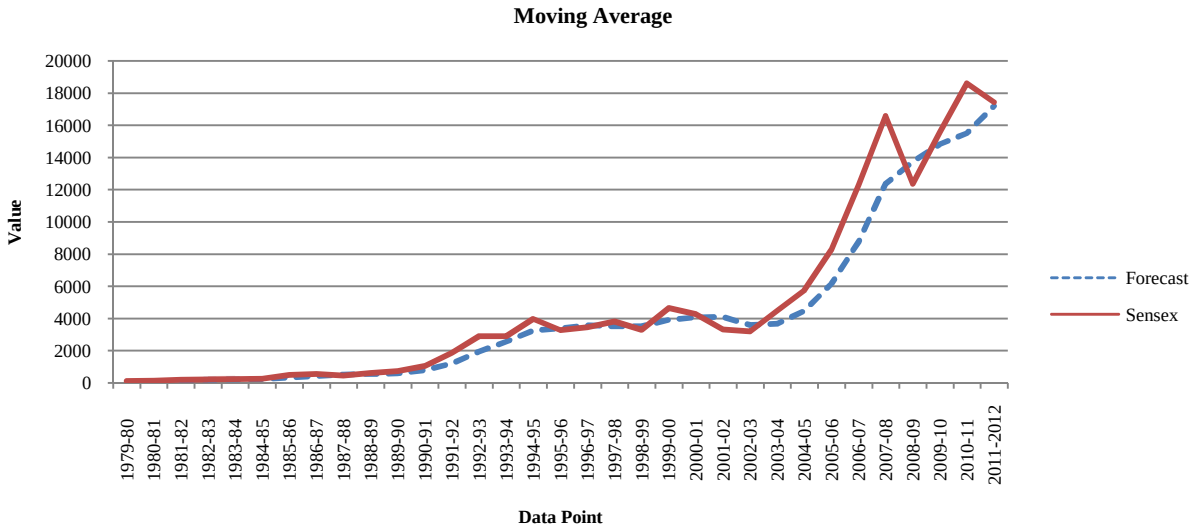



Figure 1
*Source: Statistical analysis in excel.*

From the figure 1 we notice that after 2004 the trend curve of 3 yearly moving averages is showing upward almost a straight line, but the graph of actual line is showing sharp upward trend and sharp downward trend in 2008 the start of global financial crisis till 2011.Moving averages smooth out periodic variations.

The CAGR of Sensex over the thirty two years period from the end of 1979 to the end of 2011 is:
CAGR(0,32) = 3.4511 %

**Trend in Index for Industrial Production.**
The Index for Industrial Production has gained constantly form 1980 when it was at 100 till 1993 when it has reached its highest level of 232 and the new economic

reforms were in full boom, afterwards it has undergone many ups and downs with the changing structural dynamics of economy.

**Table 4.2**
**Index for Industrial Production Moving Average (3)**

| Year | IIP | MA(3) |
|---|---|---|
| 1980 | 100 | |
| 1981 | 109.3083 | |
| 1982 | 112.8167 | 107.375 |
| 1983 | 120.3917 | 114.1722 |
| 1984 | 130.7417 | 121.3167 |
| 1985 | 142.0833 | 131.0722 |
| 1986 | 155.0917 | 142.6389 |
| 1987 | 166.4 | 154.525 |
| 1988 | 180.9 | 167.4639 |
| 1989 | 196.4167 | 181.2389 |
| 1990 | 212.625 | 196.6472 |
| 1991 | 213.875 | 207.6389 |
| 1992 | 218.9 | 215.1333 |
| 1993 | 232 | 221.5917 |
| 1994 | 109.1 | 186.6667 |
| 1995 | 123.3417 | 154.8139 |
| 1996 | 130.8333 | 121.0917 |
| 1997 | 139.525 | 131.2333 |
| 1998 | 145.2417 | 138.5333 |
| 1999 | 154.85 | 146.5389 |
| 2000 | 162.45 | 154.1806 |
| 2001 | 166.9917 | 161.4306 |
| 2002 | 176.6417 | 168.6944 |
| 2003 | 188.975 | 177.5361 |
| 2004 | 211.125 | 192.2472 |
| 2005 | 108.6167 | 169.5722 |
| 2006 | 122.625 | 147.4556 |
| 2007 | 141.6667 | 124.3028 |
| 2008 | 145.2333 | 136.5083 |
| 2009 | 152.9 | 146.6 |
| 2010 | 165.4833 | 154.5389 |
| 2011 | 170.2667 | 162.8833 |

*Source: Statistical analysis in excel.*

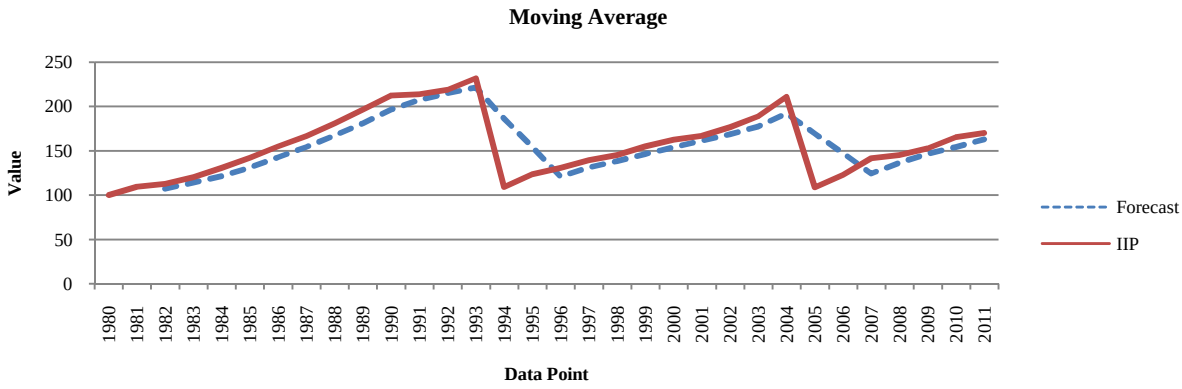



Figure 2
*Source: Statistical analysis in excel.*

IIP in figure 2 show sharp upward trend till 1993-232 as the liberalization policy began to bear fruits than a sharp decline 1997—109.1 partly due to overall economic slowdown and structural overcapacity than again a gradual upward trend till 2004-211.125 followed by a sharp decline in 2005-108.975 from where it again began to pick up interestingly showing no signs of decline due to global economic crisis. Moving averages forecast curve have closely followed the actual curve except the periods of sharp declines.

The CAGR of Index of Industrial production over the thirty one years period from the end of 1980 to the end of 2011 is:
CAGR(0,31) = -0.94508 %

**Trend of Whole Sale Price Index**
Inflation is often taken as bad, but somewhat inflation is very necessary for an economy to grow, but only at moderate level at 5% (Macro-Economics:Dwedii) as it provides momentum to the economy by motivating the producers in form of increasing profits. Inflation reduces disposal income as it decreases the value of money, thus inciting individuals to look into various investment options to maintain the value of money.

**Table 4.3**
**Whole Sale Price Index Moving Average (3)**

| Year | Inf | MA(3) |
|---|---|---|
| 1970 | 100 | |
| 1971 | 105.6 | |
| 1972 | 116.2 | 107.2667 |
| 1973 | 139.7 | 120.5 |
| 1974 | 174.9 | 143.6 |
| 1975 | 173 | 162.5333 |
| 1976 | 176.6 | 174.8333 |
| 1977 | 185.8 | 178.4667 |

| | | |
|---|---|---|
| 1978 | 185.8 | 182.7333 |
| 1979 | 217.6 | 196.4 |
| 1980 | 257.3 | 220.2333 |
| 1981 | 281.3 | 252.0667 |
| 1982 | 104.9 | 214.5 |
| 1983 | 112.8 | 166.3333 |
| 1984 | 120.1 | 112.6 |
| 1985 | 125.4 | 119.4333 |
| 1986 | 132.7 | 126.0667 |
| 1987 | 143.5 | 133.8667 |
| 1988 | 154.2 | 143.4667 |
| 1989 | 165.7 | 154.4667 |
| 1990 | 182.7 | 167.5333 |
| 1991 | 207.8 | 185.4 |
| 1992 | 228.7 | 206.4 |
| 1993 | 247.8 | 228.1 |
| 1994 | 112.6 | 196.3667 |
| 1995 | 121.6 | 160.6667 |
| 1996 | 127.2 | 120.4667 |
| 1997 | 132.8 | 127.2 |
| 1998 | 140.7 | 133.5667 |
| 1999 | 145.3 | 139.6 |
| 2000 | 155.7 | 147.2333 |
| 2001 | 161.3 | 154.1 |
| 2002 | 166.8 | 161.2667 |
| 2003 | 175.9 | 168 |
| 2004 | 187.3 | 176.6667 |
| 2005 | 104.5 | 155.9 |
| 2006 | 111.4 | 134.4 |
| 2007 | 116.6 | 110.8333 |
| 2008 | 126 | 118 |
| 2009 | 130.8 | 124.4667 |
| 2010 | 143.3 | 133.3667 |
| 2011 | 156.0667 | 143.3889 |

*Source: Statistical analysis in excel.*


*Figure 3*
*Source: Statistical analysis in excel.*

Figure 3 depicts that inflation was highest in 1981-281.3 again in 1993-247.8 owing to the gulf war as rapid increase in crude oil prices makes it hard for govt to control inflation. The 2005-104.5 decline due to falling international commodity prices. Then increase from 2008-126 is primarily due to rise in prices of primary articles, particularly food items, due to a deficient monsoon and expectations of shortage. Lately, a rising trend in food prices has also been observed in the global market till 2011-156.0067 The moving average forecast have closely followed the actual trends except sharp decline.

The CAGR of Wholesale price Index over the forty one years period from the end of 1970 to the end of 2011 is:
CAGR(0,41) = -0.96193 %

**Trend of Money supply**
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 leading to overheating of economy. It has increased from Rs.21.96 billions in 1951 to Rs.63673 billions in 2011 thus witnessing the growth of about 317172.3% in 60 years.

**Table 4.4**
**Money supply Moving Average (3)**

| Year | M3 | MA(3) |
|---|---|---|
| 1951 | 21.96 | |
| 1952 | 20.99 | |

| | | |
|---|---|---|
| 1953 | 21.37 | 21.44 |
| 1954 | 22.49 | 21.61667 |
| 1955 | 25.05 | 22.97 |
| 1956 | 27.3 | 24.94667 |
| 1957 | 29.91 | 27.42 |
| 1958 | 32.64 | 29.95 |
| 1959 | 36.55 | 33.03333 |
| 1960 | 39.02 | 36.07 |
| 1961 | 40.04 | 38.53667 |
| 1962 | 43.93 | 40.99667 |
| 1963 | 47.88 | 43.95 |
| 1964 | 52.69 | 48.16667 |
| 1965 | 58.07 | 52.88 |
| 1966 | 64.62 | 58.46 |
| 1967 | 70.42 | 64.37 |
| 1968 | 77.93 | 70.99 |
| 1969 | 88.38 | 78.91 |
| 1970 | 103.26 | 89.85667 |
| 1971 | 118.14 | 103.26 |
| 1972 | 137.46 | 119.62 |
| 1973 | 164.74 | 140.1133 |
| 1974 | 187.17 | 163.1233 |
| 1975 | 210.52 | 187.4767 |
| 1976 | 252.37 | 216.6867 |
| 1977 | 302.63 | 255.1733 |
| 1978 | 364.34 | 306.4467 |
| 1979 | 437.92 | 368.2967 |
| 1980 | 509.66 | 437.3067 |
| 1981 | 597.93 | 515.17 |
| 1982 | 685.15 | 597.58 |
| 1983 | 805.77 | 696.2833 |
| 1984 | 952.95 | 814.6233 |
| 1985 | 1110.96 | 956.56 |
| 1986 | 1306.53 | 1123.48 |
| 1987 | 1532.07 | 1316.52 |
| 1988 | 1796.87 | 1545.157 |
| 1989 | 2138.56 | 1822.5 |
| 1990 | 2494.93 | 2143.453 |
| 1991 | 2924.03 | 2519.173 |
| 1992 | 3442.38 | 2953.78 |
| 1993 | 3990.48 | 3452.297 |
| 1994 | 4781.96 | 4071.607 |
| 1995 | 5529.53 | 4767.323 |
| 1996 | 6426.31 | 5579.267 |
| 1997 | 7520.28 | 6492.04 |
| 1998 | 9012.94 | 7653.177 |

| | | |
|---|---|---|
| 1999 | 10560.25 | 9031.157 |
| 2000 | 12240.92 | 10604.7 |
| 2001 | 14200.07 | 12333.75 |
| 2002 | 16479.54 | 14306.84 |
| 2003 | 18615.8 | 16431.8 |
| 2004 | 21282.27 | 18792.54 |
| 2005 | 24589.25 | 21495.77 |
| 2006 | 29501.86 | 25124.46 |
| 2007 | 36034.44 | 30041.85 |
| 2008 | 43436.64 | 36324.31 |
| 2009 | 51778.82 | 43749.97 |
| 2010 | 60151.65 | 51789.04 |
| 2011 | 69673 | 60534.49 |

*Source: Statistical analysis in excel.*

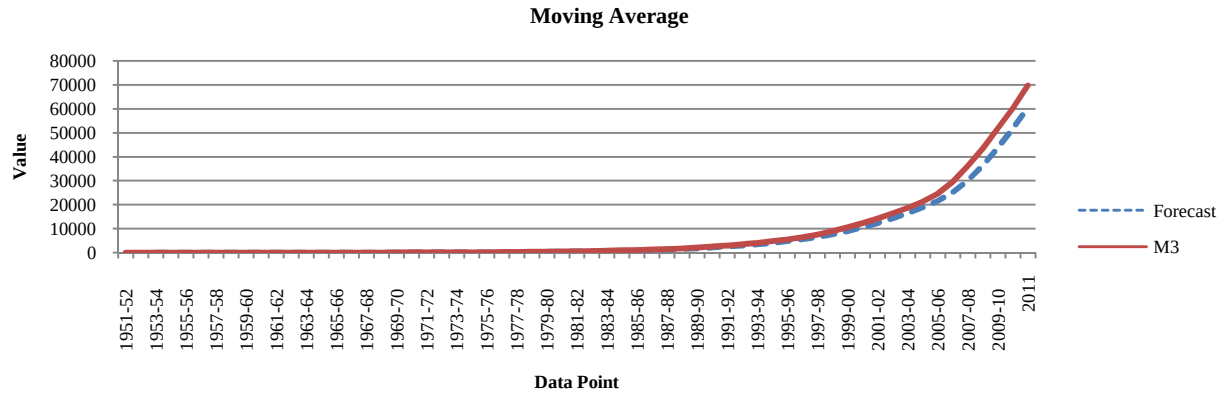



*Figure 4*
*Source: Statistical analysis in excel.*

In the case of money supply, i.e., M3 or broad money growth rate has been tremendous as seen in the figure 4.The banking systems credit to govt was the major driver of growth in broad money, from 1982 onwards the increase in govts borrowing program to finance the expansionary fiscal response to the overall economic development and at times economic slow downs was the underlying reason. Actual trend has done better than moving average forecast.
The CAGR of Broad money (M3) over the sixty years period from the end of 1951 to the end of 2011 is:
CAGR(0,60) = 51.87 %

**Trend of Market Borrowings**
To cope up with the fiscal deficit and to ensure moderate capital formation govt borrows for the open market. The table 4.5 shows that the market borrowing of government was highest in the year 2011.The market borrowing stood at just 28.11 in 1980,touched 108.65 in 1991 and 6210.91 in 2011 (see table 4.5).This pattern usually show uphill movement during the study period.
**Table 4.5**

**Market Borrowing Moving Average (3)**

| Year | MB | MA(3) |
|---|---|---|
| 1980 | 28.11 | |
| 1981 | 32.39 | |
| 1982 | 41.99 | 34.16333 |
| 1983 | 45.89 | 40.09 |
| 1984 | 48.72 | 45.53333 |
| 1985 | 60.74 | 51.78333 |
| 1986 | 64.63 | 58.03 |
| 1987 | 85.05 | 70.14 |
| 1988 | 92.53 | 80.73667 |
| 1989 | 96.54 | 91.37333 |
| 1990 | 105.7 | 98.25667 |
| 1991 | 108.65 | 103.63 |
| 1992 | 119.32 | 111.2233 |
| 1993 | 321.64 | 183.2033 |
| 1994 | 251.97 | 230.9767 |
| 1995 | 327.21 | 300.2733 |
| 1996 | 328.92 | 302.7 |
| 1997 | 476.87 | 377.6667 |
| 1998 | 736.03 | 513.94 |
| 1999 | 854.82 | 689.24 |
| 2000 | 866.67 | 819.1733 |
| 2001 | 1095.63 | 939.04 |
| 2002 | 1331.82 | 1098.04 |
| 2003 | 1351.92 | 1259.79 |
| 2004 | 800.28 | 1161.34 |
| 2005 | 1136.92 | 1096.373 |
| 2006 | 1255.49 | 1064.23 |
| 2007 | 1657.28 | 1349.897 |
| 2008 | 3460.83 | 2124.533 |
| 2009 | 5092.41 | 3403.507 |
| 2010 | 4146.68 | 4233.307 |
| 2011 | 6210.91 | 5150 |

*Source: Statistical analysis in excel.*

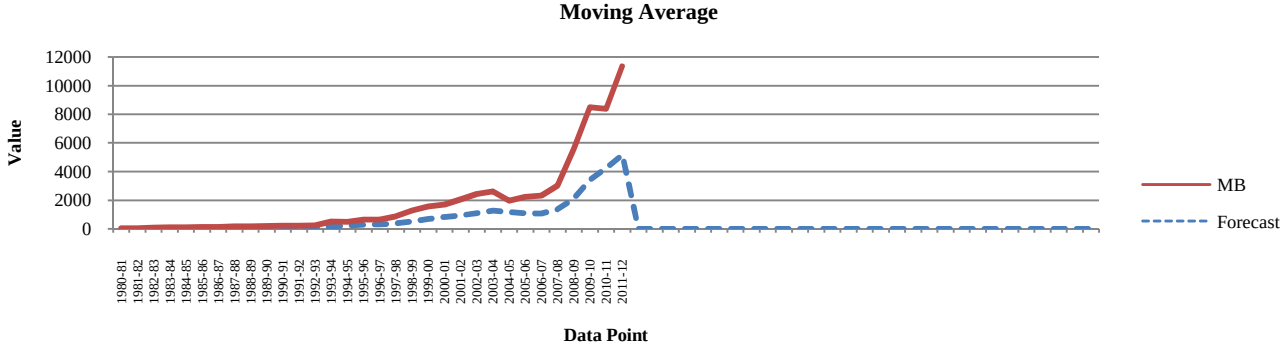


*Figure 5*
*Source: Statistical analysis in excel.*

A glance at the figure 5 shows that over the years it has increased manifold, but increase in it is more than the increase in moving average forecast owing to the unexpected demand of funds from 2008 onwards as the moving averages curve don't match making it hard to predict the next move by govt due to huge capital inadequacy of govt.A slight dip is observed in 2008 as the central govt borrowed less in order to stabilize the capital market which was facing a bearish trend due to the flight of Foreign institutional investors.

The CAGR of Market Borrowing (MB) over the thirty one years period from the end of 1980 to the end of 2011 is:
CAGR(0,31) = 6.12 %

**Trend of Gross Domestic Product (GDP)**
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 has shown consistent growth since 1950 when it was at 2939.37 till 2011 as it stands at 55958.56.

**Table 4.6**
**Gross Domestic Product Moving Average (3)**

| Year | GDP | MA(3) |
|---|---|---|
| 1950 | 2939.37 | |
| 1951 | 3025.99 | |
| 1952 | 3105.44 | 3023.6 |
| 1953 | 3296.43 | 3142.62 |
| 1954 | 3455.03 | 3285.633 |
| 1955 | 3566.84 | 3439.433 |
| 1956 | 3765.82 | 3595.897 |
| 1957 | 3750.33 | 3694.33 |
| 1958 | 4027.49 | 3847.88 |
| 1959 | 4133.2 | 3970.34 |
| 1960 | 4360.37 | 4173.687 |
| 1961 | 4522.7 | 4338.757 |
| 1962 | 4655.27 | 4512.78 |
| 1963 | 4934.32 | 4704.097 |
| 1964 | 5302.07 | 4963.887 |
| 1965 | 5162.32 | 5132.903 |
| 1966 | 5159.46 | 5207.95 |
| 1967 | 5563.24 | 5295.007 |
| 1968 | 5751.72 | 5491.473 |
| 1969 | 6127.87 | 5814.277 |
| 1970 | 6443.89 | 6107.827 |
| 1971 | 6549.76 | 6373.84 |

| | | |
|---|---|---|
| 1972 | 6513.52 | 6502.39 |
| 1973 | 6728.18 | 6597.153 |
| 1974 | 6807.93 | 6683.21 |
| 1975 | 7430.85 | 6988.987 |
| 1976 | 7554.43 | 7264.403 |
| 1977 | 8102.49 | 7695.923 |
| 1978 | 8565.34 | 8074.087 |
| 1979 | 8116.68 | 8261.503 |
| 1980 | 8663.4 | 8448.473 |
| 1981 | 9183.74 | 8654.607 |
| 1982 | 9502.94 | 9116.693 |
| 1983 | 10195.6 | 9627.427 |
| 1984 | 10585.15 | 10094.56 |
| 1985 | 11141.33 | 10640.69 |
| 1986 | 11673.5 | 11133.33 |
| 1987 | 12136.39 | 11650.41 |
| 1988 | 13304.86 | 12371.58 |
| 1989 | 14096.15 | 13179.13 |
| 1990 | 14876.15 | 14092.39 |
| 1991 | 15033.37 | 14668.56 |
| 1992 | 15857.55 | 15255.69 |
| 1993 | 16610.91 | 15833.94 |
| 1994 | 17717.02 | 16728.49 |
| 1995 | 19058.99 | 17795.64 |
| 1996 | 20497.86 | 19091.29 |
| 1997 | 21327.98 | 20294.94 |
| 1998 | 22646.99 | 21490.94 |
| 1999 | 24563.63 | 22846.2 |
| 2000 | 25540.04 | 24250.22 |
| 2001 | 26802.8 | 25635.49 |
| 2002 | 27850.13 | 26730.99 |
| 2003 | 30062.54 | 28238.49 |
| 2004 | 32422.09 | 30111.59 |
| 2005 | 35432.44 | 32639.02 |
| 2006 | 38714.89 | 35523.14 |
| 2007 | 42509.47 | 38885.6 |
| 2008 | 44163.5 | 41795.95 |
| 2009 | 47801.79 | 44824.92 |
| 2010 | 52368.23 | 48111.17 |
| 2011 | 55958.56 | 52042.86 |

*Source: Statistical analysis in excel.*

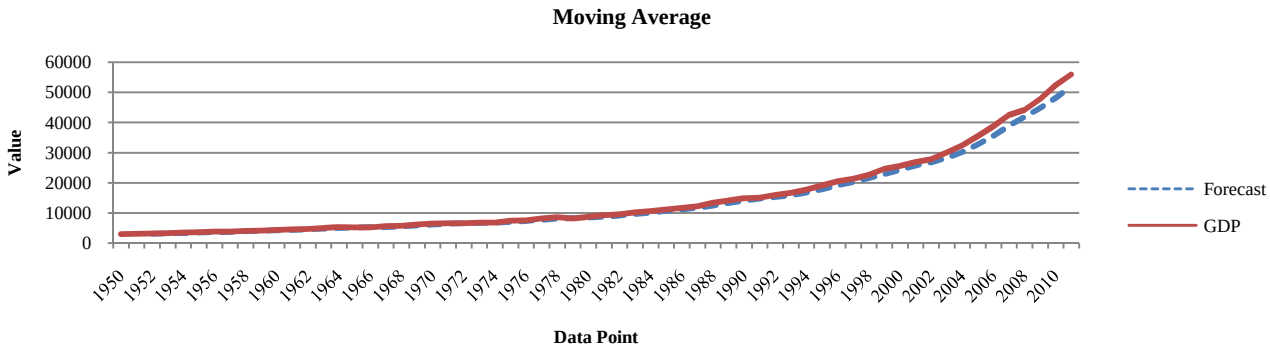



*Figure 6*
*Source: Statistical analysis in excel.*

In figure 6 frequent eruptions have not been viewed even after the new economic policy of 1990-91 may be due to lesser impact of economic reforms on the real economic sector. As per the figure GDP of India has grown somewhat steadily over the years as much as furcated by moving averages curve contrary to many other variables.

The CAGR of Gross Domestic Product (GDP) over the sixty one years period from the end of 1950 to the end of 2011 is:
CAGR(0,61) = -0.68791%

**Trend in Exchange rate**
The exchange rate has grown consistently with a varying nominal increase form 1990 onwards (see table 4.7).

**Table 4.7**
**Exchange rate Moving Average (3)**

| Year | ExR | MA(3) |
|---|---|---|
| 1970 | 7.5668 | |
| 1971 | 7.5244 | |
| 1972 | 7.5563 | 7.549167 |
| 1973 | 7.6742 | 7.584967 |
| 1974 | 8.0375 | 7.756 |
| 1975 | 8.4058 | 8.039167 |
| 1976 | 9.0017 | 8.481667 |
| 1977 | 8.7625 | 8.723333 |
| 1978 | 8.2133 | 8.659167 |
| 1979 | 8.1467 | 8.374167 |
| 1980 | 7.88 | 8.08 |
| 1981 | 8.6926 | 8.239767 |
| 1982 | 9.4924 | 8.688333 |
| 1983 | 10.1379 | 9.440967 |
| 1984 | 11.3683 | 10.33287 |

| | | |
|---|---|---|
| 1985 | 12.364 | 11.29007 |
| 1986 | 12.6053 | 12.11253 |
| 1987 | 12.9552 | 12.6415 |
| 1988 | 13.9147 | 13.1584 |
| 1989 | 16.2238 | 14.36457 |
| 1990 | 17.4992 | 15.87923 |
| 1991 | 22.689 | 18.804 |
| 1992 | 25.9206 | 22.03627 |
| 1993 | 31.4439 | 26.6845 |
| 1994 | 31.3742 | 29.57957 |
| 1995 | 32.4198 | 31.74597 |
| 1996 | 35.428 | 33.074 |
| 1997 | 36.3195 | 34.72243 |
| 1998 | 41.2665 | 37.67133 |
| 1999 | 43.0552 | 40.21373 |
| 2000 | 44.9401 | 43.08727 |
| 2001 | 47.1857 | 45.06033 |
| 2002 | 48.5993 | 46.90837 |
| 2003 | 46.5818 | 47.4556 |
| 2004 | 45.3165 | 46.83253 |
| 2005 | 44.1 | 45.33277 |
| 2006 | 45.307 | 44.90783 |
| 2007 | 41.3485 | 43.58517 |
| 2008 | 43.5049 | 43.3868 |
| 2009 | 48.4049 | 44.41943 |
| 2010 | 45.7262 | 45.87867 |
| 2011 | 46.6723 | 46.93447 |

*Source: Statistical analysis in excel.*

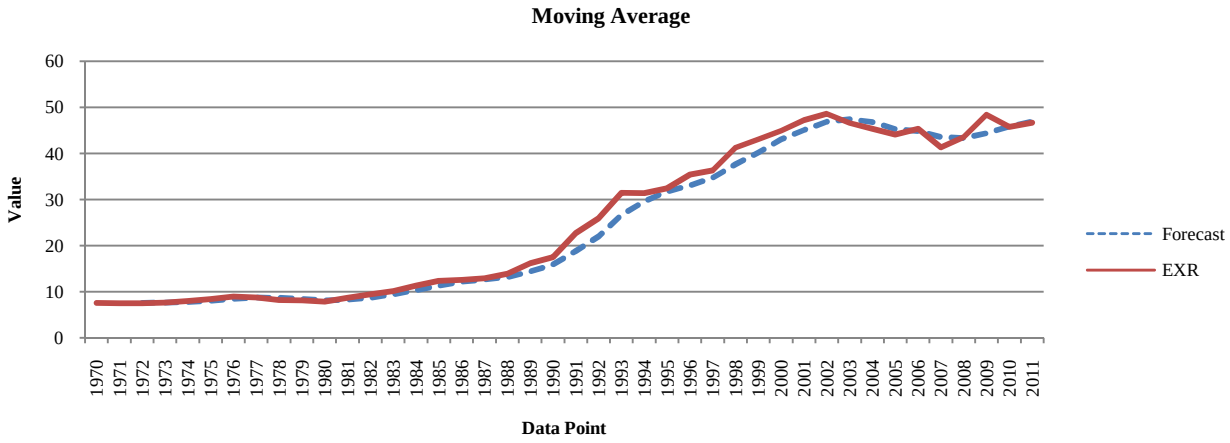



*Figure 7*
*Source: Statistical analysis in excel.*

In figure 7 some mismatch's are seen between actual and moving average forecast curve owing to the huge demand of US dollar by Indian corporate's and individuals due to relaxation in economic policy as the exchange rate was mostly determined by international forex market unlike by RBI prior to 1990.
The CAGR of Exchange rate (ExR) over the forty one years period from the end of 1970 to the end of 2011 is:
CAGR(0,41) = -0.84956 %

**Trend of Expenditure of Central Government (ECG).**
Expenditure of Central Govt has revealed a stable but incremental growth during the study period (see table 4.8) thus implying the net expenditure and investments done in the economy has increased.

**Table 4.8**
**Expenditure of Central Government Moving Average (3)**

| Year | ECG | MA(3) |
|---|---|---|
| 1970 | 5577 | |
| 1971 | 6710 | |
| 1972 | 7849 | 6712 |
| 1973 | 8131 | 7563.333 |
| 1974 | 9785 | 8588.333 |
| 1975 | 12037 | 9984.333 |
| 1976 | 13150 | 11657.33 |
| 1977 | 14986 | 13391 |
| 1978 | 17717 | 15284.33 |
| 1979 | 18504 | 17069 |
| 1980 | 22495 | 19572 |
| 1981 | 25401 | 22133.33 |
| 1982 | 30494 | 26130 |
| 1983 | 35988 | 30627.67 |
| 1984 | 43879 | 36787 |
| 1985 | 53112 | 44326.33 |
| 1986 | 64023 | 53671.33 |
| 1987 | 70305 | 62480 |
| 1988 | 81402 | 71910 |
| 1989 | 95049 | 82252 |
| 1990 | 104973 | 93808 |
| 1991 | 112731 | 104251 |
| 1992 | 125927 | 114543.7 |
| 1993 | 145788 | 128148.7 |
| 1994 | 166998 | 146237.7 |
| 1995 | 18523 | 110436.3 |
| 1996 | 211260 | 132260.3 |
| 1997 | 224866 | 151549.7 |

| | | |
|---|---|---|
| 1998 | 263755 | 233293.7 |
| 1999 | 307509 | 265376.7 |
| 2000 | 328265 | 299843 |
| 2001 | 360616 | 332130 |
| 2002 | 398879 | 362586.7 |
| 2003 | 426132 | 395209 |
| 2004 | 463831 | 429614 |
| 2005 | 501083 | 463682 |
| 2006 | 570185 | 511699.7 |
| 2007 | 688909 | 586725.7 |
| 2008 | 864530 | 707874.7 |
| 2009 | 992440 | 848626.3 |
| 2010 | 1179016 | 1011995 |
| 2011 | 1233437 | 1134964 |

*Source: Statistical analysis in excel.*

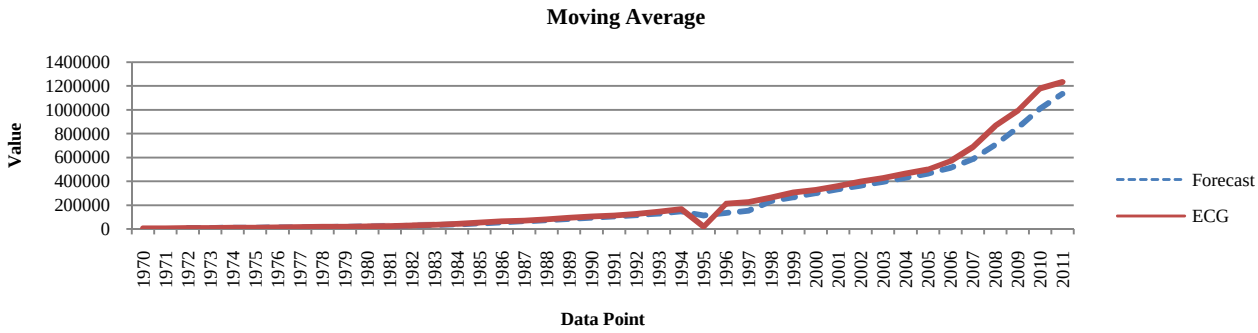



*Figure 8*
*Source: Statistical analysis in excel.*

The figure 8 depicts exponential growth of Expenditure of Central Govt. The dip in 1995 which is 18523 cr. is observed due to sanctions imposed after the nuclear tests conducted by govt and actual curve has been growing more than the forecasted moving averages curve form 2006 onwards due to many flagship programs launched buy govt in socio-economic sector.
The CAGR of Expenditure of Central govt (ECG) over the forty one years period from the end of 1970 to the end of 2011 is:
CAGR(0,41) = 4.394 %

**Trend of Interest rate**
An important rate which further acts as a barometer for determining other rates in the market is interest rate, the rate at which banks advance funds. Table 4.9 shows that the interest rate has not increased or decreased much frequently as seen in case of other variables under study.
**Table 4.9**
**Interest rate Moving Average (3)**

| Year | IR | MA(3) |
|---|---|---|

| | | |
|---|---|---|
| 1970 | 7 | |
| 1971 | 6.5 | |
| 1972 | 6.5 | 6.666667 |
| 1973 | 7 | 6.666667 |
| 1974 | 7.75 | 7.083333 |
| 1975 | 9 | 7.916667 |
| 1976 | 9 | 8.583333 |
| 1977 | 8 | 8.666667 |
| 1978 | 7.5 | 8.166667 |
| 1979 | 8.5 | 8 |
| 1980 | 10 | 8.666667 |
| 1981 | 10 | 9.5 |
| 1982 | 10 | 10 |
| 1983 | 10 | 10 |
| 1984 | 10 | 10 |
| 1985 | 10 | 10 |
| 1986 | 10 | 10 |
| 1987 | 10 | 10 |
| 1988 | 10 | 10 |
| 1989 | 10 | 10 |
| 1990 | 11 | 10.33333 |
| 1991 | 13 | 11.33333 |
| 1992 | 11 | 11.66667 |
| 1993 | 10 | 11.33333 |
| 1994 | 11 | 10.66667 |
| 1995 | 13 | 11.33333 |
| 1996 | 12 | 12 |
| 1997 | 11.5 | 12.16667 |
| 1998 | 10.5 | 11.33333 |
| 1999 | 10 | 10.66667 |
| 2000 | 9.5 | 10 |
| 2001 | 8 | 9.166667 |
| 2002 | 6.25 | 7.916667 |
| 2003 | 5.5 | 6.583333 |
| 2004 | 5.75 | 5.833333 |
| 2005 | 6.25 | 5.833333 |
| 2006 | 7.75 | 6.583333 |
| 2007 | 8 | 7.333333 |
| 2008 | 8.5 | 8.083333 |
| 2009 | 7.5 | 8 |
| 2010 | 8.25 | 8.083333 |
| 2011 | 9 | 8.25 |

*Source: Statistical analysis in excel.*

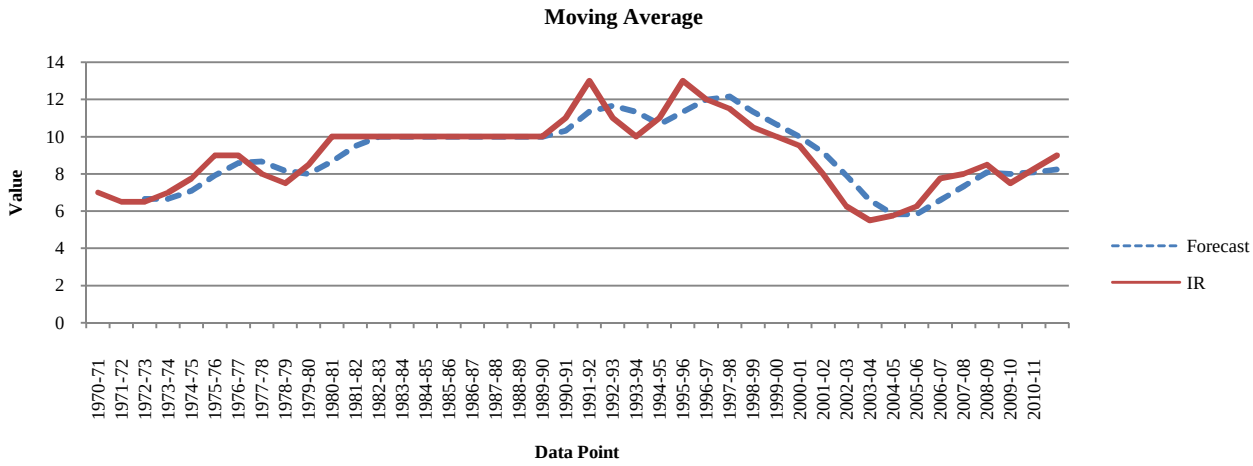



*Figure 9*
*Source: Statistical analysis in excel.*

In the figure 9 one can observe that it changes very rarely and with less volatility in it remained controllable as per the needs of economy with violent shocks observed only in 1991 when the economic restructuring was underway.

The CAGR of Interest rate (IR) over the forty one years period from the end of 1970 to the end of 2011 is:
CAGR(0,41) = -0.96864 %

**Trend in Gold Prices**
Table 4.10 shows that gold prices for 1970 onwards have constantly shown increasing trend with slight decrease in the year till 1997 and 1998.

**Table 4.10**
**Gold Prices Moving Average (3)**

| Year | GP | MA(3) |
|---|---|---|
| 1970 | 184.96 | |
| 1971 | 200.16 | |
| 1972 | 242.57 | 209.23 |
| 1973 | 369.33 | 270.6867 |
| 1974 | 519.19 | 377.03 |
| 1975 | 545.21 | 477.91 |
| 1976 | 549.82 | 538.0733 |
| 1977 | 637.93 | 577.6533 |
| 1978 | 791.22 | 659.6567 |
| 1979 | 1158.75 | 862.6333 |
| 1980 | 1522.44 | 1157.47 |
| 1981 | 1719.17 | 1466.787 |
| 1982 | 1722.54 | 1654.717 |
| 1983 | 1858.47 | 1766.727 |

| | | |
|---|---|---|
| 1984 | 1983.92 | 1854.977 |
| 1985 | 2125.47 | 1989.287 |
| 1986 | 2323.49 | 2144.293 |
| 1987 | 3082.43 | 2510.463 |
| 1988 | 3175.22 | 2860.38 |
| 1989 | 3229.33 | 3162.327 |
| 1990 | 3451.52 | 3285.357 |
| 1991 | 4297.63 | 3659.493 |
| 1992 | 4103.66 | 3950.937 |
| 1993 | 4531.87 | 4311.053 |
| 1994 | 4667.24 | 4434.257 |
| 1995 | 4957.6 | 4718.903 |
| 1996 | 5070.71 | 4898.517 |
| 1997 | 4347.07 | 4791.793 |
| 1998 | 4268 | 4561.927 |
| 1999 | 4393.56 | 4336.21 |
| 2000 | 4473.6 | 4378.387 |
| 2001 | 4579.12 | 4482.093 |
| 2002 | 5332.36 | 4795.027 |
| 2003 | 5718.95 | 5210.143 |
| 2004 | 6145.38 | 5732.23 |
| 2005 | 6900.56 | 6254.963 |
| 2006 | 9240.32 | 7428.753 |
| 2007 | 9995.62 | 8712.167 |
| 2008 | 12889.74 | 10708.56 |
| 2009 | 15756.09 | 12880.48 |
| 2010 | 19227.08 | 15957.64 |
| 2011 | 25723.66 | 20235.61 |

*Source: Statistical analysis in excel.*

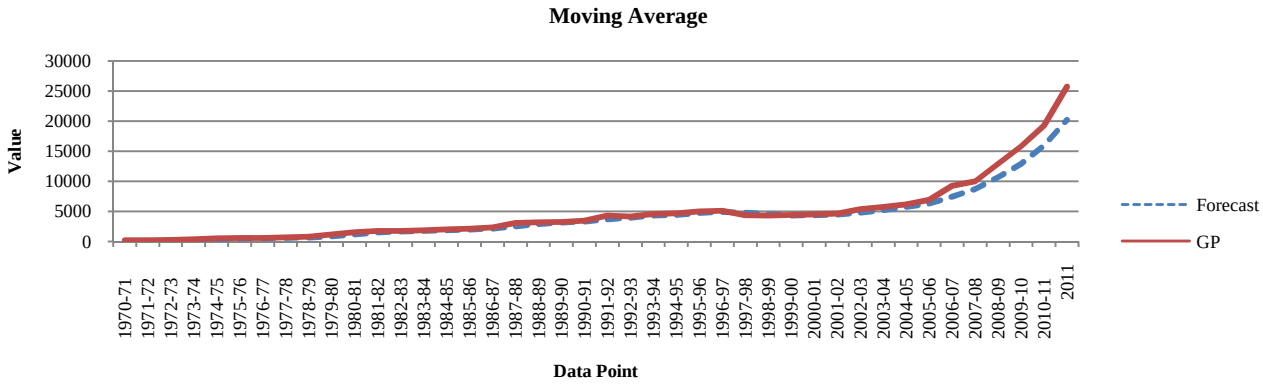



*Figure 10*

*Source: Statistical analysis in excel.*

Figure 10 depicts that gold prices has remained steady with no shocks, as liquidity increased prices has also increased in market by the forces of demand and supply except in 2008 onwards as the prices have gone up more than forecasted by moving average cure due to the global economic crisis which made green back highly volatile and central banks around began hoarding gold to stabilize their reserves and currency in international market.

The CAGR of Gold prices (GP)over the forty one years period from the end of 1970 to the end of 2011 is:
CAGR(0,41) = 2.39211 %

**Trend in Balance of Payment (BoP)**
Table 4.11 reveals extreme volatility observed in balance of payment for the period under study mostly due to current account deficit and surplus.

**Table 4.11**

.

| Year | BoP | MA(3) |
|---|---|---|
| 1950 | 29 | |
| 1951 | -165 | |
| 1952 | 17 | -39.6667 |
| 1953 | 46 | -34 |
| 1954 | -1 | 20.66667 |
| 1955 | 18 | 21 |
| 1956 | -276 | -86.3333 |
| 1957 | -294 | -184 |
| 1958 | -42 | -204 |
| 1959 | 8 | -109.333 |
| 1960 | -48 | -27.3333 |
| 1961 | -64 | -34.6667 |
| 1962 | -14 | -42 |
| 1963 | 35 | -14.3333 |
| 1964 | -56 | -11.6667 |
| 1965 | 18 | -1 |
| 1966 | -83 | -40.3333 |
| 1967 | 47 | -6 |
| 1968 | 97 | 20.33333 |
| 1969 | 268 | 137.3333 |
| 1970 | -10 | 118.3333 |
| 1971 | 20 | 92.66667 |
| 1972 | -33 | -7.66667 |
| 1973 | 22 | 3 |
| 1974 | -478 | -163 |
| 1975 | 612 | 52 |

| | | |
|---|---|---|
| 1976 | 1702 | 612 |
| 1977 | 1834 | 1382.667 |
| 1978 | 1074 | 1536.667 |
| 1979 | 327 | 1078.333 |
| 1980 | -899 | 167.3333 |
| 1981 | -2253 | -941.667 |
| 1982 | -1270 | -1474 |
| 1983 | -578 | -1367 |
| 1984 | 867 | -327 |
| 1985 | -442 | -51 |
| 1986 | -60 | 121.6667 |
| 1987 | 253 | -83 |
| 1988 | 98 | 97 |
| 1989 | 228 | 193 |
| 1990 | -4471 | -1381.67 |
| 1991 | 7274 | 1010.333 |
| 1992 | -881 | 640.6667 |
| 1993 | 26781 | 11058 |
| 1994 | 18160 | 14686.67 |
| 1995 | -4050 | 13630.33 |
| 1996 | 24220 | 12776.67 |
| 1997 | 16653 | 12274.33 |
| 1998 | 18245 | 19706 |
| 1999 | 27770 | 20889.33 |
| 2000 | 27643 | 24552.67 |
| 2001 | 56593 | 37335.33 |
| 2002 | 82037 | 55424.33 |
| 2003 | 143993 | 94207.67 |
| 2004 | 115907 | 113979 |
| 2005 | 65896 | 108598.7 |
| 2006 | 163634 | 115145.7 |
| 2007 | 369689 | 199739.7 |
| 2008 | -97100 | 145407.7 |
| 2009 | 64200 | 112263 |
| 2010 | 59500 | 8866.667 |
| 2011 | 25600 | 49766.67 |

*Source: Statistical analysis in excel.*

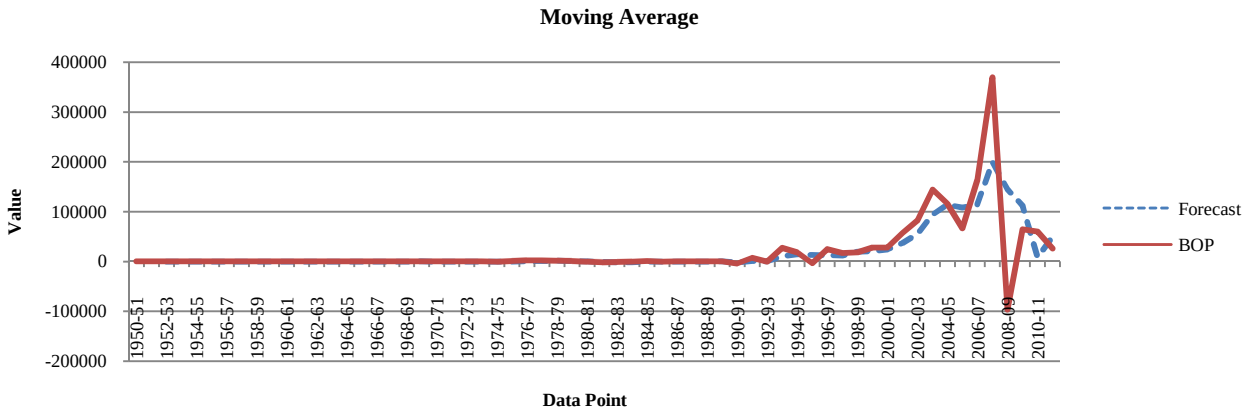



*Figure 11*
*Source: Statistical analysis in excel.*

From the figure 11 the mismatches between actual curve and moving averages forecast curve are found only from 2001 onwards owing to the adverse position in the current account due to the huge imports and subsequent decline in exports due to financial crisis in Europe and America another factor that added to this adverse position was the of relaxation in import policies by govt and rise in oil prices as it still remains to be unstable not matching the forecasts.

The CAGR of Balance of Payment (BoP) over the sixty one years period from the end of 1950 to the end of 2011 is:
CAGR(0,61) = 13.47 %

**Trend in Oil Prices**

The table 4.12 reveals that oil prices increase and decrease quite frequently from 1980 when the index was formed and from 2004 onwards have shown a constant increase till 2008 financial crisis as the index fell to 115.787 points thereby went again in the recovery mode as the economic conditions imporved.

**Table 4.12**
**Oil Prices Moving Averages (3)**

| Year | Oil | MA(3) |
|---|---|---|
| 1980 | 66.924 | |
| 1981 | 63.797 | |
| 1982 | 59.122 | 63.281 |
| 1983 | 55.233 | 59.384 |
| 1984 | 53.503 | 55.95267 |
| 1985 | 51.3 | 53.34533 |
| 1986 | 26.561 | 43.788 |
| 1987 | 34.109 | 37.32333 |
| 1988 | 27.681 | 29.45033 |
| 1989 | 33.56 | 31.78333 |
| 1990 | 43.08 | 34.77367 |
| 1991 | 36.3 | 37.64667 |
| 1992 | 35.678 | 38.35267 |

| | | |
|---|---|---|
| 1993 | 31.463 | 34.48033 |
| 1994 | 29.891 | 32.344 |
| 1995 | 32.245 | 31.19967 |
| 1996 | 38.185 | 33.44033 |
| 1997 | 36.112 | 35.514 |
| 1998 | 24.504 | 32.93367 |
| 1999 | 33.701 | 31.439 |
| 2000 | 52.918 | 37.041 |
| 2001 | 45.602 | 44.07367 |
| 2002 | 46.763 | 48.42767 |
| 2003 | 54.151 | 48.83867 |
| 2004 | 70.772 | 57.22867 |
| 2005 | 100 | 74.97433 |
| 2006 | 120.464 | 97.07867 |
| 2007 | 133.312 | 117.9253 |
| 2008 | 181.87 | 145.2153 |
| 2009 | 115.787 | 143.6563 |
| 2010 | 148.124 | 148.5937 |
| 2011 | 200.837 | 154.916 |

*Source: Statistical analysis in excel.*

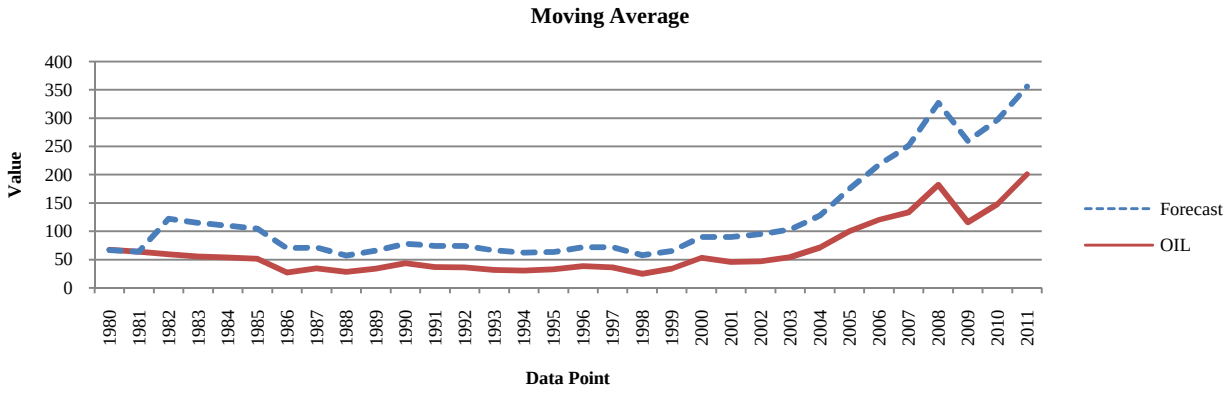



*Figure 13*
*Source: Statistical analysis in excel.*

Actual curve remained little below than the moving averages forecast as can be seen in figure 12 , the sustained upward trend can be seen form 2001 to 2008 due to war in Iraq as the supply was hampered and increased demand by developing nations. In 2009 the prices fell sharply as the OPEC increased production at the behest of international community.

The CAGR of crude Oil prices over the thirty one years period from the end of 1980 to the end of 2011 is:
CAGR(0,31) = -0.9031 %

**Trend in Agricultural Production Index**

The table 4.13 reveals consistent growth in the agricultural production index for 102.1 in 1980 to 192 in 2011,except few major declines in the index in year 1993 & 2002.

**Table 4.13**
**Agricultural Production Index Moving Average (3)**

| Year | API | MA(3) |
|---|---|---|
| 1980 | 102.1 | |
| 1981 | 109.2 | |
| 1982 | 104.8 | 105.3667 |
| 1983 | 118.6 | 110.8667 |
| 1984 | 117.9 | 113.7667 |
| 1985 | 119.5 | 118.6667 |
| 1986 | 115.2 | 117.5333 |
| 1987 | 115.3 | 116.6667 |
| 1988 | 140 | 123.5 |
| 1989 | 143 | 132.7667 |
| 1990 | 148.4 | 143.8 |
| 1991 | 145.5 | 145.6333 |
| 1992 | 151.6 | 148.5 |
| 1993 | 123 | 140.0333 |
| 1994 | 130.1 | 134.9 |
| 1995 | 126.8 | 126.6333 |
| 1996 | 137.8 | 131.5667 |
| 1997 | 130.8 | 131.8 |
| 1998 | 137.8 | 135.4667 |
| 1999 | 140.7 | 136.4333 |
| 2000 | 134.1 | 137.5333 |
| 2001 | 142.1 | 138.9667 |
| 2002 | 123.9 | 133.3667 |
| 2003 | 133 | 133 |
| 2004 | 130.9 | 129.2667 |
| 2005 | 146.8 | 136.9 |
| 2006 | 167.8 | 148.5 |
| 2007 | 172.9 | 162.5 |
| 2008 | 161.8 | 167.5 |
| 2009 | 159.6 | 164.7667 |
| 2010 | 185.3 | 168.9 |
| 2011 | 192 | 178.9667 |

*Source: Statistical analysis in excel.*

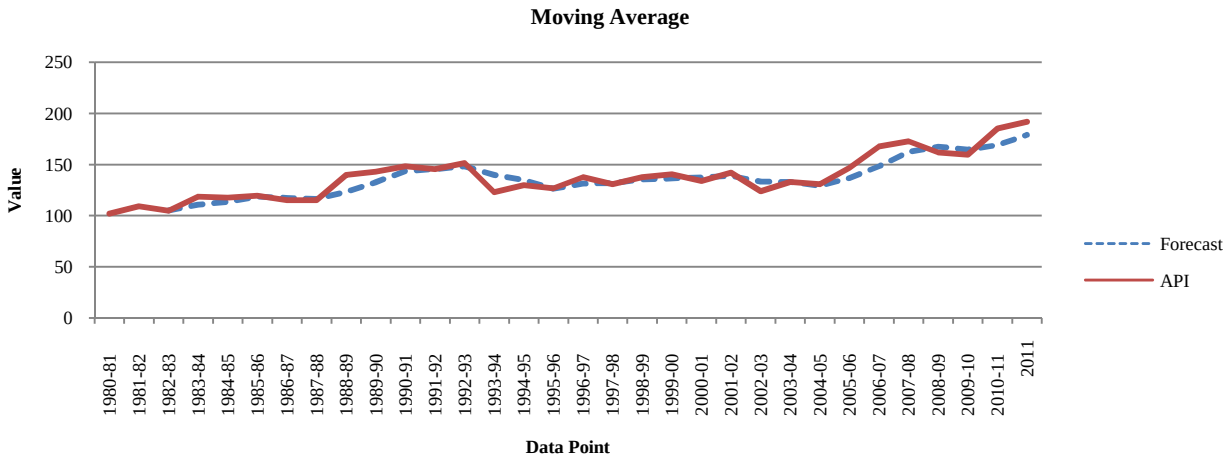



*Figure 13*
*Source: Statistical analysis in excel.*

Figure 13 depicts that good monsoon between 2005 to 2009 and the govt subsidies led to consistent increase in food production that is why actual line looks better than moving average forecast than the decline in 2009 is observed attributed to the monsoon deficit. Again actual curve is rising in 2010 and 2011 due to good monsoons.

The CAGR of Agricultural Production Index (API) over the thirty one years period from the end of 1980 to the end of 2011 is:
CAGR(0,31) = -0.93934 %

**Trend of Forex reserves**

Table 4.14 reveals that forom 1950 till 2011 the forex reserves of government of India have increased gradually to 15061.3 billion due to policy shift by govt of India, the RBI through intervention in forex market, aid receipt, interest receipt and funding from the IBRD,ADB,IDA etc.Moreover the reserve management policy followed by govt of India is to cover the "liquidity risk" on all accounts over a fairly long period hence it tries to keep ample reserves with it. These reserves mainly come from the Non-Resident Indians (NRIs), FIIs (foreign institutional investors), FPIs (foreign portfolio investment) and from FDIs (foreign direct investment).

**Table 4.14**
**Forex reserves Moving Averages (3)**

| Year | FR | MV(3) |
|---|---|---|
| 1950 | 10.29 | |
| 1951 | 8.65 | |
| 1952 | 8.81 | 9.25 |
| 1953 | 9.1 | 8.853333 |
| 1954 | 8.92 | 8.943333 |
| 1955 | 9.03 | 9.016667 |
| 1956 | 6.81 | 8.253333 |

| | | |
|---|---|---|
| 1957 | 4.21 | 6.683333 |
| 1958 | 3.79 | 4.936667 |
| 1959 | 3.63 | 3.876667 |
| 1960 | 3.04 | 3.486667 |
| 1961 | 2.98 | 3.216667 |
| 1962 | 2.95 | 2.99 |
| 1963 | 3.06 | 2.996667 |
| 1964 | 2.5 | 2.836667 |
| 1965 | 2.98 | 2.846667 |
| 1966 | 4.79 | 3.423333 |
| 1967 | 5.39 | 4.386667 |
| 1968 | 5.77 | 5.316667 |
| 1969 | 8.21 | 6.456667 |
| 1970 | 7.33 | 7.103333 |
| 1971 | 8.57 | 8.036667 |
| 1972 | 8.88 | 8.26 |
| 1973 | 9.94 | 9.13 |
| 1974 | 10.22 | 9.68 |
| 1975 | 18.86 | 13.00667 |
| 1976 | 32.43 | 20.50333 |
| 1977 | 48.63 | 33.30667 |
| 1978 | 58.21 | 46.42333 |
| 1979 | 59.34 | 55.39333 |
| 1980 | 55.45 | 57.66667 |
| 1981 | 40.25 | 51.68 |
| 1982 | 47.82 | 47.84 |
| 1983 | 59.72 | 49.26333 |
| 1984 | 72.43 | 59.99 |
| 1985 | 78.19 | 70.11333 |
| 1986 | 81.51 | 77.37667 |
| 1987 | 76.86 | 78.85333 |
| 1988 | 70.4 | 76.25667 |
| 1989 | 62.52 | 69.92667 |
| 1990 | 114.16 | 82.36 |
| 1991 | 238.5 | 138.3933 |
| 1992 | 307.44 | 220.0333 |
| 1993 | 604.2 | 383.38 |
| 1994 | 797.8 | 569.8133 |
| 1995 | 743.84 | 715.28 |
| 1996 | 949.32 | 830.32 |
| 1997 | 1159.05 | 950.7367 |
| 1998 | 1380.05 | 1162.807 |
| 1999 | 1659.13 | 1399.41 |

| | | |
|---|---|---|
| 2000 | 1972.04 | 1670.407 |
| 2001 | 2640.36 | 2090.51 |
| 2002 | 3614.7 | 2742.367 |
| 2003 | 4901.29 | 3718.783 |
| 2004 | 6191.16 | 4902.383 |
| 2005 | 6763.87 | 5952.107 |
| 2006 | 8682.22 | 7212.417 |
| 2007 | 12379.65 | 9275.247 |
| 2008 | 12838.65 | 11300.17 |
| 2009 | 12596.65 | 12604.98 |
| 2010 | 13610.13 | 13015.14 |
| 2011 | 15061.3 | 13756.03 |

*Source: Statistical analysis in excel.*

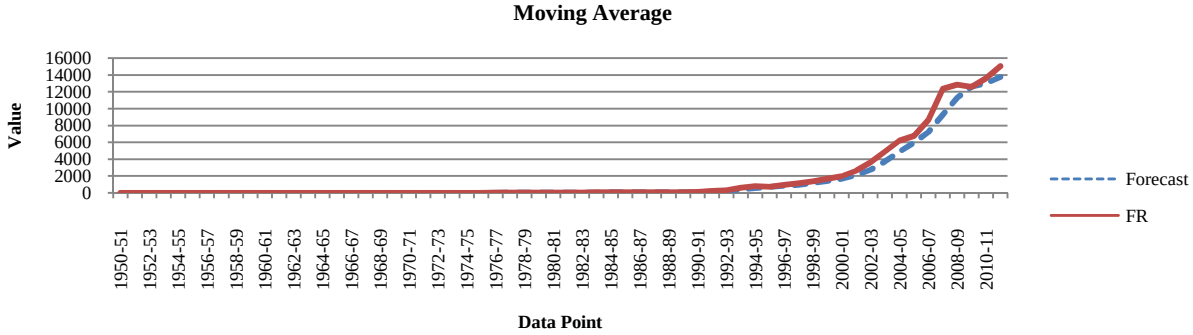



*Figure 14*
*Source: Statistical analysis in excel.*

The graph in figure 14 depicts that the decline in reserves at the end of 2009 as is evident from the graph was inter alia a fallout of the global financial crisis and strengthening of the US dollar vis-a vis other international currencies and the fact that our reserves are measured in dollar terms. During 2010 -2011 the level of forex reserves increased from 12596.65 to 15061.3 billion mainly on account of valuation gain as the US dollar depreciated against most of the other major international currencies. Hence the actual curve performing better than moving averages forecast curve.

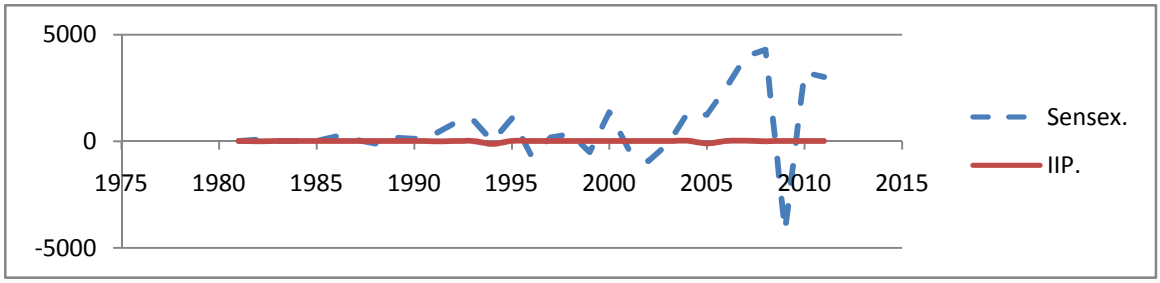
The CAGR of Forex reserves over the sixty one year's period from the end of 1950 to the end of 2011 is:
CAGR(0,61) = 22.99 %

**Comparative Trends :**

Now the Relationship between the dependent variable with each independent variable has been shown in graphs. Comparative trend in graph between the dependent

variable and independent variables gives an opportunity to visualize the trend and apparent relationship between the variables.

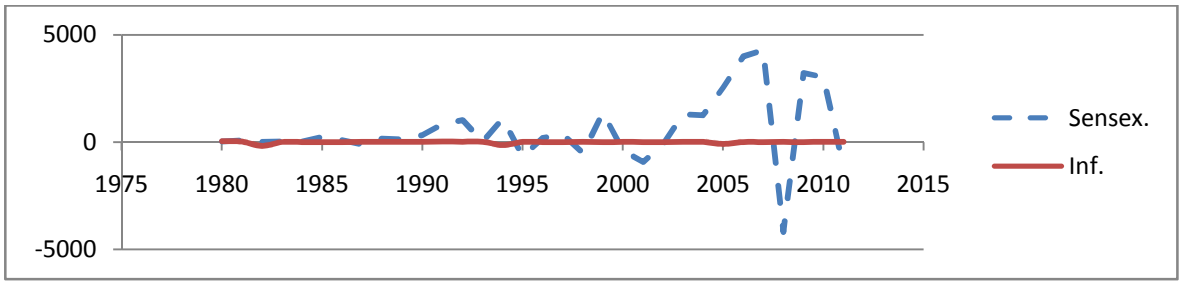
***Trend between the Change in Sensex and Index of Industrial production.***




*Source: Statistical analysis in excel.*
***Figure 15***

Figure shows that 1990 onwards ,change in index of industrial production has no profound influence on Sensex except in the year 1995 and 2005 when there was sluggish growth this is when the decline in index of industrial production was followed by Sensex. So, graphical analysis shows that there is a relationship between the market return and index of production to some extent. The expected theory behind it might be that when Industrial production declines, people's expectations of prosperous future in economic terms also decline, i.e., there is a negative sentiment develops in the economy due to which Sensex also reflects the same.

***Trend between the Change in Sensex and Inflation***

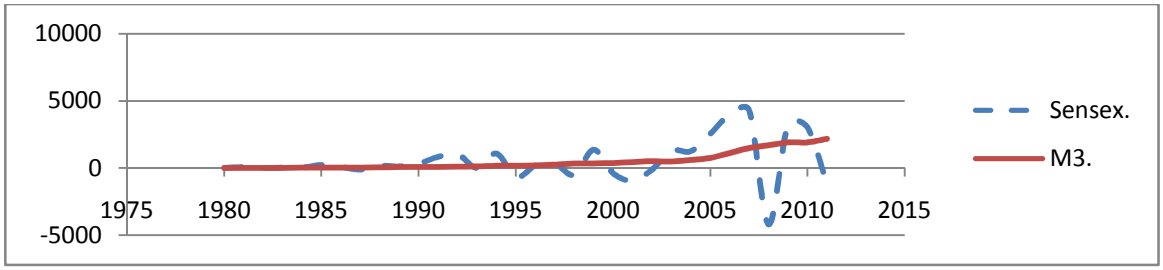



*Source: Statistical analysis in excel.*
***Figure 16***

Figure shows that in 1981 onwards with a slight dip in inflation the Sensex has reciprocated till 1990,thereafter,as the liberalization process began the Sensex has fluctuated frequently and in higher magnitude vis a vis to inflation in 2001,02 & 08, so, graphical analysis shows that there is a weak and inverse relationship between the Sensex and inflation and can be interpreted as they are due to the fact that people &

institutions liquidate their financial assets to maintain the value of their disposable income and direct their investments towards much secure avenues with least volatility.

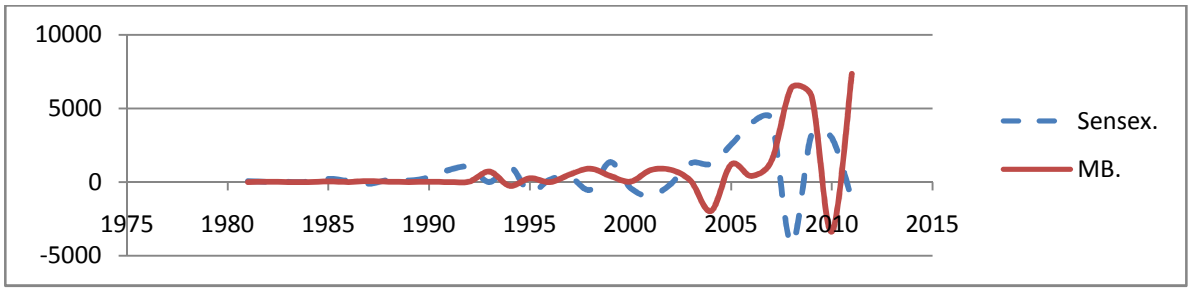
***Trend between the Change in Sensex and Money Supply.***




*Source: Statistical analysis in excel.*
***Figure 17***

Money supply grows as per the need of economy and graph shows that it has no direct influence on Sensex as without any fluctuation in money supply Sensex has kept on fluctuation of its own, Although, indirectly it has influences as it increases liquidity as can be seen in graph 2003 onwards money supply has grown exponentially thereby giving huge lift to Sensex till 2008 financial crisis.

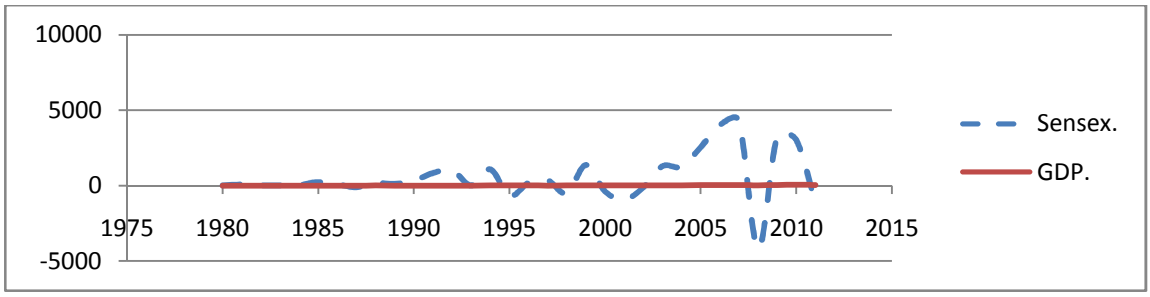
***Trend between the Change in Sensex and Market Borrowing.***




*Source: Statistical analysis in excel.*
***Figure 18***

An examination of the above graph makes it clear that Sensex has strong and inverse relationship with market borrowing. As seen in the graph 1990 onwards as and whenever the market Borrowings has dropped the Sensex has gone up or vice-versa, owing to the fact as govt absorbs liquidity form the market the activity in the capital market declines. Thus signifying a definite relationship and influence of market borrowing on Sensex.

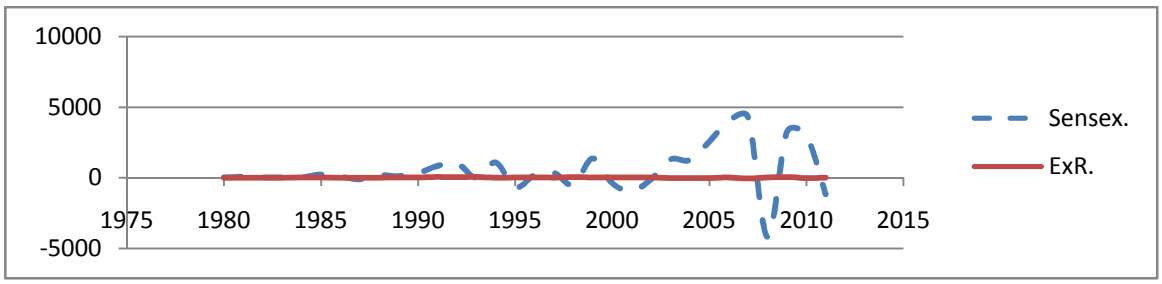
***Trend between the Change in Sensex and Gross Domestic Product (GDP).***




*Source: Statistical analysis in excel.*
***Figure 19***

The connotation that comes out of this graph is that when GDP increases (decreases), it doesn't have any impact on Sensex which is otherwise believed that increase in national income is mobilized by the capital market and allocated in productive ventures which in turn increases the liquidity in share market. From 1980-1990 both has a parallel look but 1990 onwards the upward and downward trends in Sensex has increased with longer duration vis-vis to growth in GDP which has not fluctuated in a noticeable manner.

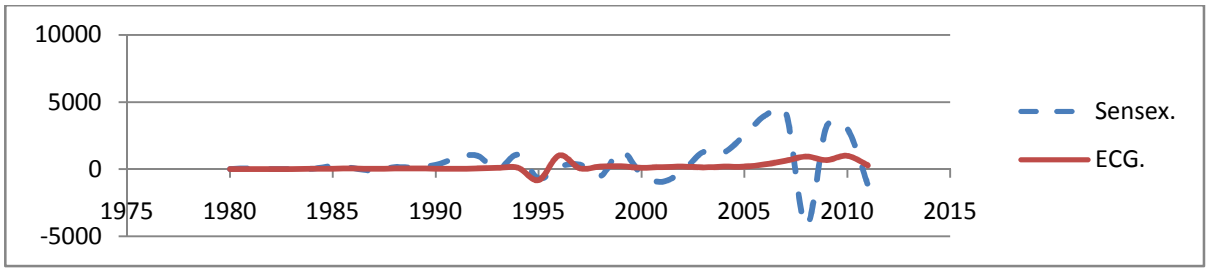
***Trend between the Change in Sensex and Exchange rate.***




*Source: Statistical analysis in excel.*
***Figure 20***

The graph shows that effects of exchange rate fluctuations on Sensex are becoming visible after 1990 but, without any noticeable change in exchange rate margins that is always too minute to monitor graphically but, the swings in Sensex are becoming larger with the nominal increase in the exchange rate of Indian rupee vis a vis to US dollar, implying a relationship between the two.

***Trend between the Change in Sensex and Expenditure of central government.***

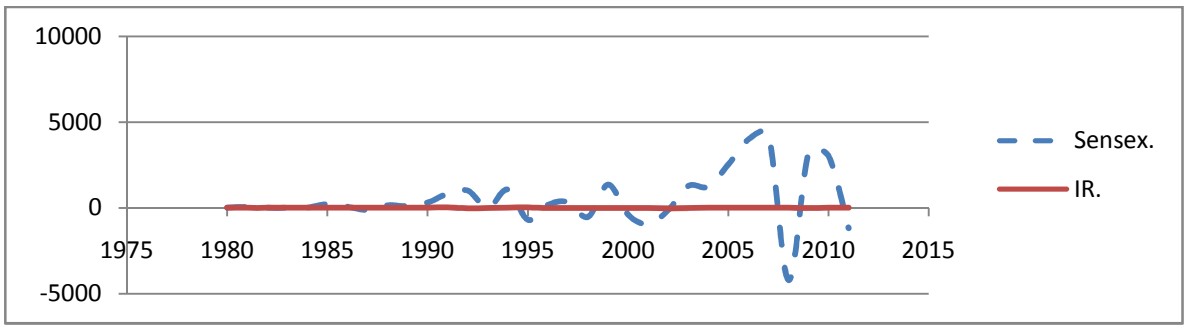


*Source: Statistical analysis in excel.*

***Figure 21***

The graph depicts that after 1990 economic reforms expenditure of Central govt & the Sensex has a relationship with each other. As in 1995 when dip in expenditure in central govt had a profound influence on Sensex by bringing it down & in 1996 rise in expenditure in central govt has influenced the rise of Sensex, then again in 2010 drop in expenditure in central govt has bought Sensex down after its recovery from 2008 financial crisis.

***Trend between the Change in Sensex and Interest rate.***

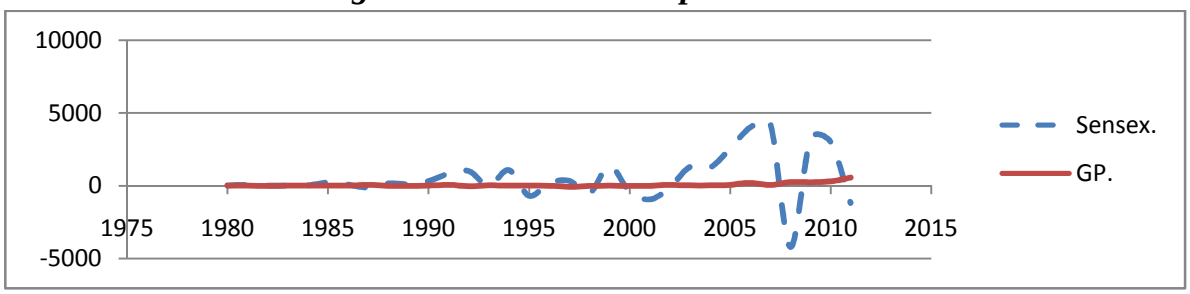



*Source: Statistical analysis in excel.*

***Figure 22***

From the beginning of 1980 to 1990, it is found that Sensex and the interest rate had no relationship with each other .But, it is only after 1990 the fluctuation in Sensex becoming larger with the nominal increase in the interest rates but, on the whole the relationship has remained inconclusive as the Sensex has fluctuated without any noticeable movement in interest rate. This may be because of the fact that Interest rate is a long term rate as it changes less often than other rates.

***Trend between the Change in Sensex and Gold prices.***

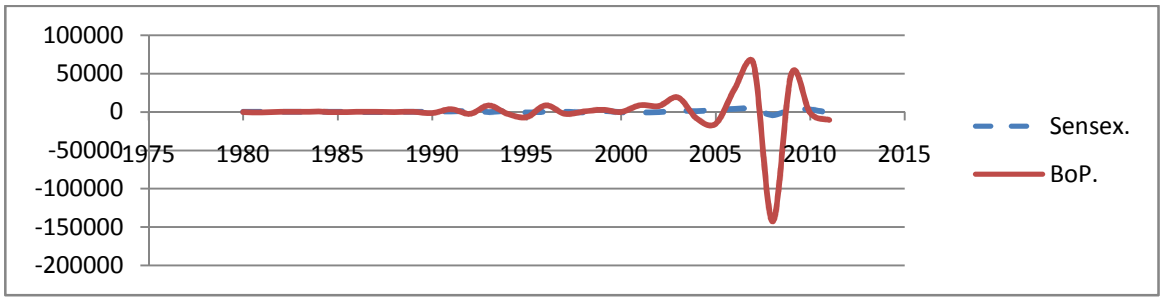



*Source: Statistical analysis in excel.*

***Figure 23***

Being an alternative avenue for investments the gold prices have an influence on Sensex as gold prices drop switching of investments occur from stocks to gold .The graph depicts that after 1990 the Sensex has made many violent movements with the size of swings increasing with the nominal increase in the gold prices but, without any noticeable movements in gold prices graphically.

***Trend between the Change in Sensex and Balance of Payments.***

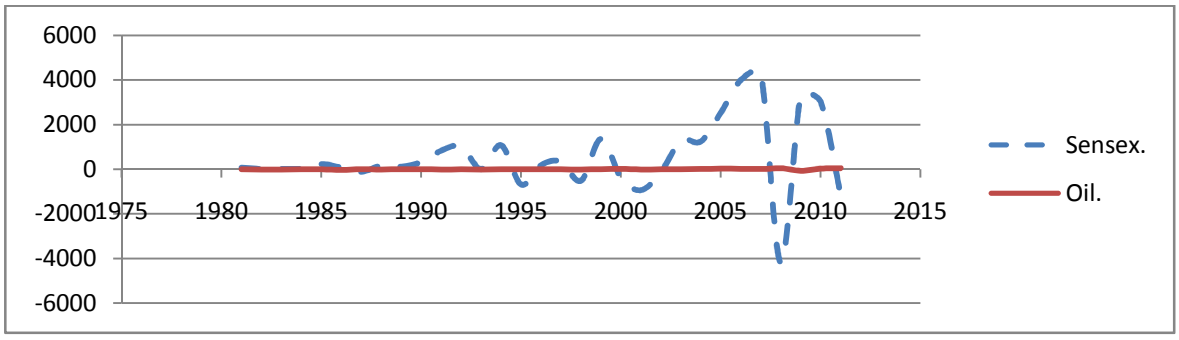



*Source: Statistical analysis in excel.*

***Figure 24***

The graph depicts that Sensex has not responded much to Balance of payments, from 1980 onwards the Sensex has almost taken a flat look till 1990. As is evident form the graph that after 1991 to 2011 the Balance of payments has made many smaller to larger upward and downward swings owing to its deficits and surpluses but, only visible occasion where Sensex has followed Balance of payments is the deficit of 2008 due to financial crisis. Thereby implying a weak relationship between the two variables.

***Trend between the Change in Sensex and Oil Prices.***

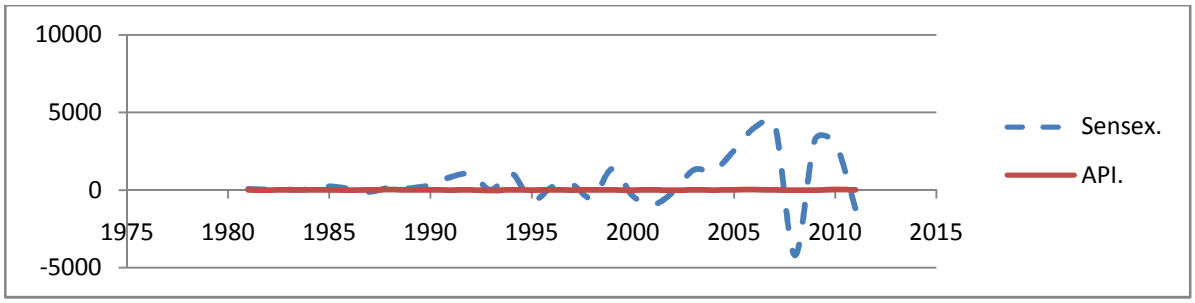



*Source: Statistical analysis in excel.*

***Figure 25***

The graphical analysis shows that right from 1985 Sensex has reflected fluctuations in oil prices as can be seen from the upward trend in Sensex due to fall in oil prices in 1985 and 1991 to 1994 and again in 1998 & 2001 fall in oil prices. Similarly the downward trends in Sensex can be seen in 1995 and 1999 due to rise in oil prices after 2001 Sensex was not much influenced by oil prices but, the large upward swing in the Sensex was being followed due to the nominal increase in oil prices up to 2008 when the sharp fall in Sensex is being attributed to financial crisis and abrupt increase in oil prices globally afterwards the drop in oil prices in 2009 was fully reflected by recovery of Sensex. Again after 2010 rise in oil prices Sensex has fallen. So on the whole it can be said by graphical analysis that Sensex is influenced by oil prices.

***Trend between the Change in Sensex and Agricultural production Index.***

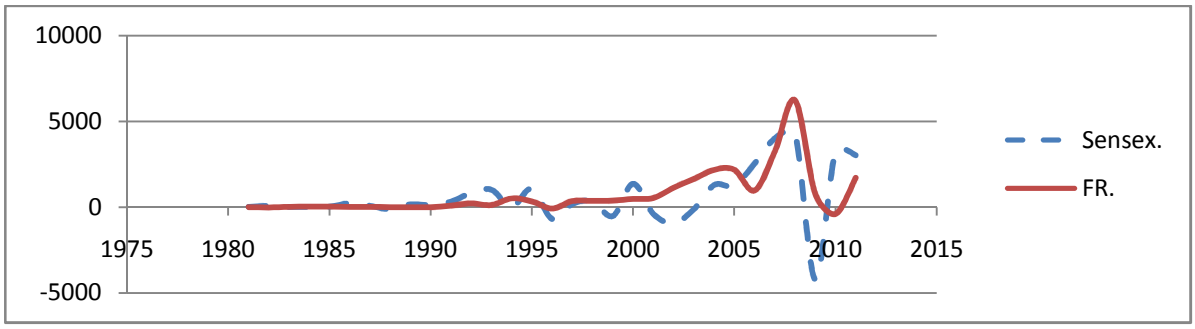



*Source: Statistical analysis in excel.*

***Figure 26***

From the above graph depicts that Sensex has reflected Agricultural production Index from 1985 onwards and the upward and downward swings in Sensex has increased with the nominal increase in the Agricultural production index and quite interestingly the drop in agricultural production index in 2008-09 with the recovery in the index in 2010 has been flowed by Sensex which was mainly due to monsoon deficit. Thereby implying that the relationship does exist between the two variables with Agricultural production index influencing Sensex.

***Trend between the Change in Sensex and Forex Reserves.***




*Source: Statistical analysis in excel.*

***Figure 27***

The graph depicts that prior to 1990 there hasn't been any noticeable relationship between Sensex and forex reserves the Sensex is found responding to forex reserves form 1990 onwards more vibrantly with every rise or fall in forex reserves translating into even greater rise or fall in Sensex except 2001-2003 where we find inverse relationship. So on the whole it can be said that relationship exists between the two variables.

**Conclusion**

On the basis of the individual trend of all the variables it is evident that the impact of financial crisis had been adverse on all except for few which are particularly national economy specific like Index of Industrial Production, money supply, market

borrowing, GDP, expenditure of central government, interest rate as the banking sector in Indian is highly regulated,

From the comparative trend analysis of stock prices with all macroeconomic variables it is evident that the volatility of Sensex has been observed more vis a vis to those macroeconomic variables which are frequently quoted in the print and electronic media & have a profound effect on public sentiments like Industrial production, inflation, market borrowing, interest rate, expenditure of central govt, exchange rate, gold prices, oil prices and forex reserves whereas no volatility in Sensex has been observed in case of the macroeconomic variables like ,money supply, GDP, balance of payment, agricultural production index which are not frequently quoted in print and electronic media & don't have a profound effect on public sentiments.

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# Chapter V

## Relationship between Macroeconomic Variables and Stock Prices

The various descriptive statistics are calculated of the variables (already discussed in proceeding pages) under study in order to describe the characteristics of the stock prices and the macroeconomic variables over the entire sample period are presented in Table 5.1 .

*Table 5.1: Descriptive Statistics of Various Variables.*

| | Mean | Median | SD | Kurtosis | Skewness | JB | p.v | Range | Minimum | Maximum | Sum | Count |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Sensex*** | 19.95 | 17.072 | 28.16 | -0.275 | 0.366573 | 0.817 | 0.66 | 110.286 | -25.3689 | 84.91679 | 638.4 | 32 |
| ***IIP*** | 3.287 | 6.6433 | 14.83 | 11.24 | -3.40455 | 223 | 0 | 68.5025 | -52.9741 | 15.52837 | 101.9 | 31 |
| ***Inf*** | 3.271 | 6.481 | 17.14 | 8.752 | -2.93566 | 189.7 | 0 | 87.9057 | -62.7089 | 25.19685 | 134.1 | 41 |
| ***M3*** | 1161 | 87.745 | 2309 | 5.345 | 2.482402 | 133 | 0 | 9522.32 | -0.97 | 9521.35 | 69651 | 60 |
| ***MB*** | 199.4 | 12.02 | 597.1 | 4.681 | 1.926458 | 47.48 | 0 | 3009.96 | -945.73 | 2064.23 | 6183 | 31 |
| ***GDP*** | 869.2 | 462.89 | 1090 | 2.708 | 1.802724 | 51.68 | 0 | 5015.1 | -448.66 | 4566.44 | 53019 | 61 |
| ***ExR*** | 0.954 | 0.8126 | 1.963 | 1.072 | 0.34272 | 2.766 | 0.25 | 9.4818 | -3.9585 | 5.5233 | 39.11 | 41 |
| ***ECG*** | 29948 | 11097 | 58794 | 3.894 | 0.896107 | 31.4 | 0 | 341212 | -148475 | 192737 | 1E+06 | 41 |
| ***IR*** | 0.049 | 0 | 0.944 | -0.167 | 0.042838 | 0.06 | 0.97 | 4 | -2 | 2 | 2 | 41 |
| ***GP*** | 622.9 | 149.86 | 1276 | 11.23 | 3.124213 | 282.1 | 0 | 7220.22 | -723.64 | 6496.58 | 25539 | 41 |
| ***BoP*** | 419.2 | 30 | 71673 | 31.9 | -4.12292 | 2759 | 0 | 672844 | -466789 | 206055 | 25571 | 61 |
| ***Oil*** | 6.625 | 2.5459 | 24.76 | -0.374 | -0.12974 | 0.268 | 0.87 | 105.246 | -48.2242 | 57.02205 | 205.4 | 31 |
| ***API*** | 2.9 | 3 | 11.4 | 1.257 | -0.33351 | 2.616 | 0.27 | 54.3 | -28.6 | 25.7 | 89.9 | 31 |
| ***FR*** | 246.7 | 1.81 | 613 | 17.05 | 3.739205 | 881.4 | 0 | 3939.43 | -242 | 3697.43 | 15051 | 61 |

In the table 5.1, the statistics have been calculated like mean,median,maximum and minimum value, standard deviation,skewness,kurotsis,jarque-bera test statistic and probability value. These statistics define various characteristics of the variables like, mean value represents the average of all the values of a variable; 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.Kurotsis 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 and then calculates JB statistic with

the joint null hypothesis that the data are normally distributed. If the computed JB statistic is low then probability value the null hypothesis is accepted i.e skewness and kurtosis is zero or vice versa.

Further analysis of table 5.1 shows that standard deviation is very high in case of Expenditure of central government comparative to others which portrays that it is dispersed around its mean value by 58793.77% i.e, there is high volatility in its values and from the skewness measure we found that all the variables are asymmetrical. More precisely, skewness is positive for nine variables, indication fat tails on the right–hand side of the distribution ,on the contrary only industrial production ,inflation, balance of payment oil prices and agricultural production is negatively skewed which indicates the tails on the left-hand side of the distribution. In case of kurtosis, all variables are positively skewed i.e having peaked distribution comparative with normal distribution and it is highest in forex reserves except Sensex, interest rate,oil price which are negatively skewed. The computed values of JB statistic is very high which compels us to reject the null hypothesis of normality at 5 % level of significance owing to the fact that the sample size is not enough to apply this test as we have just 31 observation in all whereas for this test to be precise the sample size should not be less that 55 (Gujrati,2007, p.153).
So the results of above descriptive statistics rise the issue of the inefficiency of Indian market as it shows that the values are not normally distributed about its mean and variance or in other words we say there is no randomness in any data series except in case of interest rate and oil prices and therefore being prone to periodic changes. This indicates that investors should rely on market sentiments more than giving too much consideration to fundamental indicators.

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

The correlations matrix of Table 5.2 below:

*Table 5.2: Correlation matrix.*

| | ***Sensex*** | ***IIP*** | ***Inf*** | ***M3*** | ***MB*** | ***GDP*** | ***ExR*** | ***ECG*** | ***IR*** | ***GP*** | ***BoP*** | ***OIL*** | ***API*** | ***FR*** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sensex** | 1 | | | | | | | | | | | | | |
| **IIP** | -0.14 | 1 | | | | | | | | | | | | |
| **Inf** | -0.06 | 0.73 | 1 | | | | | | | | | | | |
| **M3** | -0.15 | 0.02 | 0.11 | 1 | | | | | | | | | | |
| **MB** | -0.28 | -0.05 | 0.06 | 0.58 | 1 | | | | | | | | | |
| **GDP** | 0.03 | -0.04 | 0.03 | 0.88 | 0.27 | 1 | | | | | | | | |
| **ExR** | -0.11 | 0.09 | 0.22 | -0.22 | 0.29 | -0.4 | 1 | | | | | | | |
| **ECG** | -0.05 | 0.01 | 0.07 | 0.65 | 0.25 | 0.57 | -0.1 | 1 | | | | | | |
| **IR** | 0.232 | -0.13 | -0.1 | 0.13 | -0.04 | 0.15 | -0.3 | -0.2 | 1 | | | | | |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **GP** | -0.15 | 0.03 | 0.14 | 0.87 | 0.62 | 0.68 | -0.1 | 0.45 | 0.29 | 1 | | | | |
| **BoP** | 0.31 | 0.16 | 0.02 | -0.08 | -0.3 | 0.21 | -0.1 | -0.1 | -0.16 | -0.17 | 1 | | | |
| **OIL** | -0.09 | -0.09 | 0.01 | 0.28 | 0.02 | 0.32 | -0.4 | 0.2 | 0.23 | 0.27 | -0.3 | 1 | | |
| **API** | 0.317 | -0.14 | -0.05 | 0.17 | -0.24 | 0.42 | -0.4 | 0.21 | 0.24 | 0.15 | 0.19 | 0.12 | 1 | |
| **FR** | 0.057 | 0.13 | 0.08 | 0.55 | 0.09 | 0.66 | -0.6 | 0.36 | 0.11 | 0.34 | 0.29 | 0.3 | 0.172 | 1 |

This matrix is very important as it helps to know that the variables on which we wish to apply OLS are even related to each other. Hence a correlation matrix is worked out between them. In the following correlation matrix only few variables are correlated to each other.

Prior to the formation of a regression model, a check on multicollinearity is necessary to detect the probable existence of any linear relationships among the explanatory variables. As one of the basic assumptions of ordinary Least Square method is that regressors are not mutually correlated. If more than one of them is correlated with other, multicollinearity is said to exist, thereby increasing standard error of our estimates. To overcome this problem two rule of thumb procedures are followed viz;first,transformation of variables by taking the first difference form because we run the regression ,not on the original variables, but on the difference of successive values of variables, the first difference regression model reduces the severity of multicollinearity (Gujrati,4/e.2007,p.375).Second suggested rule of thumb is that if correlation is in excess of .8 multicollinearity may pose serious problem. Therefore we controlled the same by taking .7 correlation coefficient between any two variables as the highest value allowed for forming regression models if two or more variables are correlated, one of them should be included instead of both. This was done by reviewing the correlations between the explanatory variables.

The correlation coefficient matrix, reported in Table 5.2 reveal that the stock prices appeared to be rather weakly but positively correlated with ΔGDP (.03), ΔIR (0.23), ΔBoP (0.31),ΔAPI (.31) and ΔFR (.057) & s weakly by negatively correlated with variables like ΔIIP(-.14), ΔInf, ΔM3(-.15), ΔMB(-.28), ΔExR(-.11), ΔGP(-.15) & ΔOil(-.09). Hence, six separate regressions were run to minimize the effect of multicollinearity as being an natural phenomenon it can only be minimized but can't be eliminated altogether (Blanchard,1998,p.190).

**Effects of Macroeconomic Variables on Stock Prices.**

Six cross-sectional regression models have been framed for the final analysis to investigate the effects of macroeconomic variables on stock prices in India. Model 1 consisted of ten macroeconomic variables viz. ΔInf, ΔM3, ΔMB,ΔExR, ΔECG, ΔIR, ΔBOP,ΔOIL,ΔAPI, ΔFR Model 2 consisted of ten macroeconomic variables viz ΔIIP, ΔM3, ΔMB, ΔExR, ΔECG, ΔIR, ΔBoP, ΔOil, ΔAPI,ΔFR. Model 3 consisted of ten macroeconomic variables viz; ΔInf, ΔGDP, ΔMB,ΔExR, ΔECG, ΔIR, ΔBOP,ΔOIL,ΔAPI, ΔFR. Model 4 consisted of ten macroeconomic variables viz; ΔIIP, ΔGDP, ΔMB, ΔExR, ΔECG, ΔIR, ΔBoP, ΔOil, ΔAPI,ΔFR Model 5 consisted

of ten macroeconomic variables viz ΔInf, ΔGP, ΔMB,ΔExR, ΔECG, ΔIR, ΔBOP,ΔOIL,ΔAPI, ΔFR. Model 6 consisted of ten macroeconomic variables viz ΔIIP, ΔMB, ΔGP, ΔExR, ΔECG, ΔIR, ΔBoP, ΔOil, ΔAPI,ΔFR.

The six models were as follows:

***Model 1***

$$P = \beta_0 + \beta_1 \Delta Inf + \beta_2 \Delta M3 + \beta_3 \Delta MB + \beta_4 \Delta ExR + \beta_5 \Delta ECG + \beta_6 \Delta IR + \beta_7 \Delta BOP + \beta_8 \Delta OIL + \beta_9 \Delta API + \beta_{10} \Delta FR + \varepsilon_t$$

***Model 2***

$$P = \beta_0 + \beta_1 \Delta IIP + \beta_2 \Delta M3 + \beta_3 \Delta MB + \beta_4 \Delta ExR + \beta_5 \Delta ECG + \beta_6 \Delta IR + \beta_7 \Delta BoP + \beta_8 \Delta Oil + \beta_9 \Delta API + \beta_{10} \Delta FR + \varepsilon_t$$

***Model 3***

$$P = = \beta_0 + \beta_1 \Delta Inf + \beta_2 \Delta GDP + \beta_3 \Delta MB + \beta_4 \Delta ExR + \beta_5 \Delta ECG + \beta_6 \Delta IR + \beta_7 \Delta BOP + \beta_8 \Delta OIL + \beta_9 \Delta API + \beta_{10} \Delta FR + \varepsilon_t$$

***Model 4***

$$P = \beta_0 + \beta_1 \Delta IIP + \beta_2 \Delta GDP + \beta_3 \Delta MB + \beta_4 \Delta ExR + \beta_5 \Delta ECG + \beta_6 \Delta IR + \beta_7 \Delta BoP + \beta_8 \Delta Oil + \beta_9 \Delta API + \beta_{10} \Delta FR + \varepsilon_t$$

***Model 5***

$$P = \beta_0 + \beta_1 \Delta Inf + \beta_2 \Delta GP + \beta_3 \Delta MB + \beta_4 \Delta ExR + \beta_5 \Delta ECG + \beta_6 \Delta IR + \beta_7 \Delta BOP + \beta_8 \Delta OIL + \beta_9 \Delta API + \beta_{10} \Delta FR + \varepsilon_t$$

***Model 6***

$$P = \beta_0 + \beta_1 \Delta IIP + \beta_2 \Delta MB + \beta_3 \Delta GP + \beta_4 \Delta ExR + \beta_5 \Delta ECG + \beta_6 \Delta IR + \beta_7 \Delta BoP + \beta_8 \Delta Oil + \beta_9 \Delta API + \beta_{10} \Delta FR + \varepsilon_t$$

The Regression results of Model 1,2,3,4,5 and 6 using OLS were :
**Model 1**

Table 5.3: Excel output of regression analysis of Sensex using Regressors selected in model 1.

| *Regression Statistics* | |
|---|---|
| Multiple R | 0.533119 |
| R Square | 0.284216 |
| Adjusted R Square | -0.07368 |
| Standard Error | 29.63204 |
| Observations | 31 |

Table 5.4:Associated ANOVA summary of model 1

| | *df* | *SS* | *MS* | *F* | *Significance F* |
|---|---|---|---|---|---|
| Regression | 10 | 6973.011 | 697.3011 | 0.79414 | 0.635514737 |
| Residual | 20 | 17561.16 | 878.058 | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Total | 30 | 24534.17 | | | | |

Table 5.5:Least square point estimate of parameters of model 1

| | *Coefficients* | *Standard Error* | *t Stat* | *P-value* | *Lower 95%* | *Upper 95%* |
|---|---|---|---|---|---|---|
| Intercept | 22.33483 | 10.74684 | 2.078269 | 0.050773 | -0.08268773 | 44.75235 |
| Inf | -0.00571 | 0.317586 | -0.01798 | 0.985833 | -0.66818358 | 0.656764 |
| M3 | -0.00405 | 0.004169 | -0.97153 | 0.342888 | -0.01274626 | 0.004646 |
| MB | 0.001522 | 0.015522 | 0.098042 | 0.922875 | -0.03085556 | 0.033899 |
| ExR | 0.334892 | 4.125043 | 0.081185 | 0.936102 | -8.26979733 | 8.93958 |
| ECG | 0.000114 | 0.000136 | 0.840673 | 0.410477 | -0.00016892 | 0.000397 |
| IR | 10.17811 | 6.852138 | 1.485392 | 0.153033 | -4.11519577 | 24.47142 |
| BoP | 8.81E-05 | 7.42E-05 | 1.18665 | 0.249271 | -6.6735E-05 | 0.000243 |
| OIL | -0.04946 | 0.264737 | -0.18684 | 0.853668 | -0.60169544 | 0.502768 |
| API | 0.503817 | 0.592068 | 0.850945 | 0.404873 | -0.73121487 | 1.73885 |
| FR | 0.001668 | 0.011593 | 0.143876 | 0.887039 | -0.02251474 | 0.025851 |

## Model 2.

Table 5.6: Excel output of regression analysis of Sensex using Regressors selected in model 2.

| *Regression Statistics* | |
|---|---|
| Multiple R | 0.54931302 |
| R Square | 0.301744794 |
| Adjusted R Square | -0.047382809 |
| Standard Error | 29.26697124 |
| Observations | 31 |

Table 5.7:Presents associated ANOVA summary of model 2

| | *df* | *SS* | *MS* | *F* | *Significance F* |
|---|---|---|---|---|---|
| Regression | 10 | 7403.058142 | 740.3058 | 0.864282 | 0.578490186 |
| Residual | 20 | 17131.11212 | 856.5556 | | |
| Total | 30 | 24534.17026 | | | |

Table 5.8:Least square point estimate of parameters of model 2

| | *Coefficients* | *Standard Error* | *t Stat* | *P-value* | *Lower 95%* | *Upper 95%* |
|---|---|---|---|---|---|---|
| Intercept | 22.16327324 | 10.14929873 | 2.183725 | 0.041066 | 0.992207135 | 43.33434 |
| IIP | -0.271695705 | 0.383317995 | -0.7088 | 0.486629 | -1.071283028 | 0.527892 |
| M3 | -0.003758402 | 0.004079752 | -0.92123 | 0.367908 | -0.012268616 | 0.004752 |
| MB | -0.000245931 | 0.015259414 | -0.01612 | 0.987301 | -0.03207651 | 0.031585 |
| ExR | 0.786688903 | 3.862729526 | 0.203661 | 0.840676 | -7.270823673 | 8.844201 |
| ECG | 0.000106939 | 0.000133005 | 0.804026 | 0.430836 | -0.000170504 | 0.000384 |
| IR | 9.737039462 | 6.739646718 | 1.44474 | 0.164017 | -4.321617198 | 23.7957 |
| BoP | 8.86908E-05 | 7.28784E-05 | 1.216971 | 0.237782 | -6.33308E-05 | 0.000241 |
| OIL | -0.060015763 | 0.261649445 | -0.22937 | 0.820907 | -0.60580694 | 0.485775 |
| API | 0.458602685 | 0.586599024 | 0.781799 | 0.44349 | -0.765021435 | 1.682227 |
| FR | 0.003028608 | 0.011365727 | 0.266468 | 0.792606 | -0.020679884 | 0.026737 |

## Table 5.9: Durbin-Watson test for model 2

| ***Observation*** | ***Predicted Sensex*** | ***Residuals*** |
|---|---|---|
| 1 | 23.62183916 | 26.09372215 |
| 2 | 20.66696057 | -14.12566867 |
| 3 | 27.8009348 | -20.20759815 |
| 4 | 21.11907295 | -9.429398971 |
| 5 | 21.86243206 | 63.0543567 |
| 6 | 21.26259078 | -5.993306095 |
| 7 | 18.63063011 | -38.53404752 |
| 8 | 33.16539903 | 1.86518672 |
| 9 | 21.91238894 | -3.037115983 |
| 10 | 30.89486822 | 12.97687779 |
| 11 | 45.80940197 | 33.27171052 |
| 12 | 6.439316922 | 47.62583836 |
| 13 | 6.104704461 | -6.000410808 |
| 14 | 48.92661232 | -11.79880631 |
| 15 | 16.08802406 | -33.35206274 |
| 16 | 37.4514004 | -31.96105169 |
| 17 | 10.57783959 | -0.673076591 |

| | | |
|---|---|---|
| 18 | 19.63969644 | -33.22739701 |
| 19 | 16.50631369 | 24.88795239 |
| 20 | 7.831606673 | -16.18041308 |
| 21 | 13.69494799 | -35.6576666 |
| 22 | -3.159800729 | -0.611564388 |
| 23 | 18.87349339 | 21.23204915 |
| 24 | 13.17341462 | 14.62594382 |
| 25 | 32.85067693 | 11.35006197 |
| 26 | 45.9921675 | 2.310735785 |
| 27 | 36.48183281 | -1.526675624 |
| 28 | -28.7253586 | 3.356489592 |
| 29 | 11.51549923 | 14.52183837 |
| 30 | 26.60170507 | -7.224551992 |
| 31 | 1.277269247 | -7.631951115 |

Durbin-Watson test results :

d= 1.6763277;$d_L$ = .741**;**$d_U$ =2.33 at 5% level of significance.
$d_L$ < d> $d_U$,the test is inconclusive.

**Table 5.10: Whites General Heterocadasticity test :**

| Observation | *Residuals* | Residuals .sq | *Predicted Sensex* | Predicted sensex .sq |
|---|---|---|---|---|
| 1 | 26.09372 | 680.8823358 | 23.62183916 | 557.9912854 |
| 2 | -14.1257 | 199.5345153 | 20.66696057 | 427.1232594 |
| 3 | -20.2076 | 408.3470231 | 27.8009348 | 772.8919756 |
| 4 | -9.4294 | 88.91356495 | 21.11907295 | 446.0152424 |
| 5 | 63.05436 | 3975.851899 | 21.86243206 | 477.9659356 |
| 6 | -5.99331 | 35.91971794 | 21.26259078 | 452.0977666 |
| 7 | -38.534 | 1484.872818 | 18.63063011 | 347.1003785 |
| 8 | 1.865187 | 3.478921499 | 33.16539903 | 1099.943693 |
| 9 | -3.03712 | 9.224073495 | 21.91238894 | 480.1527889 |
| 10 | 12.97688 | 168.3993572 | 30.89486822 | 954.4928825 |
| 11 | 33.27171 | 1107.006721 | 45.80940197 | 2098.501309 |
| 12 | 47.62584 | 2268.220479 | 6.439316922 | 41.46480242 |
| 13 | -6.00041 | 36.00492987 | 6.104704461 | 37.26741655 |
| 14 | -11.7988 | 139.2118303 | 48.92661232 | 2393.813393 |
| 15 | -33.3521 | 1112.360089 | 16.08802406 | 258.8245181 |
| 16 | -31.9611 | 1021.508825 | 37.4514004 | 1402.607392 |
| 17 | -0.67308 | 0.453032097 | 10.57783959 | 111.8906905 |
| 18 | -33.2274 | 1104.059912 | 19.63969644 | 385.7176762 |
| 19 | 24.88795 | 619.410174 | 16.50631369 | 272.4583918 |
| 20 | -16.1804 | 261.8057675 | 7.831606673 | 61.33406308 |

| | | | | |
|---|---|---|---|---|
| 21 | -35.6577 | 1271.469187 | 13.69494799 | 187.5516005 |
| 22 | -0.61156 | 0.374011 | -3.159800729 | 9.984340647 |
| 23 | 21.23205 | 450.7999113 | 18.87349339 | 356.2087527 |
| 24 | 14.62594 | 213.9182327 | 13.17341462 | 173.5388527 |
| 25 | 11.35006 | 128.8239067 | 32.85067693 | 1079.166975 |
| 26 | 2.310736 | 5.339499867 | 45.9921675 | 2115.279471 |
| 27 | -1.52668 | 2.33073846 | 36.48183281 | 1330.924125 |
| 28 | 3.35649 | 11.26602238 | -28.7253586 | 825.1462266 |
| 29 | 14.52184 | 210.8837896 | 11.51549923 | 132.6067226 |
| 30 | -7.22455 | 52.19415148 | 26.60170507 | 707.6507129 |
| 31 | -7.63195 | 58.24667782 | 1.277269247 | 1.631416729 |

Table 5.11:Whites Heterocadasticity test.

| *Regression Statistics* | | |
|---|---|---|
| Multiple R | 0.196212 | |
| R Square | 0.038499 | **1.193474** |
| Adjusted R Square | -0.03018 | |
| Standard Error | 859.8211 | |
| Observations | 31 | |

Table 5.12: Associated ANOVA

| | *df* | *SS* | *MS* | *F* | *Significance F* |
|---|---|---|---|---|---|
| Regression | 2 | 828849.8 | 414424.9 | 0.56057 | 0.577159 |
| Residual | 28 | 20700184 | 739292.3 | | |
| Total | 30 | 21529034 | | | |

Table 5.13: Least square estimate.

| | *Coefficients* | *Standard Error* | *t Stat* | *P-value* | *Lower 95%* | *Upper 95%* |
|---|---|---|---|---|---|---|
| Intercept | 540.9047 | 254.0344 | 2.129258 | 0.042163 | 20.5389 | 1061.271 |
| Predicted Sensex | 12.84871 | 14.96301 | 0.858698 | 0.397799 | -17.8016 | 43.49906 |
| Predicted Sensex .sq | -0.38331 | 0.364067 | -1.05286 | 0.301409 | -1.12907 | 0.362447 |

**Whites General Heterocadasticity test results :**

From the table 5.11-5.12,

$n.R^2 \sim$ Chi-square distribution with degrees of freedom 2 .

WGH =1.193

Critical value at 5% level of significance and 2 degrees of freedom=5.99

We conclude on the basis of white's test, that there is no Heterocadasticity in the above model.

## Model 3:

Table 5.14: Excel output of regression analysis of Sensex using Regressors selected in model 3.

| *Regression Statistics* | |
|---|---|
| Multiple R | 0.515344 |
| R Square | 0.26558 |
| Adjusted R Square | -0.10163 |
| Standard Error | 30.01532 |
| Observations | 31 |

Table 5.15:Associated ANOVA summary of model 3

| | *df* | *SS* | *MS* | *F* | *Significance F* |
|---|---|---|---|---|---|
| Regression | 10 | 6515.776 | 651.5776 | 0.723236 | 0.694489843 |
| Residual | 20 | 18018.39 | 900.9197 | | |
| Total | 30 | 24534.17 | | | |

Table 5.16:Least square point estimate of parameters of model 3

| | *Coefficients* | *Standard Error* | *t Stat* | *P-value* | *Lower 95%* | *Upper 95%* |
|---|---|---|---|---|---|---|
| Intercept | 24.23013 | 13.29688 | 1.822242 | 0.083407 | -3.506676069 | 51.96693 |
| Inf | -0.05261 | 0.3171 | -0.1659 | 0.8699 | -0.71406617 | 0.608852 |
| GDP | -0.00568 | 0.008847 | -0.64219 | 0.528046 | -0.02413593 | 0.012773 |
| MB | -0.00516 | 0.012752 | -0.40453 | 0.69012 | -0.031759803 | 0.021442 |
| ExR | 0.770619 | 4.136451 | 0.1863 | 0.854086 | -7.857865386 | 9.399104 |
| ECG | 7.17E-05 | 0.000124 | 0.578283 | 0.569528 | -0.000186993 | 0.00033 |
| IR | 8.904535 | 6.708117 | 1.327427 | 0.199322 | -5.088351252 | 22.89742 |
| BoP | 9.5E-05 | 8.01E-05 | 1.186057 | 0.2495 | -7.20869E-05 | 0.000262 |
| OIL | -0.03311 | 0.274274 | -0.12072 | 0.905114 | -0.605237208 | 0.539014 |
| API | 0.597485 | 0.630515 | 0.947613 | 0.354637 | -0.717747528 | 1.912717 |
| FR | 0.001249 | 0.011862 | 0.105261 | 0.917218 | -0.023494352 | 0.025991 |

## Model 4:

Table 5.17: Excel output of regression analysis of Sensex using Regressors selected in model 4.

| *Regression Statistics* | |
|---|---|
| Multiple R | 0.538849572 |

| | |
|---|---|
| R Square | 0.290358861 |
| Adjusted R Square | -0.064461708 |
| Standard Error | 29.5046238 |
| Observations | 31 |

Table 5.18: Associated ANOVA summary of model 4

| | *df* | *SS* | *MS* | *F* | *Significance F* |
|---|---|---|---|---|---|
| Regression | 10 | 7123.714 | 712.3714 | 0.818326 | 0.615642975 |
| Residual | 20 | 17410.46 | 870.5228 | | |
| Total | 30 | 24534.17 | | | |

Table 5.19: Least square point estimate of parameters of model 4

| | *Coefficients* | *Standard Error* | *t Stat* | *P-value* | *Lower 95%* | *Upper 95%* |
|---|---|---|---|---|---|---|
| Intercept | 25.21071817 | 12.78091 | 1.97253 | 0.062535 | -1.449784004 | 51.87122 |
| IIP | -0.328443386 | 0.385248 | -0.85255 | 0.404003 | -1.132056067 | 0.475169 |
| GDP | -0.006248976 | 0.008715 | -0.71705 | 0.481634 | -0.024427812 | 0.01193 |
| MB | -0.005844264 | 0.01251 | -0.46715 | 0.645442 | -0.031940649 | 0.020252 |
| ExR | 1.013863667 | 3.874755 | 0.261659 | 0.79626 | -7.068733653 | 9.096461 |
| ECG | 7.48308E-05 | 0.000122 | 0.614672 | 0.545701 | -0.000179117 | 0.000329 |
| IR | 8.720866855 | 6.577958 | 1.325771 | 0.19986 | -5.000512239 | 22.44225 |
| BoP | 9.96039E-05 | 7.86E-05 | 1.26766 | 0.21948 | -6.42965E-05 | 0.000264 |
| OIL | -0.041780217 | 0.269356 | -0.15511 | 0.878288 | -0.603647071 | 0.520087 |
| API | 0.552001148 | 0.619858 | 0.890529 | 0.38377 | -0.740999509 | 1.845002 |
| FR | 0.002905275 | 0.011591 | 0.250654 | 0.804638 | -0.021272642 | 0.027083 |

## Model 5:

Table 5.20 Excel output of regression analysis of Sensex using Regressors selected in model 5.

| *Regression Statistics* | |
|---|---|
| Multiple R | 0.525993338 |
| R Square | 0.276668991 |
| Adjusted R Square | -0.084996513 |
| Standard Error | 29.787855 |
| Observations | 31 |

Table 5.21: Associated ANOVA summary of model 5

| | *df* | *SS* | *MS* | *F* | *Significance F* |
|---|---|---|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| Regression | 10 | 6787.844 | 678.7844 | 0.764986 | 0.65967622 |
| Residual | 20 | 17746.33 | 887.3163 | | |
| Total | 30 | 24534.17 | | | |

Table 5.22: Least square point estimate of parameters of model 5

| | *Coefficients* | *Standard Error* | *t Stat* | *P-value* | *Lower 95%* | *Upper 95%* |
|---|---|---|---|---|---|---|
| Intercept | 20.01181486 | 10.26018 | 1.950434 | 0.065279 | -1.390555454 | 41.41419 |
| Inf | 0.003938078 | 0.322968 | 0.012193 | 0.990392 | -0.669762235 | 0.677638 |
| MB | -0.00039012 | 0.015071 | -0.02589 | 0.979605 | -0.031827386 | 0.031047 |
| GP | -0.005692326 | 0.006684 | -0.85167 | 0.40448 | -0.019634314 | 0.00825 |
| ExR | 0.933308311 | 4.052641 | 0.230296 | 0.820201 | -7.520352392 | 9.386969 |
| ECG | 7.22439E-05 | 0.000117 | 0.618159 | 0.543446 | -0.000171541 | 0.000316 |
| IR | 10.79007715 | 7.288324 | 1.480461 | 0.154332 | -4.413100514 | 25.99325 |
| BoP | 8.46823E-05 | 7.42E-05 | 1.140632 | 0.267498 | -7.01829E-05 | 0.00024 |
| OIL | -0.035152831 | 0.268755 | -0.1308 | 0.897241 | -0.595765243 | 0.52546 |
| API | 0.537339981 | 0.59934 | 0.896553 | 0.380623 | -0.712861057 | 1.787541 |
| FR | -0.000776911 | 0.011411 | -0.06808 | 0.946395 | -0.024580167 | 0.023026 |

## Model 6

Table 5.23: Excel output of regression analysis of Sensex using Regressors selected in model 6

| *Regression Statistics* | |
|---|---|
| Multiple R | 0.539989 |
| R Square | 0.291588 |
| Adjusted R Square | -0.06262 |
| Standard Error | 29.47906 |
| Observations | 31 |

Table 5.24:Associated ANOVA summary of model 6

| | *df* | *SS* | *MS* | *F* | *Significance F* |
|---|---|---|---|---|---|
| Regression | 10 | 7153.87 | 715.387 | 0.823216 | 0.611648918 |
| Residual | 20 | 17380.3 | 869.015 | | |
| Total | 30 | 24534.17 | | | |

Table 5.25:Least square point estimate of parameters of model 6

| | *Coefficients* | *Standard Error* | *t Stat* | *P-value* | *Lower 95%* | *Upper 95%* |
|---|---|---|---|---|---|---|
| Intercept | 19.88076 | 9.755208 | 2.037964 | 0.054999 | -0.46824502 | 40.22977 |
| IIP | -0.25384 | 0.39106 | -0.64911 | 0.52365 | -1.06957927 | 0.561895 |
| MB | -0.0026 | 0.014901 | -0.17438 | 0.863317 | -0.03368161 | 0.028485 |
| GP | -0.00487 | 0.006562 | -0.74145 | 0.467036 | -0.01855286 | 0.008822 |
| ExR | 1.356854 | 3.817134 | 0.355464 | 0.725963 | -6.60554813 | 9.319257 |
| ECG | 6.53E-05 | 0.000115 | 0.567113 | 0.576948 | -0.0001748 | 0.000305 |
| IR | 10.11235 | 7.177107 | 1.408973 | 0.174202 | -4.85883276 | 25.08353 |
| BoP | 8.47E-05 | 7.3E-05 | 1.159769 | 0.259801 | -6.764E-05 | 0.000237 |
| OIL | -0.04877 | 0.266754 | -0.18283 | 0.856771 | -0.6052106 | 0.507668 |
| API | 0.488224 | 0.597237 | 0.817471 | 0.423291 | -0.75759094 | 1.734039 |
| FR | 0.000705 | 0.011154 | 0.063252 | 0.950194 | -0.0225606 | 0.023972 |

*Analysis of Regression results of models 1,2,3,4,5& 6.*

The R-square value all the six models are as :
Model 1 (28%)
Model 2 (30%)
Model 3 (26%)
Model 4 (29%)
Model 5 (27%)
Model 6 (29%)

Following the statement by Gujarati (2007,4/e:p265) the model 2 has been chosen for the final analysis, as the R-square value is highest explaining 30% variation in model by all independent variables jointly and that the regressors have the theoretically expected signs suggesting that model serves purpose in determining the effect of macroeconomic variables on stock prices, and that the model is correctly specified by the highest F-value of (86.42%) and is significant at 5% level which shows the fitness of the model, further,Durbin-Watson (DW) test statistic shows the value of "d" lies between $d_L$ and $d_U$ the D-W test statistic is inconclusive about autocorrelation. As in our case d= 1.6763277;$d_L$ = .741**;**$d_U$ =2.33 at 5% level of significance i.e $d_L < d < d_U$ and this result confirms that the autocorrelation may not be observed in the model under investigation. Further the Whites General Heterocadasticity test gives the value of 1.193 which is less than critical value of 5.99 at 5% level of significance at 2 degrees of freedom thereby accepting the null hypothesis ($H_0$ ) that there is homocadasticity in the model 2 ,so OLS is unbiased and the prediction by this model are reliable. This implies that model 2 had higher explanatory power in accounting for stock prices. Thus, the variables of Model 2 are considered for this study. As the actual results of investigated variables coincide with the expected results except IIP,M3,IR which showed spurious regression.
As seen in Model 2, ΔMB, ΔOil, had negative though insignificant influence on share prices This was consistent with the results of the correlation matrix which showed

relatively weak and negative correlation between them this was also consistent with the previous findings. for the UK economy (Abdullah et.al 1993)and for Greece Hodroyiannis et.al (2001) similarly Forex reserve, Exchange rate and Expenditure of Central Govt and BoP are positively related is consistent with the findings of Ibrahim (1999) for Malaysia,Ratanapakorn et.al (2007) for US economy and Chaudhuri et.al (2004) for US economy and Petra et.al (2006) for Greece. Also it was found that Index for Agricultural production had a positive influence as agriculture sector is complementary to various industries. Amongst all the variables, only ΔExR, ΔIAP , ΔBoP influenced stock prices in India in the samople period given their large regression coefficients. while ΔOil, ΔFR, ΔECG and ΔMB explained with small regression coefficients. Whereas relationship observed between Interest rate, Money supply and Industrial production with stock prices was found spurious for the reasons beyond the scope of this research..

With computed F-value of .86 and F-critical value of .57 at 5% level of significance, we reject null hypothesis ($H_0$) that all coefficients are simultaneously zero while explaining their influence on stock prices and accept that there is statistical evidence to conclude that a regression relationship exists between stock prices and macroeconomic variables as analyzed in the model 2. Additionally to test the assumption of independence of errors and variance of errors the Durbin-Watson test of autocorrelation and Whites General test for Heterocadasticity is employed for which the value of the statistic confirm the model 2 to be Best Linear Unbiased Estimate (BLUE).

In sum, the analysis indicates the model to be valid and reliable. Thus we conclude that all the variables were insignificant in predicting changes in stock prices, which suggests that the Indian stock market did not violated the theory of market efficiency from 1980-2011.Thereby suggesting that investors should not only go by the macroeconomic fundamentals which if all taken into account yields only 30% precision but should also consider market sentiments.

Now testing the same null hypothesis ($H_0$) for the sub-sample periods pertaining to pre-liberalization & post –liberalization.

***Effects in Pre-Liberalization period of Indian Economy on Stock Prices.***

The sub-sample period to study post-liberalization from the period of 1980-1991 are presented as:

**Model 1:**

Table 5.26:Excel output of regression analysis of Sensex using Regressors selected in model 1

| *Regression Statistics* | |
|---|---|
| Multiple R | 0.999772 |
| R Square | 0.999545 |

| | |
|---|---|
| Adjusted R Square | 0.995445 |
| Standard Error | 2.160587 |
| Observations | 11 |

Table 5.27:Associated ANOVA summary of model 1

| | *df* | *SS* | *MS* | *F* | *Significance F* |
|---|---|---|---|---|---|
| Regression | 9 | 10244.67 | 1138.296 | 243.8439 | 0.049661 |
| Residual | 1 | 4.668134 | 4.668134 | | |
| Total | 10 | 10249.33 | | | |

Table 5.28:Least square point estimate of parameters of model 1

| | *Coefficients* | *Standard Error* | *t Stat* | *P-value* | *Lower 95%* | *Upper 95%* |
|---|---|---|---|---|---|---|
| Intercept | -35.3986 | 2.990932 | -11.8353 | 0.053662 | -73.402 | 2.604767 |
| Inf | 0.554772 | 0.039597 | 14.01058 | 0.045362 | 0.051649 | 1.057894 |
| M3 | -0.34409 | 0.021287 | -16.1644 | 0.039334 | -0.61457 | -0.07361 |
| MB | 5.064464 | 0.213167 | 23.75817 | 0.02678 | 2.355917 | 7.77301 |
| ExR | 70.56517 | 1.926515 | 36.62841 | 0.017376 | 46.08648 | 95.04386 |
| ECG | 0.001295 | 0.000494 | 2.62372 | 0.23182 | -0.00498 | 0.007565 |
| BoP | -0.01592 | 0.00048 | -33.139 | 0.019205 | -0.02202 | -0.00981 |
| OIL | -1.46347 | 0.059474 | -24.6071 | 0.025857 | -2.21916 | -0.70779 |
| API | 0.387343 | 0.094684 | 4.090919 | 0.152625 | -0.81573 | 1.590412 |
| FR | 0.227442 | 0.044379 | 5.124982 | 0.122678 | -0.33645 | 0.791331 |

## Model 2 :

Table 5.29:Excel output of regression analysis of Sensex using Regressors selected in model 2

| *Regression Statistics* | |
|---|---|
| Multiple R | 0.993957 |
| R Square | 0.987951 |
| Adjusted R Square | 0.879508 |
| Standard Error | 11.1129 |
| Observations | 11 |

Table 5.30:Associated ANOVA summary of model 2

| | *df* | *SS* | *MS* | *F* | *Significance F* |
|---|---|---|---|---|---|
| Regression | 9 | 10125.84 | 1125.093 | 9.110317 | 0.252005 |
| Residual | 1 | 123.4966 | 123.4966 | | |
| Total | 10 | 10249.33 | | | |

Table 5.31 :Least square point estimate of parameters of model 2

| | *Coefficients* | *Standard Error* | *t Stat* | *P-value* | *Lower 95%* | *Upper 95%* |
|---|---|---|---|---|---|---|
| Intercept | -90.2585 | 25.7147 | -3.50999 | 0.176692 | -416.995 | 236.4778 |
| IIP | 7.229617 | 2.844952 | 2.541209 | 0.23867 | -28.9189 | 43.37816 |
| M3 | -0.30498 | 0.105504 | -2.89067 | 0.212029 | -1.64553 | 1.035579 |
| MB | 5.168223 | 1.112965 | 4.643652 | 0.135032 | -8.97334 | 19.30979 |
| ExR | 68.26671 | 9.807454 | 6.960696 | 0.090838 | -56.3488 | 192.8822 |
| ECG | 0.000174 | 0.002502 | 0.069379 | 0.955903 | -0.03162 | 0.031971 |
| BoP | -0.01274 | 0.002682 | -4.75126 | 0.132062 | -0.04682 | 0.021336 |
| OIL | -1.34907 | 0.308197 | -4.37729 | 0.142983 | -5.26508 | 2.566948 |
| API | 0.668932 | 0.47802 | 1.399382 | 0.394996 | -5.40488 | 6.742749 |
| FR | 0.442834 | 0.253143 | 1.749348 | 0.330601 | -2.77365 | 3.659316 |

## Model 3:

Table 5.32:Excel output of regression analysis of Sensex using Regressors selected in model 3

| *Regression Statistics* | |
|---|---|
| Multiple R | 0.989372 |
| R Square | 0.978857 |
| Adjusted R Square | 0.788574 |
| Standard Error | 14.72066 |
| Observations | 11 |

Table 5.33:Associated ANOVA summary of model 3

| | *df* | *SS* | *MS* | *F* | *Significance F* |
|---|---|---|---|---|---|
| Regression | 9 | 10032.64 | 1114.737 | 5.144198 | 0.330315 |
| Residual | 1 | 216.698 | 216.698 | | |
| Total | 10 | 10249.33 | | | |

Table 5.34:Least square point estimate of parameters of model 3

| | *Coefficients* | *Standard Error* | *t Stat* | *P-value* | *Lower 95%* | *Upper 95%* |
|---|---|---|---|---|---|---|
| Intercept | 43.13756 | 37.84884 | 1.139733 | 0.458485 | -437.778 | 524.0527 |
| Inf | 0.122612 | 0.266381 | 0.460289 | 0.725377 | -3.26208 | 3.507304 |
| GDP | -0.34613 | 0.160508 | -2.15644 | 0.276427 | -2.38558 | 1.693322 |
| MB | 4.157265 | 1.35992 | 3.056992 | 0.201266 | -13.1222 | 21.43669 |
| ExR | 61.88941 | 12.48386 | 4.957554 | 0.126714 | -96.7331 | 220.5119 |
| ECG | 0.007431 | 0.00619 | 1.200471 | 0.442161 | -0.07122 | 0.086086 |
| BoP | -0.02276 | 0.004606 | -4.94136 | 0.127118 | -0.08128 | 0.035763 |
| OIL | -1.77954 | 0.386404 | -4.6054 | 0.13612 | -6.68927 | 3.130183 |
| API | 7.621173 | 3.625678 | 2.101999 | 0.282691 | -38.4474 | 53.68978 |

| | | | | | | |
|---|---|---|---|---|---|---|
| FR | -0.3297 | 0.246386 | -1.33816 | 0.408563 | -3.46034 | 2.800933 |

## Model 4:

Table 5.35:Excel output of regression analysis of Sensex using Regressors selected in model 4

| *Regression Statistics* | |
|---|---|
| Multiple R | 0.987421 |
| R Square | 0.975 |
| Adjusted R Square | 0.750005 |
| Standard Error | 16.00714 |
| Observations | 11 |

Table 5.36:Associated ANOVA summary of model 4

| | *df* | *SS* | *MS* | *F* | *Significance F* |
|---|---|---|---|---|---|
| Regression | 9 | 9993.105 | 1110.345 | 4.333414 | 0.357582 |
| Residual | 1 | 256.2287 | 256.2287 | | |
| Total | 10 | 10249.33 | | | |

Table 5.37:Least square point estimate of parameters of model 4

| | *Coefficients* | *Standard Error* | *t Stat* | *P-value* | *Lower 95%* | *Upper 95%* |
|---|---|---|---|---|---|---|
| Intercept | 38.82199 | 65.21497 | 0.595293 | 0.658166 | -789.813 | 867.4568 |
| IIP | 0.721625 | 4.57305 | 0.1578 | 0.900363 | -57.3845 | 58.82773 |
| GDP | -0.35608 | 0.19008 | -1.87333 | 0.312152 | -2.77128 | 2.059118 |
| MB | 4.148082 | 1.495277 | 2.774123 | 0.220255 | -14.8512 | 23.14737 |
| ExR | 61.60637 | 13.56329 | 4.54214 | 0.137958 | -110.732 | 233.9444 |
| ECG | 0.007886 | 0.007527 | 1.047665 | 0.485184 | -0.08776 | 0.103532 |
| BoP | -0.02259 | 0.006138 | -3.67963 | 0.168932 | -0.10058 | 0.055407 |
| OIL | -1.75064 | 0.418041 | -4.18772 | 0.149226 | -7.06234 | 3.561074 |
| API | 7.930975 | 4.223956 | 1.877618 | 0.311548 | -45.7395 | 61.60143 |
| FR | -0.29733 | 0.311695 | -0.95393 | 0.515009 | -4.2578 | 3.663128 |

## Model 5:

Table 5.35:Excel output of regression analysis of Sensex using Regressors selected in model 5

| *Regression Statistics* | |
|---|---|
| Multiple R | 0.999914 |
| R Square | 0.999828 |
| Adjusted R Square | 0.998275 |

| | |
|---|---|
| Standard Error | 1.329623 |
| Observations | 11 |

Table 5.39:Associated ANOVA summary of model 5

| | *df* | *SS* | *MS* | *F* | *Significance F* |
|---|---|---|---|---|---|
| Regression | 9 | 10247.57 | 1138.618 | 644.052 | 0.030571 |
| Residual | 1 | 1.767898 | 1.767898 | | |
| Total | 10 | 10249.33 | | | |

Table 5.40:Least square point estimate of parameters of model 5

| | *Coefficients* | *Standard Error* | *t Stat* | *P-value* | *Lower 95%* | *Upper 95%* |
|---|---|---|---|---|---|---|
| Intercept | -3.75721 | 1.997306 | -1.88114 | 0.311053 | -29.1354 | 21.62097 |
| Inf | 1.353855 | 0.045443 | 29.79232 | 0.021361 | 0.776446 | 1.931264 |
| MB | 8.4939 | 0.21648 | 39.23633 | 0.016222 | 5.743254 | 11.24454 |
| GP | -0.16031 | 0.006096 | -26.2977 | 0.024196 | -0.23777 | -0.08285 |
| ExR | 57.12666 | 1.135807 | 50.29612 | 0.012656 | 42.69487 | 71.55845 |
| ECG | -0.00773 | 0.000197 | -39.3016 | 0.016195 | -0.01023 | -0.00523 |
| BoP | -0.0088 | 0.000397 | -22.1796 | 0.028683 | -0.01384 | -0.00376 |
| OIL | -1.65318 | 0.035097 | -47.1037 | 0.013513 | -2.09912 | -1.20723 |
| API | -0.82429 | 0.062158 | -13.2613 | 0.047915 | -1.61408 | -0.0345 |
| FR | 0.106868 | 0.02478 | 4.312679 | 0.145052 | -0.20799 | 0.421727 |

Table 5.41
Whites General Heterocadasticity test :

| ***Observation*** | ***Residuals*** | ***Residual Sq.*** | ***Predicted Sensex*** | ***Predicted sensex Sq.*** |
|---|---|---|---|---|
| 1 | -0.082793719 | 0.0068548 | 51.50658393 | 2652.928188 |
| 2 | -0.00280801 | 7.88492E-06 | 10.80153585 | 116.6731767 |
| 3 | 0.754747775 | 0.569644204 | -4.215679454 | 17.77195326 |
| 4 | -0.895906182 | 0.802647888 | 20.10513248 | 404.216352 |
| 5 | 0.196146516 | 0.038473456 | 75.88708522 | 5758.849703 |
| 6 | 0.189496544 | 0.03590894 | 14.25520288 | 203.2108091 |
| 7 | -0.033159629 | 0.001099561 | -18.87108776 | 356.1179533 |
| 8 | -0.424314272 | 0.180042602 | 42.29746066 | 1789.075178 |
| 9 | 0.353774092 | 0.125156108 | 15.48454733 | 239.771206 |
| 10 | -0.084776816 | 0.007187108 | 46.6106853 | 2172.555984 |
| 11 | 0.029593701 | 0.000875787 | 78.81977067 | 6212.556248 |

**Table 5.42: Whites Heterocadasticity test.**

| *Regression Statistics* | |
|---|---|
| Multiple R | 0.373475 |
| R Square | 0.139484 |
| Adjusted R Square | -0.07565 |
| Standard Error | 0.281282 |
| Observations | 11 |

**1.534323**

Table 5.43:Associated ANOVA

| | *df* | *SS* | *MS* | *F* | *Significance F* |
|---|---|---|---|---|---|
| Regression | 2 | 0.102598 | 0.051299 | 0.648373 | 0.548322 |
| Residual | 8 | 0.632957 | 0.07912 | | |
| Total | 10 | 0.735555 | | | |

Table 5.44:Least square estimate.

| | *Coefficients* | *Standard Error* | *t Stat* | *P-value* | *Lower 95%* | *Upper 95%* |
|---|---|---|---|---|---|---|
| Intercept | 0.229633 | 0.121675 | 1.88727 | 0.095828 | -0.05095 | 0.510215 |
| Predicted Sensex | 0.001486 | 0.006899 | 0.215454 | 0.834805 | -0.01442 | 0.017396 |
| Predicted sensex Sq. | -6.3E-05 | 9.59E-05 | -0.65551 | 0.530534 | -0.00028 | 0.000158 |

Whites General Heterocadasticity test results :
From the table 5.42
n.$R^2$ ~ Chi-square distribution with degrees of freedom 2 .
WGH =1.534323
Critical value at 5% level of significance and 2 degrees of freedom=5.99
We conclude on the basis of white's test, that there is no Heterocadasticity in the selected Pre-Liberalization model.

## Model 6 :

Table 5.45:Excel output of regression analysis of Sensex using Regressors selected in model 6

| *Regression Statistics* | |
|---|---|
| Multiple R | 0.980932378 |
| R Square | 0.96222833 |
| Adjusted R Square | 0.622283304 |
| Standard Error | 19.67573213 |
| Observations | 11 |

Table 5.46:Associated ANOVA summary of model 6

| | *df* | *SS* | *MS* | *F* | *Significance F* |
|---|---|---|---|---|---|
| Regression | 9 | 9862.199 | 1095.8 | 2.830541 | 0.433104 |
| Residual | 1 | 387.1344 | 387.1344 | | |
| Total | 10 | 10249.33 | | | |

Table 5.47:Least square point estimate of parameters of model 6

| | *Coefficients* | *Standard Error* | *t Stat* | *P-value* | *Lower 95%* | *Upper 95%* |
|---|---|---|---|---|---|---|
| Intercept | -117.3011853 | 56.8064 | -2.06493 | 0.28711 | -839.095 | 604.4926 |
| IIP | 13.65630608 | 7.809567 | 1.748664 | 0.330708 | -85.5736 | 112.8863 |
| MB | 7.261470413 | 2.956098 | 2.456438 | 0.246121 | -30.2993 | 44.82226 |
| GP | -0.101806991 | 0.072268 | -1.40875 | 0.39299 | -1.02006 | 0.816443 |
| ExR | 56.29848214 | 16.87463 | 3.33628 | 0.185392 | -158.114 | 270.7109 |
| ECG | -0.007584248 | 0.002992 | -2.5348 | 0.239218 | -0.0456 | 0.030433 |
| BoP | -0.005402568 | 0.007499 | -0.7204 | 0.602566 | -0.10069 | 0.089886 |
| OIL | -1.416471285 | 0.539826 | -2.62394 | 0.231802 | -8.27561 | 5.442671 |
| API | 0.060772014 | 0.77369 | 0.078548 | 0.950097 | -9.76989 | 9.891434 |
| FR | 0.489051033 | 0.503035 | 0.9722 | 0.508973 | -5.90262 | 6.880723 |

*Analysis of Regression results of models 1,2,3,4,5& 6.*

The R-square value all the six models are as :
Model 1 (99%)
Model 2 (98%)
Model 3 (97%)
Model 4 (97%)
Model 5 (99%)
Model 6 (96%)

Again following the statement by Gujarati (2007,4/e:p265),after eliminating Interest rate variable which was giving spurious regression from all the six models in Pre-liberalization period, the model 5 has been chosen for the final analysis, as the R-square value is higher explaining 99% variation in model by all independent variables jointly and that the model is with the four regressors that have theoretically expected signs and three regressors with significant p-values and above all lest standard error viz (1.32) suggesting that model serves purpose in determining the effect of macroeconomic variables on stock prices.

In this model 5 three macroeconomic variables viz Exchange rate, gold price, oil price were found significant to influence stock prices in this sub-sample period at the 2 levels of significance viz 5% and 10%. And were consistent with the previous studies whereas forex reserves influenced positively but not significantly. While Inflation Market borrowing ,Balance of payments, Agricultural production index show spurious

results. This model was also supported by Whites general Heterocadasticity test to be unbiased one.
Thus we conclude that the Indian stock market in pre-liberalization period violated the theory of market efficiency, thence was not informationally efficient from 1980-1991.

### *Effects in Post-Liberalization period of Indian Economy on Stock Prices.*

The sub-sample period to study post-liberalization from the period of 1991-2011. are presented as:

### Model 1:

Table 5.48:Excel output of regression analysis of Sensex using Regressors selected in model 1

| *Regression Statistics* | |
|---|---|
| Multiple R | 0.610332 |
| R Square | 0.372505 |
| Adjusted R Square | -0.25499 |
| Standard Error | 32.18579 |
| Observations | 21 |

Table 5.49:Associated ANOVA summary of model 1

| | *df* | *SS* | *MS* | *F* | *Significance F* |
|---|---|---|---|---|---|
| Regression | 10 | 6149.659 | 614.9659 | 0.593639 | 0.78809892 |
| Residual | 10 | 10359.25 | 1035.925 | | |
| Total | 20 | 16508.91 | | | |

Table 5.50:Least square point estimate of parameters of model 1

| | *Coefficients* | *Standard Error* | *t Stat* | *P-value* | *Lower 95%* | *Upper 95%* |
|---|---|---|---|---|---|---|
| Intercept | 20.65462 | 24.13269 | 0.855877 | 0.412104 | -33.1163709 | 74.42561 |
| Inf | -0.20644 | 0.573446 | -0.36001 | 0.726329 | -1.48416177 | 1.071273 |
| M3 | -0.00345 | 0.005845 | -0.58948 | 0.568617 | -0.01646892 | 0.009578 |
| MB | -8.4E-05 | 0.020707 | -0.00403 | 0.996861 | -0.04622144 | 0.046054 |
| ExR | 0.809176 | 6.698688 | 0.120796 | 0.906245 | -14.1164318 | 15.73478 |
| ECG | 0.000105 | 0.000161 | 0.653631 | 0.528093 | -0.00025356 | 0.000464 |
| IR | 9.19902 | 8.216925 | 1.119521 | 0.289087 | -9.10942893 | 27.50747 |
| BoP | 9.63E-05 | 8.69E-05 | 1.107611 | 0.29396 | -9.7398E-05 | 0.00029 |
| OIL | 0.038085 | 0.395663 | 0.096257 | 0.925218 | -0.84350779 | 0.919679 |
| API | 0.381738 | 0.774258 | 0.493037 | 0.632633 | -1.34341707 | 2.106894 |
| FR | 0.001554 | 0.015535 | 0.100044 | 0.922286 | -0.03305956 | 0.036168 |

## Model 2:

Table 5.51:Excel output of regression analysis of Sensex using Regressors selected in model 2

| *Regression Statistics* | |
|---|---|
| Multiple R | 0.634149 |
| R Square | 0.402145 |
| Adjusted R Square | -0.19571 |
| Standard Error | 31.41646 |
| Observations | 21 |

Table 5.52:Associated ANOVA summary of model 2

| | *df* | *SS* | *MS* | *F* | *Significance F* |
|---|---|---|---|---|---|
| Regression | 10 | 6638.97 | 663.897 | 0.672645 | 0.728934 |
| Residual | 10 | 9869.943 | 986.9943 | | |
| Total | 20 | 16508.91 | | | |

Table 5.53:Least square point estimate of parameters of model 2

| | *Coefficients* | *Standard Error* | *t Stat* | *P-value* | *Lower 95%* | *Upper 95%* |
|---|---|---|---|---|---|---|
| Intercept | 16.2986 | 22.46903 | 0.725381 | 0.484847 | -33.7655 | 66.36271 |
| IIP | -0.41485 | 0.521924 | -0.79485 | 0.445155 | -1.57777 | 0.748066 |
| M3 | -0.00255 | 0.005536 | -0.45969 | 0.655567 | -0.01488 | 0.009791 |
| MB | -0.00347 | 0.019716 | -0.17589 | 0.863889 | -0.0474 | 0.040462 |
| ExR | 1.737071 | 6.024696 | 0.288325 | 0.778986 | -11.6868 | 15.16093 |
| ECG | 9.17E-05 | 0.000155 | 0.592701 | 0.566542 | -0.00025 | 0.000436 |
| IR | 8.367532 | 7.953471 | 1.05206 | 0.31753 | -9.35391 | 26.08897 |
| BoP | 9.8E-05 | 8.35E-05 | 1.172835 | 0.268042 | -8.8E-05 | 0.000284 |
| OIL | 0.058825 | 0.383922 | 0.15322 | 0.881272 | -0.79661 | 0.914256 |
| API | 0.29257 | 0.765016 | 0.382436 | 0.71014 | -1.41199 | 1.997132 |
| FR | 0.004337 | 0.015059 | 0.287988 | 0.779236 | -0.02922 | 0.03789 |

## Table 5.54: Durbin-Watson Test:

| *Observation* | *Predicted Sensex* | *Residuals* |
|---|---|---|
| 1 | 41.32940858 | 37.7517 |
| 2 | 5.239707356 | 48.82545 |
| 3 | 9.701601176 | -9.59731 |
| 4 | 48.47139289 | -11.3436 |
| 5 | 10.74778075 | -28.0118 |

| | | |
|---|---|---|
| 6 | 33.97981985 | -28.4895 |
| 7 | 6.658291657 | 3.246471 |
| 8 | 14.96351501 | -28.5512 |
| 9 | 17.33841147 | 24.05585 |
| 10 | 13.70513725 | -22.0539 |
| 11 | 10.93581427 | -32.8985 |
| 12 | 0.14420015 | -3.91557 |
| 13 | 15.85514621 | 24.2504 |
| 14 | 13.94608483 | 13.85327 |
| 15 | 37.00795485 | 7.192784 |
| 16 | 44.25995072 | 4.042953 |
| 17 | 36.2795187 | -1.32436 |
| 18 | -30.65786283 | 5.288994 |
| 19 | 11.06172577 | 14.97561 |
| 20 | 26.67788717 | -7.30073 |
| 21 | 3.64227018 | -9.99695 |

Durbin-Watson test results :

d= 1.348;$d_L$ = .380;$d_U$ =2.806 at 5% level of significance.
$d_L$ < d> $d_U$,the test is inconclusive.

**Table 5.55**

**Whites General Heterocadasticity test :**

| *Observation* | *Residuals* | *Residuals sq* | *Predicted Sensex* | *PS Sq* |
|---|---|---|---|---|
| 1 | 37.75170392 | 1425.191149 | 41.32940858 | 1708.120014 |
| 2 | 48.82544792 | 2383.924365 | 5.239707356 | 27.45453318 |
| 3 | -9.597307524 | 92.10831171 | 9.701601176 | 94.12106538 |
| 4 | -11.34358688 | 128.6769634 | 48.47139289 | 2349.475929 |
| 5 | 28.01181943 | 784.6620277 | 10.74778075 | 115.514791 |
| 6 | -28.48947114 | 811.649966 | 33.97981985 | 1154.628157 |
| 7 | 3.246471346 | 10.5395762 | 6.658291657 | 44.33284779 |
| 8 | -28.55121558 | 815.171911 | 14.96351501 | 223.9067814 |
| 9 | 24.05585461 | 578.6841409 | 17.33841147 | 300.6205125 |
| 10 | -22.05394366 | 486.3764309 | 13.70513725 | 187.830787 |
| 11 | -32.89853288 | 1082.313465 | 10.93581427 | 119.5920338 |
| 12 | -3.915565267 | 15.33165136 | 0.14420015 | 0.020793683 |
| 13 | 24.25039634 | 588.0817225 | 15.85514621 | 251.3856612 |
| 14 | 13.85327361 | 191.9131897 | 13.94608483 | 194.4932822 |
| 15 | 7.192784049 | 51.73614237 | 37.00795485 | 1369.588722 |

| | | | | |
|---|---|---|---|---|
| 16 | 4.042952566 | 16.34546545 | 44.25995072 | 1958.943238 |
| 17 | -1.324361514 | 1.753933421 | 36.2795187 | 1316.203477 |
| 18 | 5.288993825 | 27.97345568 | -30.65786283 | 939.9045534 |
| 19 | 14.97561183 | 224.2689498 | 11.06172577 | 122.361777 |
| 20 | -7.30073409 | 53.30071825 | 26.67788717 | 711.709664 |
| 21 | -9.996952048 | 99.93905025 | 3.64227018 | 13.26613206 |

Table 5.56:

SUMMARY OUTPUT

| *Regression Statistics* | | |
|---|---|---|
| Multiple R | 0.222906 | |
| R Square | 0.049687 | **1.043433** |
| Adjusted R Square | -0.0559 | |
| Standard Error | 617.9177 | |
| Observations | 21 | |

Table 5.57:

ANOVA

| | *df* | *SS* | *MS* | *F* | *Significance F* |
|---|---|---|---|---|---|
| Regression | 2 | 359345.8 | 179672.9 | 0.470567 | 0.632119 |
| Residual | 18 | 6872802 | 381822.3 | | |
| Total | 20 | 7232148 | | | |

Table 5.58:

| | *Coefficients* | *Standard Error* | *t Stat* | *P-value* | *Lower 95%* | *Upper 95%* |
|---|---|---|---|---|---|---|
| Intercept | 505.7235 | 193.1653 | 2.618087 | 0.017423 | 99.89829 | 911.5487 |
| Predicted Sensex | 7.261781 | 10.77212 | 0.674127 | 0.508796 | -15.3696 | 29.89317 |
| PS Sq | -0.26103 | 0.269129 | -0.9699 | 0.344951 | -0.82645 | 0.304391 |

Whites General Heterocadasticity test results :
From the table 5.56
n.$R^2$ ~ Chi-square distribution with degrees of freedom 2 .
WGH =1.04343
Critical value at 5% level of significance and 2 degrees of freedom=5.99
We conclude on the basis of white's test, that there is no Heterocadasticity in the selected Post-Liberalization model.

**Model 3:**

Table 5.59:Excel output of regression analysis of Sensex using Regressors selected in model 3

| *Regression Statistics* | |
|---|---|
| Multiple R | 0.603908 |
| R Square | 0.364705 |
| Adjusted R Square | -0.27059 |
| Standard Error | 32.38524 |
| Observations | 21 |

Table 5.60:Associated ANOVA summary of model 3

| | *df* | *SS* | *MS* | *F* | *Significance F* |
|---|---|---|---|---|---|
| Regression | 10 | 6020.877 | 602.0877 | 0.574071 | 0.802516902 |
| Residual | 10 | 10488.04 | 1048.804 | | |
| Total | 20 | 16508.91 | | | |

Table 5.61:Least square point estimate of parameters of model 3

| | *Coefficients* | *Standard Error* | *t Stat* | *P-value* | *Lower 95%* | *Upper 95%* |
|---|---|---|---|---|---|---|
| Intercept | 22.84404 | 30.67706 | 0.744662 | 0.473613 | -45.50869943 | 91.19678 |
| Inf | -0.29625 | 0.528337 | -0.56072 | 0.587332 | -1.473455795 | 0.880959 |
| GDP | -0.00613 | 0.013054 | -0.4695 | 0.648781 | -0.035215373 | 0.022957 |
| MB | -0.00512 | 0.016025 | -0.31967 | 0.755794 | -0.040828076 | 0.030583 |
| ExR | 1.302869 | 6.669801 | 0.195339 | 0.84904 | -13.55837292 | 16.16411 |
| ECG | 7.96E-05 | 0.000145 | 0.549107 | 0.59498 | -0.000243293 | 0.000402 |
| IR | 8.285139 | 7.857248 | 1.054458 | 0.316484 | -9.221899096 | 25.79218 |
| BoP | 0.000108 | 0.0001 | 1.079608 | 0.305667 | -0.000115085 | 0.000331 |
| OIL | 0.080134 | 0.3962 | 0.202256 | 0.843772 | -0.80265487 | 0.962923 |
| API | 0.458292 | 0.832012 | 0.550824 | 0.593846 | -1.395545918 | 2.31213 |
| FR | 0.002048 | 0.015592 | 0.131332 | 0.898117 | -0.03269421 | 0.03679 |

## Model 4:

Table 5.62:Excel output of regression analysis of Sensex using Regressors selected in model 4

| *Regression Statistics* | |
|---|---|
| Multiple R | 0.629984 |
| R Square | 0.39688 |
| Adjusted R Square | -0.20624 |
| Standard Error | 31.5545 |
| Observations | 21 |

Table 5.63:Associated ANOVA summary of model 4

| | *df* | *SS* | *MS* | *F* | *Significance* |
|---|---|---|---|---|---|

| | | | | | *F* |
|---|---|---|---|---|---|
| Regression | 10 | 6552.05 | 655.205 | 0.658044 | 0.73992 |
| Residual | 10 | 9956.862 | 995.6862 | | |
| Total | 20 | 16508.91 | | | |

Table 5.64:Least square point estimate of parameters of model 4

| | *Coefficients* | *Standard Error* | *t Stat* | *P-value* | *Lower 95%* | *Upper 95%* |
|---|---|---|---|---|---|---|
| Intercept | 18.15499 | 29.72234 | 0.61082 | 0.554947 | -48.0705 | 84.38048 |
| IIP | -0.46334 | 0.498288 | -0.92987 | 0.374342 | -1.5736 | 0.646913 |
| GDP | -0.00448 | 0.012813 | -0.34954 | 0.733933 | -0.03303 | 0.02407 |
| MB | -0.00715 | 0.015685 | -0.45588 | 0.658214 | -0.0421 | 0.027797 |
| ExR | 1.965907 | 6.205533 | 0.316799 | 0.757911 | -11.8609 | 15.7927 |
| ECG | 7.25E-05 | 0.000141 | 0.513634 | 0.618665 | -0.00024 | 0.000387 |
| IR | 7.705247 | 7.667723 | 1.004894 | 0.338644 | -9.3795 | 24.79 |
| BoP | 0.000108 | 9.63E-05 | 1.117667 | 0.289841 | -0.00011 | 0.000322 |
| OIL | 0.086877 | 0.384916 | 0.225704 | 0.825978 | -0.77077 | 0.944524 |
| API | 0.344829 | 0.824963 | 0.417993 | 0.684786 | -1.4933 | 2.182961 |
| FR | 0.004507 | 0.015218 | 0.296197 | 0.77314 | -0.0294 | 0.038414 |

## Model 5:

Table 5.65:Excel output of regression analysis of Sensex using Regressors selected in model 5

| *Regression Statistics* | |
|---|---|
| Multiple R | 0.600677 |
| R Square | 0.360813 |
| Adjusted R Square | -0.27837 |
| Standard Error | 32.48429 |
| Observations | 21 |

Table 5.66:Associated ANOVA summary of model 5

| | *df* | *SS* | *MS* | *F* | *Significance F* |
|---|---|---|---|---|---|
| Regression | 10 | 5956.624 | 595.6624 | 0.564486 | 0.809519 |
| Residual | 10 | 10552.29 | 1055.229 | | |
| Total | 20 | 16508.91 | | | |

Table 5.67:Least square point estimate of parameters of model 5

| | *Coefficients* | *Standard Error* | *t Stat* | *P-value* | *Lower 95%* | *Upper 95%* |
|---|---|---|---|---|---|---|
| Intercept | 12.82203 | 18.70956 | 0.68532 | 0.508716 | -28.8655 | 54.50953 |
| Inf | -0.2918 | 0.543389 | -0.537 | 0.603007 | -1.50255 | 0.918944 |
| MB | -0.00493 | 0.017622 | -0.27971 | 0.7854 | -0.04419 | 0.034335 |

| | | | | | | |
|---|---|---|---|---|---|---|
| GP | -0.00314 | 0.007896 | -0.39774 | 0.699178 | -0.02073 | 0.014453 |
| ExR | 2.652149 | 5.699837 | 0.465303 | 0.651683 | -10.0479 | 15.35218 |
| ECG | 6.09E-05 | 0.00013 | 0.468111 | 0.649741 | -0.00023 | 0.000351 |
| IR | 8.605624 | 8.429617 | 1.02088 | 0.331374 | -10.1767 | 27.38798 |
| BoP | 8.87E-05 | 8.59E-05 | 1.032492 | 0.326166 | -0.0001 | 0.00028 |
| OIL | 0.090218 | 0.400795 | 0.225098 | 0.826436 | -0.80281 | 0.983244 |
| API | 0.384873 | 0.794549 | 0.484391 | 0.638542 | -1.38549 | 2.155238 |
| FR | 0.002797 | 0.015414 | 0.181439 | 0.859648 | -0.03155 | 0.037141 |

## Model 6:

Table 5.68:Excel output of regression analysis of Sensex using Regressors selected in model 6

| *Regression Statistics* | |
|---|---|
| Multiple R | 0.631025 |
| R Square | 0.398192 |
| Adjusted R Square | -0.20362 |
| Standard Error | 31.52014 |
| Observations | 21 |

Table 5.69:Associated ANOVA summary of model 6

| | *df* | *SS* | *MS* | *F* | *Significance F* |
|---|---|---|---|---|---|
| Regression | 10 | 6573.723 | 657.3723 | 0.661661 | 0.737199 |
| Residual | 10 | 9935.19 | 993.519 | | |
| Total | 20 | 16508.91 | | | |

Table 5.70:Least square point estimate of parameters of model 6

| | *Coefficients* | *Standard Error* | *t Stat* | *P-value* | *Lower 95%* | *Upper 95%* |
|---|---|---|---|---|---|---|
| Intercept | 10.75225 | 17.62021 | 0.610223 | 0.555327 | -28.508 | 50.01254 |
| IIP | -0.47038 | 0.488445 | -0.96302 | 0.358246 | -1.5587 | 0.61794 |
| MB | -0.00631 | 0.016619 | -0.37953 | 0.712231 | -0.04334 | 0.030723 |
| GP | -0.00281 | 0.007387 | -0.37981 | 0.712025 | -0.01926 | 0.013653 |
| ExR | 3.006785 | 5.222445 | 0.575743 | 0.577515 | -8.62955 | 14.64312 |
| ECG | 6.21E-05 | 0.000126 | 0.4945 | 0.631636 | -0.00022 | 0.000342 |
| IR | 8.171231 | 8.076802 | 1.011691 | 0.335538 | -9.82501 | 26.16747 |
| BoP | 9.42E-05 | 8.27E-05 | 1.138784 | 0.281338 | -9E-05 | 0.000279 |
| OIL | 0.10074 | 0.388676 | 0.259188 | 0.800748 | -0.76528 | 0.966765 |
| API | 0.299482 | 0.777304 | 0.385283 | 0.708096 | -1.43246 | 2.031424 |
| FR | 0.005212 | 0.014867 | 0.350596 | 0.733165 | -0.02791 | 0.038339 |

*Analysis of Regression results of models 1,2,3,4,5& 6.*

The R-square value all the six models are as :
Model 1 (37%)
Model 2 (40%)
Model 3 (36%)
Model 4 (39%)
Model 5 (36%)
Model 6 (39%)

Following the statement by Gujarati (2007,4/e:p265) once again the model 2 has been chosen for the final analysis, as the R-square value is higher than other models explaining 40% variation in the model by all independent variables jointly and that six regressors viz,market borrowing, exchange rate, expenditure of central govt,balance of payment, agricultural production index and forex reserve have the theoretically expected signs. After conducting Durbin-Watson test and Whites General Heterocadasticity test no auto- correlation was found and that homocadasticity does existed in the model 2 as per the results of Whites test confirming it to be Best Linear Unbiased Estimate (BLUE).But quite interestingly after conducting F-test our null hypothesis ($H_0$) got accepted, evidently from the model itself none of the regressors is found statistically significant.

Thus making us to draw this conclusion that Indian stock market had became informationally efficient in the post-liberalization era from our study.

## Conclusion.

In all the 3 cases under consideration viz; Whole sample period of 1980-2011,and 2 sub-sample periods viz; Pre-liberalization period of 1980-91 & Post-liberalization period of 1991-2011 the results where interestingly different. In First case null hypothesis got rejected in second case null hypothesis got rejected but in third case null hypothesis got accepted. Thence we can conclude that Indian stock market has moved from market inefficiency in pre-liberalization era towards market efficiency in post-liberalization era, as the stock prices can't be predicted by mere following the news about macroeconomic variables in India.

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# CHAPTER VI

## CONCLUSIONS, AND POLICY IMPLICATIONS

The Indian stock market has witnessed significant developments in both pre-liberalization and post-liberalization eras but, more specifically in last two decades where it has its has been restructured under many capital market reforms like establishment of capital market regulator namely Securities & Exchange Board of India (SEBI),Demutualization of stock exchanges, establishment of depositories namely National Securities Depository Ltd and Central Depository Services (India) Ltd, introduction of derivatives but, given potential and the size of resource base of Indian economy there seems to be an ample scope for its further development firstly, in terms of the number of companies that are listed vis a vis to the total number of domestic and foreign companies operating in India secondly, proportion of retail investors participation vis a vis to population of the country, thirdly, an increase in the free float, as in India shares available for trading are less compared to the actual issued shares because majority of the share holding is held by promoters and strategic partners of business concerned leaving small percentage for trading, *(The Securities Contracts(Regulation(Ammendment)Rules,2010).*

The empirical results that have been found are supported by all the tests conducted viz,Descriptive statistics,Jerque-Bera test of normality,OLS,as correlation coefficient of almost all the macroeconomic variables with Sensex was weak the same was found in OLS as the variables were found mostly insignificant in predicting stock prices and in case of exchange rate and expenditure of central govt where correlation coefficient is negative but OLS in selected models show positive influence, i.e., they are all moving in the opposite direction, but such a sequence was not followed by the OLS.Thus results in some cases have been found diversified and vague as OLS analysis pointed towards a different story where macroeconomic variables undoubtedly explain stock prices when analyzed jointly but, none of them were found significant. As we developed six models to test null hypothesis for all the three cases viz; Overall sample period, Pre-liberalization sub-sample period ,Post-liberalization sub-sample period, quite interestingly the null hypothesis ($H_0$) was rejected in first

two cases with the explained variation in the first model was only 30 % with none of the variables individually significant to influence stock prices, in the second case the explained variation was unexpectedly as high as 99% with four variables with theoretically expected signs and 3 variables statistically significant, in the last case the explained variation was 40% but, our null hypothesis got accepted, as expected none of the variable was found statistically significant which is in line with the results of F-test. Thus the results that have been found are mixed and ambiguous to some extent. These findings are be pointing towards the developing phase that Indian economy is undergoing over the last six decades in financial sector moving from market inefficiency in pre-liberalization era towards stock market efficiency in post-liberalization era.

**Policy Implications.**

As pointed out by this study that it is macroeconomic variables which are influencing Sensex. Thus the most important implication turns out to be that if the government wants to bring out some amendments in the financial sector, it can always do so through the change in macroeconomic variables. This entails that stock market in India still can be symbolized as the "indicator" of economy of the country. The study clearly indicates that since macroeconomic economic variables are affecting the stock market index to some extent hence certainly some exogenous variables or non-macroeconomic factors are there which affects it and needs to be found and scrutinized to study this whole impact chain completely.

**Limitations**

The limitations of this research study also are two:, first of all is that due to time constraint more detailed research could not be done in this area, second because of lack of availability of data more variables such as human development index (HDI),Gini coefficient, Corporate expenditure on Advertising, total foreign institutional investments, total dividend distributed, proportion of population involved in secondary market and non macroeconomic variables like supports events,Epidemic,natural calamity etc are not taken into consideration.

## 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 dynamic relation needs to be known that how economic fundamentals 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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Appendix I:

Turnover ratio (%) of Indian stock market.

| Year | Annual Turnover | Market capitalization. | Turnover ratio |
|---|---|---|---|
| 1990 | 360.11 | 908.36 | 39.644 |
| 1991 | 717.77 | 3233.6 | 22.197 |
| 1992 | 456.96 | 1881.5 | 24.2875 |
| 1993 | 845.36 | 3680.7 | 22.9673 |
| 1994 | 677.49 | 4354.8 | 15.5573 |
| 1995 | 500.63 | 5264.8 | 9.50908 |
| 1996 | 1242.84 | 4639.2 | 26.7903 |
| 1997 | 2076.46 | 5603.3 | 37.0581 |
| 1998 | 3120.00 | 5453.6 | 57.2098 |
| 1999 | 6850.28 | 9128.4 | 75.0435 |
| 2000 | 10000.32 | 5715.5 | 174.967 |
| 2001 | 3072.92 | 6122.2 | 50.1928 |
| 2002 | 3140.73 | 5722 | 54.8889 |
| 2003 | 5026.18 | 12012 | 41.8428 |
| 2004 | 5187.16 | 16984 | 30.5409 |
| 2005 | 8160.74 | 30222 | 27.0027 |
| 2006 | 9561.85 | 35450 | 26.9725 |
| 2007 | 15788.56 | 51380 | 30.7289 |
| 2008 | 11000.74 | 30861 | 35.6464 |
| 2009 | 13788.09 | 61642 | 22.3682 |
| 2010 | 11034.66 | 68369 | 16.1399 |
| 2011 | 6670.22 | 62095 | 10.7419 |

*Source; RBI Handbook,Statistical analysis in excel.*

Appendix II

*Sensex average change.*

| ***Year*** | ***Sensex*** | ***Sensex (% change)*** |
|---|---|---|
| *1979* | *122.32* | |
| *1980* | *138.87* | *13.53* |
| *1981* | *207.91* | *49.72* |
| *1982* | *221.51* | *6.54* |
| *1983* | *238.33* | *7.59* |
| *1984* | *266.19* | *11.69* |
| *1985* | *492.23* | *84.92* |
| *1986* | *567.39* | *15.27* |
| *1987* | *454.46* | *-19.90* |
| *1988* | *613.66* | *35.03* |
| *1989* | *729.49* | *18.88* |
| *1990* | *1049.53* | *43.87* |
| *1991* | *1879.51* | *79.08* |
| *1992* | *2895.67* | *54.07* |
| *1993* | *2898.69* | *0.10* |
| *1994* | *3974.91* | *37.13* |
| *1995* | *3288.68* | *-17.26* |
| *1996* | *3469.24* | *5.49* |
| *1997* | *3812.86* | *9.90* |
| *1998* | *3294.78* | *-13.59* |
| *1999* | *4658.63* | *41.39* |
| *2000* | *4269.69* | *-8.35* |
| *2001* | *3331.95* | *-21.96* |
| *2002* | *3206.29* | *-3.77* |
| *2003* | *4492.19* | *40.11* |
| *2004* | *5740.99* | *27.80* |
| *2005* | *8278.55* | *44.20* |
| *2006* | *12277.33* | *48.30* |
| *2007* | *16568.89* | *34.96* |
| *2008* | *12365.55* | *-25.37* |
| *2009* | *15585.21* | *26.04* |
| *2010* | *18605.18* | *19.38* |
| *2011* | *17422.88* | *-6.35* |

*Source: Reserve bank of India, Statistical analysis Excel*

Appendix-III

*Market capitalization & Market capitalization ratio.*

| ***Year*** | ***MARKET CAPITALISATION - BSE*** | ***GDP at Market price*** | ***Market Capitalization Ratio*** | ***Market Capitalisation (% Change)*** |
|---|---|---|---|---|
| *1979* | *54.21* | *1257.29* | *4.311654* | |
| | *-* | *1496.42* | | |
| | *-* | *1758.05* | | |
| *1982* | *97.69* | *1966.44* | *4.967861* | |
| *1983* | *102.19* | *2290.21* | *4.462036* | *4.606408025* |
| *1984* | *203.78* | *2566.11* | *7.941203* | *99.4128584* |
| *1985* | *216.36* | *2895.24* | *7.472956* | *6.173324173* |
| *1986* | *259.37* | *3239.49* | *8.006507* | *19.87890553* |
| *1987* | *455.19* | *3682.11* | *12.36221* | *75.49832286* |
| *1988* | *545.6* | *4368.93* | *12.48818* | *19.86203563* |
| *1989* | *652.06* | *5019.28* | *12.99111* | *19.51246334* |
| *1990* | *908.36* | *5862.12* | *15.49542* | *39.30619882* |
| *1991* | *3233.63* | *6738.75* | *47.98561* | *255.9855124* |
| *1992* | *1881.46* | *7745.45* | *24.29116* | *-41.815854* |
| *1993* | *3680.71* | *8913.55* | *41.29342* | *95.63052098* |
| *1994* | *4354.81* | *10455.90* | *41.64931* | *18.3144013* |
| *1995* | *5264.76* | *12267.25* | *42.9172* | *20.8952859* |
| *1996* | *4639.15* | *14192.77* | *32.68671* | *-11.8829728* |
| *1997* | *5603.25* | *15723.94* | *35.63515* | *20.78182426* |
| *1998* | *5453.61* | *18033.78* | *30.24108* | *-2.67059296* |
| *1999* | *9128.42* | *20121.98* | *45.36542* | *67.38307286* |
| *2000* | *5715.53* | *21686.52* | *26.35522* | *-37.3875216* |
| *2001* | *6122.24* | *23483.30* | *26.07061* | *7.115875518* |
| *2002* | *5721.98* | *25306.63* | *22.6106* | *-6.53780316* |
| *2003* | *12012.07* | *28379.00* | *42.32732* | *109.9285562* |
| *2004* | *16984.28* | *32422.09* | *52.3849* | *41.39344842* |
| *2005* | *30221.91* | *36933.69* | *81.82749* | *77.94048379* |
| *2006* | *35450.41* | *42947.06* | *82.54444* | *17.30036255* |
| *2007* | *51380.15* | *49870.90* | *103.0263* | *44.93527719* |
| *2008* | *30860.76* | *56300.63* | *54.81424* | *-39.9364151* |
| *2009* | *61641.57* | *64573.52* | *95.45952* | *99.74093315* |
| *2010* | *68368.78* | *76741.48* | *89.08973* | *10.91343066* |
| *2011* | *62095.35* | *88557.97* | *70.11831* | *-9.17586945* |

*Source: Reserve bank of India, Statistical analysis Excel*

Appendix IV

*Value Traded Ratio of Indian Stock Market.*

| ***Year*** | ***Turnover (Bill.)*** | ***GDP (Bill.)*** | ***Value Traded Ratio (%GDP)*** | ***Value Traded (% Change)*** |
|---|---|---|---|---|
| *1990* | *360.1* | *5862.1* | *6.1* | |
| *1991* | *717.8* | *6738.8* | *10.7* | *99.3* |
| *1992* | *457.0* | *7745.5* | *5.9* | *-36.3* |
| *1993* | *845.4* | *8913.6* | *9.5* | *85.0* |
| *1994* | *677.5* | *10455.9* | *6.5* | *-19.9* |
| *1995* | *500.6* | *12267.3* | *4.1* | *-26.1* |
| *1996* | *1242.8* | *14192.8* | *8.8* | *148.3* |
| *1997* | *2076.5* | *15723.9* | *13.2* | *67.1* |
| *1998* | *3120.0* | *18033.8* | *17.3* | *50.3* |
| *1999* | *6850.3* | *20122.0* | *34.0* | *119.6* |
| *2000* | *10000.3* | *21686.5* | *46.1* | *46.0* |
| *2001* | *3072.9* | *23483.3* | *13.1* | *-69.3* |
| *2002* | *3140.7* | *25306.6* | *12.4* | *2.2* |
| *2003* | *5026.2* | *28379.0* | *17.7* | *60.0* |
| *2004* | *5187.2* | *32422.1* | *16.0* | *3.2* |
| *2005* | *8160.7* | *36933.7* | *22.1* | *57.3* |
| *2006* | *9561.9* | *42947.1* | *22.3* | *17.2* |
| *2007* | *15788.6* | *49870.9* | *31.7* | *65.1* |
| *2008* | *11000.7* | *56300.6* | *19.5* | *-30.3* |
| *2009* | *13788.1* | *64573.5* | *21.4* | *25.3* |
| *2010* | *11034.7* | *76741.5* | *14.4* | *-20.0* |
| *2011* | *6670.2* | *88558.0* | *7.5* | *-39.6* |

*Source: Reserve bank of India, Statistical analysis Excel*

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