3.1: Introduction

The stock market is an integral part of the overall economy of a country especially that of an emerging economy like India. It plays an important role in the economy by mobilizing domestic resources and channeling them to productive investment. Price of a stock may be defined as discounted value of its future cash flows. For an investor or security analyst cash flows means dividend and earnings which is expected to accrue from his stock investments. So the stock returns should be affected by any factor that influences future cash flows or the discount rate of cash flows.
(Chen, Roll and Ross 1986). Cash flows of the firms move according to the real economic activity. The movement of stock prices is highly sensitive to changes in fundamentals of the economy and to the changes in expectations about future prospects. If the economy grows rapidly, the industry is also expected to show rapid growth reflecting the prosperous outlook for its sales and earnings which would result in increased cash flows and stock prices. An outlook sagging economic growth can lead to lower corporate profits, a prospect that can endanger investor pessimism and lower stock prices. Similarly if the economy is recovering and booming, when the corporate turnaround is in progress, the corporate revival will be faster and stronger. On the other hand, if the economy is in the grip of severe recession when the corporate turnaround is launched, the entire recovery process will slow down. So the analysis of macroeconomic environment is very important in order to understand the earning prospects of companies and to study the behavior of the prices of their stocks traded in a market.

One can relate the stock markets of a country with the performance of its economy in many ways. A significant amount of literature now available examines the relationship between stock market returns and the macroeconomic environment over a number of stock markets and time period. On consolidating these literatures we can find that two general views exist among the scholars and practitioners with regard to such relationship. The first relationship views that the changes in stock market cause fluctuations in macroeconomic environment of a country and the second
perceives that the stock market development and changes are the result of economic conditions of the country. In other words the former case implies that stock market leads economic activity, whereas the latter suggests that it lags economic activity and which is more important for a security analyst.

3.2: Performance of Indian economy: An overview

India is an emerging economy which has witnessed unprecedented levels of economic expansion, alongside China, Russia, Mexico and Brazil. India is a cost effective labour intensive economy, and has benefitted immensely from outsourcing of work from developed countries and has a strong manufacturing and export oriented industrial/service framework.

The Indian economy is one of the attractive destinations for business and investment opportunities due to huge manpower base, diversified natural resources and strong macroeconomic fundamentals. Also the process of economic reforms initiated since 1991 has been providing an investor friendly environment though a liberalized framework spanning the whole economy. India has transverse a long way since then and is now widely recognized as one of the fastest growing countries in the world. Table 3.1 gives some glimpses of the performance of Indian economy during the period 2000-01 to 2009-10:
Table 3.1
Performance of Indian Economy during the period 2000-01 to 2009-10

<table>
<thead>
<tr>
<th>Financial Year</th>
<th>GDP at Factor cost (%)</th>
<th>Index of Industrial Production</th>
<th>WPI Inflation (%)</th>
<th>Forex Reserves in USD billion</th>
<th>Exchange rate (Rs Vs $)</th>
<th>Money supply (M in Rs.) billion</th>
<th>Repo rate (%)</th>
<th>Fiscal deficit (in billion)</th>
<th>FII Net flows (in Crore)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000-01</td>
<td>4.40</td>
<td>162.6</td>
<td>7.2</td>
<td>42.28</td>
<td>46.78</td>
<td>13132.20</td>
<td>9.00</td>
<td>1188.16</td>
<td>184.7</td>
</tr>
<tr>
<td>2001-02</td>
<td>5.80</td>
<td>167.0</td>
<td>3.6</td>
<td>54.11</td>
<td>48.91</td>
<td>14983.55</td>
<td>8.00</td>
<td>1409.55</td>
<td>150.5</td>
</tr>
<tr>
<td>2002-03</td>
<td>3.80</td>
<td>176.6</td>
<td>3.4</td>
<td>76.10</td>
<td>47.37</td>
<td>17179.60</td>
<td>7.00</td>
<td>1450.72</td>
<td>37.7</td>
</tr>
<tr>
<td>2003-04</td>
<td>8.50</td>
<td>189.0</td>
<td>5.5</td>
<td>112.96</td>
<td>43.93</td>
<td>20058.76</td>
<td>6.00</td>
<td>1232.72</td>
<td>1091.8</td>
</tr>
<tr>
<td>2004-05</td>
<td>7.50</td>
<td>204.8</td>
<td>6.5</td>
<td>141.51</td>
<td>43.74</td>
<td>22539.38</td>
<td>6.00</td>
<td>1252.02</td>
<td>868.6</td>
</tr>
<tr>
<td>2005-06</td>
<td>9.50</td>
<td>221.5</td>
<td>5.4</td>
<td>151.80</td>
<td>44.61</td>
<td>27295.45</td>
<td>6.50</td>
<td>1464.35</td>
<td>992.6</td>
</tr>
<tr>
<td>2006-07</td>
<td>9.70</td>
<td>247.1</td>
<td>4.7</td>
<td>199.20</td>
<td>41.29</td>
<td>33102.78</td>
<td>7.75</td>
<td>1425.73</td>
<td>322.5</td>
</tr>
<tr>
<td>2007-08</td>
<td>9.20</td>
<td>268.0</td>
<td>8.3</td>
<td>309.70</td>
<td>39.97</td>
<td>40178.82</td>
<td>7.75</td>
<td>1269.12</td>
<td>2032.8</td>
</tr>
<tr>
<td>2008-09</td>
<td>6.70</td>
<td>275.4</td>
<td>10.2</td>
<td>252.00</td>
<td>50.95</td>
<td>47914.81</td>
<td>5.00</td>
<td>3265.15</td>
<td>-1501.7</td>
</tr>
<tr>
<td>2009-10</td>
<td>7.40</td>
<td>275.7</td>
<td>11.5</td>
<td>279.10</td>
<td>45.14</td>
<td>55997.62</td>
<td>5.00</td>
<td>3328.35</td>
<td>2094.8</td>
</tr>
</tbody>
</table>

Source: RBI Handbook on Indian economy, Economic Survey reports various issues, CSO
Indian economy showed robust growth during the last ten years of the study. High growth rates in industry and service sectors and a benign world economic environment provided a backdrop conducive to the Indian economy. Until the global financial crisis showed its head in mid-2007, the Indian economy was witnessing a break in its growth and had moved to a range of above 9 per cent, supported by strong domestic consumption, investment and export demand. Then after a spell of long growth it has experienced a slump in 2008. It showed down turn to 6.8 per cent in 2008-09, but achieved more than 7 per cent growth in 2009-10. The economy has expanded on an average 8.5 per cent between 2003-04 and 2009-10. The industrial upturn, from the beginning of the study peaked by the end of 2006-07 and has moderated from 2007-08. From the close examination of the trend persisting in these growth indicators of the economy it is implied that India has not faced any recession so far, but experienced only an economic deceleration during the last two years. However Indian policymakers should rely on well-tested homegrown policies in taking the country to the higher and sustained growth path.

During the first seven years of the study period Wholesale Price Inflation (WPI) in India was within the tolerance band of 5-7 per cent. Softening trend in inflation was found until the FY ended 31st March 2003, increased subsequently to 6.5 per cent by end March 2005 before reached its comfort zone of below 5 per cent in 2006-07. Thereafter it remained always at elevated level (ie at two digit level, way above the desired level of about 3 -5 per cent), by and large has been on an upward trajectory partly reflecting supply-side pressures on key agricultural commodities such as rice, wheat, oilseeds/edible oils, increase in iron and steel prices in line with
international prices, partial pass-through of international crude oil prices to domestic prices and continued demand pressures.

Interest rate was on upward trend during the period 2003-04 to 2007-08. The repo rate was increased from 6.00 per cent to 7.75 per cent during this period. This could be taken as part of the Reserve Bank of India’s continued effort to take pre-emptive monetary actions in a calibrated manner in line with the evolving monetary and liquidity conditions for containing inflation and inflationary expectations in the country. But monetary management during 2008-09 (reduction of repo rate to 5 per cent) had to contend with challenges of high inflation in the first half and the high speed and magnitude of the external shocks and its spillover effect through the real, financial and confidence channels in the second half. Policy measures at this time were aimed at providing ample rupee liquidity, ensuring comfortable foreign exchange liquidity and maintaining a market environment conducive for the continued flow of credit at viable rates to production sectors of the economy. The expansionary money supply justifies its impact on the real economic activities in the country.

On the external sector front, although India’s current account deficit has been widening, its robust macroeconomic fundamentals have also facilitated some capital inflows into the country. But during the periods of heightened global uncertainty (2008-09), panic were seen among the Foreign Institutional investors, on account of which huge amount of capital was out flowed from the country. The reduction in capital flows may have made monetary management easier, but the reduction is so sharp that the rupee is coming under heavy pressure, having dipped below Rs 50 to the dollar, even as RBI’s foreign exchange reserves have fallen by $57.70
billion during that year. Fiscal pressures were seen which have led international credit agencies to consider downgrading India’s credit rating from investment to speculative grade. But the recovery of the market from short term obscurity in 2009-10 has reinstated the investor confidence and regained the previous momentum slightly at an increasing scale, in the capital inflows from Foreign Investors to the country, which could be viewed as an outcome of diminishing returns from other investment destinations of the globe and the potential of the Indian economy to grow further.

Finances of the Government are under some stress, especially during the last two years, on account of several factors such as increased pressures from oil, fertilizers and food subsidies, the farm loan waiver scheme and the hike in wages following the implementation of the Sixth Pay Commission recommendations.

3.3: Capital market reforms in India

3.3.1: Reforms (1991-2000)

The liberalization and globalization measures initiated in India during the 1990s have brought in drastic changes in the structure and working of her stock market. In fact it fuelled the growth of equity cult in India. Trading was through open outcry and settlement and transactions were paper based till then. Regulations were not effective and disclosure norms by companies were inadequate. The security scam of Harshadh Metha (June 1992) revealed inadequacy of and inefficiencies in the financial system, which prompted a radical change of Indian stock market. The Parliamentary Committee headed by M.J Pherwani which probed into the scam recommended a vigilant regulatory body in order to reform and
regulate the market. Consequently, SEBI which had formed in 1988 as a non-statutory body (an advisory body) was endowed with statutory powers through the enactment of SEBI Act, 1992. Since then, the Indian stock market witnessed a sea change in terms of technology and market practices.

Technology made radical change in the trading mechanism in India. The Over the Counter Exchange of India (OTCEI) set up in 1992 with an intention to provide an alternate market for the securities of smaller companies which could not fulfill the minimum capital requirement for listing. It is the first decentralized and transparent market in India. National Stock Exchange (NSE) was set up in 1994 with tight disclosure norms and electronic trading was established. The screen based trading introduced has made the price discovery process more efficient. The National Securities Clearing Corporation (NSCC) was established in April 1995 for having improved clearing and settlement mechanism in the market. The Depository Act 1996 paved the way for setting depositories for trading in dematerialized form. National Securities Depository Ltd. (NSDL) and Central Depository Services Ltd. (CDSL) were set up in November 1996 and July 1999 respectively for facilitating the dematerialized trading which virtually eliminate the risks of bad deliveries involved in securities trading. Takeover Code (1996) was drafted in the country to regulate the activities connected with corporate takeovers and acquisitions due to the changing corporate scenario in new economic regime. In-depth review of the mutual fund regulations led to a new set of regulations known as SEBI (Mutual Fund) Regulations, 1996 which brought about restructuring of mutual fund industry and laid down norms for the structure of management of mutual funds by defining required relationship between the fund sponsor, trustees, custodian, and AMC. Also, as per this notification Foreign Institutional
Investors (FIIs) registered with SEBI were permitted to invest in domestic mutual funds.

Rolling settlement was introduced in January 1998 (T+5 day basis) by replacing the age-old permanent settlement mechanism for helping traders to settle their accounts quickly without waiting for a fixed settlement date. Buy back of shares were permitted in 1998 which enabled the companies to purchase back of its shares from the shareholders by using their reserves. The companies later cancel these shares, which reduce its equity capital and increase Earnings per Share. This in turn sends a positive signal in the market and the company’s share price rises.

3.3.2: Reforms (2000-2010)

Liberalization of the insurance sector for the purpose of opening it to private Indian business houses as well as international players was made in 2000. IRDA bill, which permit this was approved by the Indian cabinet in December 1999. Since then domestic and International private players have been entering in to Indian Insurance Industry. Internet trading was permitted in February 2000 for providing wider market access for investors. In order to improve the liquidity and efficiency of the market the definition of securities was expanded to include derivatives. Trading on index futures (June 2000) and options (June 2001) were started at first and then stock futures (July 2001) and stock options (November 2001) were commenced to trade in the stock market. The Government decision to privatize PSUs in 2000 fuelled stock prices. Ketan Parekh security scam of 2001 led to the abolition of badla system in July 2001 and rolling settlement made compulsory for all stocks in January 2002. The rolling settlement cycle was reduced from T+5 to T+2. Since the difference between trade date and
settlement date is small, the systematic risk could be reduced by this reform. Disinvestment of major public sector units in India (For eg: VSNL in 2002) fuelled the stock prices.

For providing liquidity to market and also for including the excluded group of small investors in the stock market operations many measures were initiated in Indian stock market. The ‘lot trading system’ was given up and the investors were allowed to buy stocks in odd lot quantities, even in one or two share basis. Similarly, the directions from SEBI persuade the companies to split shares of their larger denominations in to smaller denominations which again provide opportunity to small investors to participate in stock market investment with their tiny savings. Both of the measures also provide liquidity to market by enhancing the investor base in the country.

The Indian capital market went global with permission for companies to issue Global Depository Receipts (GDR) traded largely in Europe and American Depository Receipts (ADRs) traded on the US market. Foreign institutional investors have emerged as the largest and dominant players in the Indian bourses especially after 2005. NSE has gained an upper hand over its rival BSE in terms of volumes not only in equity market but in the case of derivative market also. With an intention to end the broker’s control over stock exchanges in India, Securities Contract Regulation Act 1956 was amended by the Government in 2006 through the promulgation of an ordinance making the corporatization and demutualization of stock exchanges mandatory. The amendment not only requires separation of ownership and trading right, but also requires that the majority ownership rests with the public and those without any trading right. Currency futures were permitted to trade in NSE and BSE in 2007 which provides an
alternative investment avenue to market investors. By taking into account the preference of investors in Gold as an investment medium trading in Gold Exchange Traded Fund (ETF) was started in 2008.

Bygone years were a long journey for the Indian capital market. Now, the capital market is well organized, fairly integrated, matured, more global and highly modernized. When we analyze these developments of Indian capital market in two different time periods, we can see that the first phase reforms were given more thrust to the modernization of trading and settlement mechanism of the market. But the second phase of reforms has been focusing on the governance and financial innovation facilitating wider investment options and protective measures to investors in Indian stock market. Indian capital market is one of the best in the world in terms of technology upgradation. Internet trading has become common and it is getting integrated with global markets. In terms of governance and financial innovation also the Indian market is able to meet the international level standards. These developments have increased the participation of Foreign Institutional Investors and other institutional investors in Indian stock market, thereby widening the investor base and increasing the volume of business.

3.4: Performance of Indian stock market (NSE) during the period 2000-2010

Table 3.2 gives summary statistics on the performance of Indian stock market during the ten year period of the study. Indian stock market, in terms of return has performed very well during the post reform period. In most of the years it was able to produce positive returns to its investors. It is surprising to note that every alternate year from 2003-04, the market has delivered terrific returns and its return profile during those years is
abnormally higher than that of just previous years. Highest market growth (85.11 per cent) was observed in 2003-04 which could be attributed to the overall IT boom in the world economy. Since then, the stock market of the country was able to produce return for investors and the same trend continued until 2008-09. But the year 2008-09 brought in relentless distress to the investors by causing a loss of more than one-third of the value of their wealth which they would have hold at the beginning of the year. But the financial year 2009-10 again saw the market delivering amazing returns (71.51 per cent) which enable the investors to earn twice of their capital which they lost in the previous year (on considering it in relative terms).

**Table 3.2**

Indian Stock market performance – Descriptive statistics

<table>
<thead>
<tr>
<th>Year</th>
<th>Monthly return (%)</th>
<th>Annual return (%)</th>
<th>Risk (S.D)</th>
<th>Skewness</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Minimum</td>
<td>Maximum</td>
<td>Average</td>
<td>Minimum</td>
</tr>
<tr>
<td>2000-01</td>
<td>-16.2</td>
<td>10.84</td>
<td>-2.06</td>
<td>-24.54</td>
</tr>
<tr>
<td>2001-02</td>
<td>-13.16</td>
<td>9.22</td>
<td>0.19</td>
<td>0.76</td>
</tr>
<tr>
<td>2002-03</td>
<td>-10.41</td>
<td>12.24</td>
<td>-1.03</td>
<td>-12.47</td>
</tr>
<tr>
<td>2003-04</td>
<td>-7.49</td>
<td>15.36</td>
<td>5.50</td>
<td>85.11</td>
</tr>
<tr>
<td>2006-07</td>
<td>-17.84</td>
<td>9.14</td>
<td>0.66</td>
<td>11.99</td>
</tr>
<tr>
<td>2007-08</td>
<td>-13.46</td>
<td>15.73</td>
<td>2.58</td>
<td>31.59</td>
</tr>
<tr>
<td>2008-09</td>
<td>-22.96</td>
<td>14.42</td>
<td>-2.80</td>
<td>-35.51</td>
</tr>
<tr>
<td>2009-10</td>
<td>-10.22</td>
<td>23.97</td>
<td>5.04</td>
<td>71.53</td>
</tr>
</tbody>
</table>

Compiled from NSE price data

Indian stock market, in terms of return has performed very well during the post reform period. In most of the years it was able to produce
Economic environment analysis

positive returns to its investors. It is surprising to note that every alternate year from 2003-04 the market has delivered terrific returns and its return profile during those years is abnormally higher than that of just previous years. Highest market growth (85.11 per cent) was observed in 2003-04 which could be attributed to the overall IT boom in the world economy. Since then, the stock market of the country was able to produce return for investors and the same trend continued until 2008-09. But the year 2008-09 brought in relentless distress to the investors by causing a loss of more than one-third of the value of their wealth which they would have hold at the beginning of the year. But the financial year 2009-10 again saw the market delivering amazing returns (71.51 per cent) which enable the investors to earn twice of their capital which they lost in the previous year (on considering it in relative terms).

When we look into the risk profile of Indian stock market, it can be seen that return variability has been increasing year by year especially from 2004-05 onwards. In 2008-09, when Indian market tumbled down due to the Global financial tsunami, market volatility reached its extreme high of 12.84 per cent. During the subsequent year of recovery also, risk per cent was at double digit level, however slightly less than its previous year. The persisting trend in stock market volatility of the country confirms the observation of market critics that India is one of the riskiest emerging markets of this world.

. It can also be seen that frequency distribution of monthly stock returns in India were not normal during most part of the study period. In fact, during mid years of the study (2004-05 to 2006-07) it showed extreme form of skewness as its coefficients were excess of unity. Skewness
coefficient in 2007-08 almost equals to zero which in one way help to say that market is relatively normal during the year. It is also interesting to note that 6 out of 10 year study period the distribution of stock returns in India exhibited medium to high degree of negative asymmetry indicating the greater possibility of large decreases in prices there rather than rises, which could be a real concern to investors.

On considering the overall performance of Indian stock market, we can say that the size of the returns that could be produced by it for the investors is significantly much higher than the losses made by it during the period of observation. Existence of such a wide gap between gains and losses gives the indication that investors can maximize their wealth by parking their savings in the stock market of the country on a long term perceptive even though at a relatively higher level of risk.

3.5: Stock market and its linkage with the macroeconomic environment

– Theories and Empirical evidences

As suggested by Chen, Roll and Ross (1986), the selection of relevant macroeconomic variables requires judgment which should draw upon both on existing theory and existing empirical evidence. The following paragraphs briefly discuss the existing theory and empirical findings on the stock market movement and its linkage with macroeconomic environment of a country.

Theory suggests, as many authors find, that corporate cash flows are related to a measure of aggregate output such as GDP or industrial production. The levels of real economic activity will likely influence the stock prices in the same direction, through its impact on corporate profitability: an increase in output may increase expected future cash and,
hence, raise stock prices, while the opposite effect would be valid in a recession. Chen, Roll and Ross (1986), Mukherjee and Naka (1995), Wongbangpo and Sharma (2002) and Majid and Yousof (2009), all of these researchers and their studies have found significant positive association between stock prices and economic activities in various countries.

The changes in the direction of monetary policy are expected to have essential effect on the stock market. The interest rates in the organized financial sector of the economy are determined by the monetary policy of the government and trend in money supply. These rates are thus controlled and varied within certain ranges. For instance, restrictive policies via higher interest rates or discount rates would make cash flows worthless after being discounted. This would reduce the attractiveness of investment, hence, shrinks the value of stock returns. From the substitution effect hypothesis, a raise in the rate of interest increases the opportunity cost of holding cash, which later on leads to a substitution effect between stocks and other interest bearing securities like bonds. In summary, both the restrictive policy and the substitution effect hypothesis suggest that interest rate should be inversely related to stock return. In his study, Shahid Ahamad (2008) observed such inverse relationship between stock returns and interest rate movement. Frequently, researchers on financial economics have included both a long term interest rate and a short term interest rate. Changes in the short rate are mainly driven by the business cycle and monetary policy. In contrast, the long term interest rate should indicate the longer term view of the economy concerning the discount rate.

Another important variable concerning monetary policy is money supply. Many experts have seen the relation between money supply and stock prices even though they failed to bring the consensus regarding the
direction of relationship. When consolidating their findings it can be seen that the money supply likely to influence share prices through at least three mechanisms: First, a change in the money supply is related to unanticipated increase in inflation and future inflation uncertainty and hence negatively related to the share prices (Geske and Roll 1983, Pearce 1985); Second, changes in the money supply may positively influence the share price through its impact on economic activity (Mukherjee and Naka 1995). A change in the money supply provides information on money demand, which is caused by future output expectations. If the money supply increases, it means that money demand is increasing, which in effect, signals an increase in economic activity. Higher economic activity implies higher cash flows, which causes stock prices to rise. Finally, portfolio theory suggests a positive relationship, since it relates an increase in the money supply to a portfolio shift from non-interest bearing money to financial assets including equities (Fama and French 1993).

Beside interest rate and money supply the inflation can also cause the movement of stock prices. Unanticipated inflation may directly influence real stock prices (negatively) through unexpected changes in the price level. Inflation uncertainty may also affect the discount rate thus reducing the present value of future corporate cash flows. DeFina (1991) argued that rising inflation initially has a negative effect on corporate income due to immediate rising costs and slowly adjusting output prices, reducing profits and therefore the share price. Empirical studies by Barrows and Naka (1994) and Chen et.al (2005) reveal that inflation has negative impact on stock market.

According to 'Good market approaches' (Dornbusch and Fischer, 1980), changes in exchange rates affect the competitiveness of a firm as
fluctuations in exchange rate affects the value of he earnings, and cost of its funds in many companies borrow in foreign currencies to fund their operations and hence its stock price. An alternative explanation for the relation between exchange rates and stock prices can be provided through portfolio balance approaches that stress the role of capital account transactions. Like all commodities, exchange rates are determined by market mechanism, i.e., the demand and supply condition. A blooming stock market would attract capital flows from foreign investors, which may cause an increase in the demand for a country’s currency. The reverse would happen in case of falling stock prices where the investors would try to sell their stocks to avoid further losses and would convert their money into foreign currency to move out of the country. There would be demand for foreign currency in exchange of local currency and it would lead depreciation of local currency. As a result, rising (declining) stock prices would lead to an appreciation (depreciation) in exchange rates. Ma and Kao (1990) and Abdulla Murinde (1997) provided empirical evidences on the inverse relationship between exchange rate and stock returns.

Apart from other macro economic consequences, stock market investments in emerging economies like India are directly affected by the Foreign Institutional Inflows. The foreign investments in domestic equities of these countries have been increasing overtime due to the international diversification strategies pursued by the foreign investors in their effort to minimize the risks and maximize the returns from their portfolios. There are studies (Chakrabarti 2001, Griffin et al. 2004) which reveal that it is the Foreign Portfolio investments that move the stock in emerging economies and these capital flows could be regarded as the major source of growth and development of the market there. But some other research in this area
Agarwal (1997, Trivedi and Nair 2003) argues that FII inflows are not a cause, but an effect of equity returns from the domestic markets. The high rates of growth coupled with an increasing trend in corporate responsibility have imparted buoyancy to the stock markets, triggering of return chasing behavior by the FIIs. But some others (Babu and Prabheesh 2007) agree on bidirectional causality between stock market performance and FII inflows to India. Furthermore, movements in stock prices may influence exchange rates and money demand because investors’ wealth and liquidity demand could depend upon the performance of the stock market.

Literature reveals differential levels of cause – effect relationship between key macroeconomic variables and stock prices. This relationship varies in different stock markets across the globe. Studies relate to the Indian stock market and its linkage with the economy have produced contradicting results which might be due to the difference in time horizons covered under study or due to the divergence in techniques employed. Since the post financial liberalization era we can see a completed trading cycle in Indian stock market by encompassing all of its phases and a study covering such a period definitely can produce more robust results. Moreover, this study is employing more than one technique, looking for the causality between Indian economy and the performance of its stock market indicating both degree and its direction.

3.6: Data frame and the variables

As it would be almost impossible to incorporate every potential aspect to explain the stock market behavior, the researcher limits this study to selected macroeconomic variable which were identified through literature review and intuitive financial theory. The study has employed NSE
benchmark Index - CNX S&P Nifty to proxy for Indian stock market. Industrial production index in India is compiling and publishing on monthly basis, hence it is used instead of GDP to give proxy for the domestic supply factors/national output. To gauge the money stock in the economy the most popularly used Broad Money Supply (M3) and to give proxy for interest rate prevailing in the economy 3 months’s Treasury Bill (TB) rate have been used in this study. To account for inflation, the Whole Sale Price Index and to check the linkage with the external world, Rs/$ exchange rate is used. To recheck the validity of some of the earlier studies finding that Foreign Institutional Investors is the crucial factor deciding the stock price behavior in India, FII net flows to India has also included in the data frame. Data selection takes into account the data availability and their accessibility within the available timeframe. The monthly data ranged from April 2000 which symbolises the beginning of financial liberalizations in India and spans to as far as March 2010. Required data were mainly obtained from RBI handbook on statistics and Economic Survey reports (various issues) published by Government of India.

3.7: Hypothesis and Empirical methodology

The study hypothesizes a relationship between the stock return and six macroeconomic variables – money supply (M3), exchange rate, TB interest rate, WPI, IIP and FII net flows - which were identified on the basis of available literature.

3.8: Non-stationary time series (Unit Root)

Time series analysis must fulfill the stationary property of data series for drawing useful inferences. Broadly speaking a data series is said to be
stationary if its mean and variance are constant (non-changing) overtime and the value of covariance between time periods depends only on the distance or lag between two time periods and not on the actual time at which the covariance is computed. Estimation using non-stationary data will lead to unreliable t-statistics, as the underlying time series would theoretically have infinite variances. So at first stationarity of the time series variables is tested by performing unit root test. The study has followed the standard procedure of unit root testing by employing the Augmented Dicky Fuller (ADF) test. Since ADF test is often criticized by low power, this test is also complimented with Phillips Perron (PP) test. Both ADF and PP tests on the variables in levels and first differences to check for stationarity or unit roots.

3.8.1: Augmented Dickey Fuller (ADF) Test

ADF is a parametric method for controlling higher order correlation by assuming that the series follows an AR (p) process. This process is done by adding lagged difference terms of the dependent variable to the right-hand side of the regression. The Augmented Dickey-Fuller test requires running a regression of the first difference of the series against the series lagged once, lagged difference terms and a constant with a time trend such as:

$$\Delta Y_t = \alpha_0 + \beta_0 t + \lambda Y_{t-1} + \gamma \sum_{i=1}^{m} \Delta Y_{t-i} + u_t$$

(1)

Where $\Delta$ is the first difference operator, $u_t$ is an error term, and $m$ is the number of lagged first differenced term and is determined such that $u_t$ is approaching white noise. The $H_0$ hypothesize that $Y_t$ is non stationary time series (has a unit root) translates in to $H_0: \lambda = 0$. The output of the ADF test
consists of the t (tau) statistic on estimated coefficient of the lagged variable ($\lambda$) and the critical values for the test of a zero coefficient. If the estimated ADF statistic is larger (in absolute) than its critical value then the null is rejected suggesting that the series is a stationary. The choice of optimal lag lengths used in the unit root tests is determined by applying Akaike (AIC) and Schwarz (SC) information criteria.

**3.8.2: Phillips-Perron (PP) Test**

Phillips and Perron (1988) proposed a nonparametric method for controlling higher-order serial correlation in a series. Like ADF PP test is a test of the hypothesis $\rho = 1$ in the following equation.

$$\Delta Y_t = \alpha_0 + \alpha_t + \rho Y_{t-1} + u_t \quad \cdots \quad (2)$$

While the ADF test corrects for higher order serial correlation by adding lagged differenced terms on the right-hand side, the PP test makes a correction to the t-statistic $\rho$, which is corrected for serial correlation in $u_t$. The correction is nonparametric. The advantage of Phillips-Perron test is that it is free from parametric errors and allows the disturbances to be weakly dependent and heterogeneously distributed.

**3.9: Modeling causality between stock prices and macro economic variables**

The Vector Auto Regression (VAR) by Sims (1980) has been estimated to capture short run causality between stock prices and key macro economic variables. VAR is an extension of uni-variate auto regression model. This technique is commonly used for forecasting system of interrelated time-series and for analyzing the dynamic impact of random
disturbances on the system of variables. The VAR model allows for characterization of dynamic interaction between variables, without any restrictions on the structure of the system. VAR approach sidesteps the need for structural modeling by treating every endogenous variable in the system as a function of the lagged values of all of the endogenous variables in the system. All seven variables used in this study are considered as endogenous variables for VAR models with assumptions that all these variables are interrelated. It is assumed that constant is the only exogenous variable in the system. In the present study, multivariate VAR model taking Log Nifty as endogenous variable has been specified in first differences as given in equation 3

$$
\Delta LNFT_t = \alpha + \sum_{i=1}^{k} \beta_{i1} \Delta LNFT_{t-i} + \sum_{i=1}^{k} \beta_{i2} \Delta TBR_{t-i} + \sum_{i=1}^{k} \beta_{i3} \Delta WPI_{t-i} + \sum_{i=1}^{k} \beta_{i4} FII_{t-i} + \sum_{i=1}^{k} \beta_{i5} IIP_{t-i} + \sum_{i=1}^{k} \beta_{i6} \Delta M_{t-i} + \sum_{i=1}^{k} \beta_{i7} \Delta EXT_{t-i} + e_{it} \quad \text{--------- (3)}
$$

Where, $\Delta LNFT$ – Log value of monthly relative change in NSE Nifty

$\Delta TBR$ – Monthly relative change in 3 months Treasury bill rate

$\Delta WPI$– Monthly relative change in Wholesale Price Index

FII - Monthly Foreign Institutional Investment net flows to India

IIP - Monthly relative change in Industrial Production in India

$\Delta M_{t}$ – Monthly relative change in money supply (broad money)

$\Delta EXT$ – Monthly relative change in exchange rate (Rs vs $)

‘$\alpha$’ and ‘$e_{it}$’ are constant and error terms respectively.
Similarly six more VAR equations (listed below) were framed, by taking each of the six macroeconomic variables as endogenous variables in each equation. This has been done for identifying the explanatory and forecasting power of the variables in the relational matrix.

\[
\Delta \text{EXT}_t = \alpha + \sum_{i=1}^{k} \beta_{1i} \Delta \text{LNFT}_{r-i} + \sum_{i=1}^{k} \beta_{2i} \Delta \text{TBR}_{r-i} + \sum_{i=1}^{k} \beta_{3i} \Delta \text{WPI}_{r-i} + \sum_{i=1}^{k} \beta_{4i} \text{FII}_{r-i} + \\
\sum_{i=1}^{k} \beta_{5i} \text{HP}_{r-i} + \sum_{i=1}^{k} \beta_{6i} \Delta \text{M}_{3r-i} + \sum_{i=1}^{k} \beta_{7i} \Delta \text{EXT}_{r-i} + \epsilon_{1t},
\]

\[
\Delta \text{M}_{st} = \alpha + \sum_{i=1}^{k} \beta_{1i} \Delta \text{LNFT}_{r-i} + \sum_{i=1}^{k} \beta_{2i} \Delta \text{TBR}_{r-i} + \sum_{i=1}^{k} \beta_{3i} \Delta \text{WPI}_{r-i} + \sum_{i=1}^{k} \beta_{4i} \text{FII}_{r-i} + \\
\sum_{i=1}^{k} \beta_{5i} \text{HP}_{r-i} + \sum_{i=1}^{k} \beta_{6i} \Delta \text{M}_{3r-i} + \sum_{i=1}^{k} \beta_{7i} \Delta \text{EXT}_{r-i} + \epsilon_{1t},
\]

\[
\Delta \text{WPI}_{tj} = \alpha + \sum_{i=1}^{k} \beta_{1i} \Delta \text{LNFT}_{r-i} + \sum_{i=1}^{k} \beta_{2i} \Delta \text{TBR}_{r-i} + \sum_{i=1}^{k} \beta_{3i} \Delta \text{WPI}_{r-i} + \sum_{i=1}^{k} \beta_{4i} \text{FII}_{r-i} + \\
\sum_{i=1}^{k} \beta_{5i} \text{HP}_{r-i} + \sum_{i=1}^{k} \beta_{6i} \Delta \text{M}_{3r-i} + \sum_{i=1}^{k} \beta_{7i} \Delta \text{EXT}_{r-i} + \epsilon_{1t},
\]

\[
\Delta \text{TBR}_{si} = \alpha + \sum_{i=1}^{k} \beta_{1i} \Delta \text{LNFT}_{r-i} + \sum_{i=1}^{k} \beta_{2i} \Delta \text{TBR}_{r-i} + \sum_{i=1}^{k} \beta_{3i} \Delta \text{WPI}_{r-i} + \sum_{i=1}^{k} \beta_{4i} \text{FII}_{r-i} + \\
\sum_{i=1}^{k} \beta_{5i} \text{HP}_{r-i} + \sum_{i=1}^{k} \beta_{6i} \Delta \text{M}_{3r-i} + \sum_{i=1}^{k} \beta_{7i} \Delta \text{EXT}_{r-i} + \epsilon_{1t},
\]

\[
\text{FII}_{t} = \alpha + \sum_{i=1}^{k} \beta_{1i} \Delta \text{LNFT}_{r-i} + \sum_{i=1}^{k} \beta_{2i} \Delta \text{TBR}_{r-i} + \sum_{i=1}^{k} \beta_{3i} \Delta \text{WPI}_{r-i} + \sum_{i=1}^{k} \beta_{4i} \text{FII}_{r-i} + \\
\sum_{i=1}^{k} \beta_{5i} \text{HP}_{r-i} + \sum_{i=1}^{k} \beta_{6i} \Delta \text{M}_{3r-i} + \sum_{i=1}^{k} \beta_{7i} \Delta \text{EXT}_{r-i} + \epsilon_{1t},
\]
With in the framework of this VAR system of equations, the significance of all the lags of each of the individual variables is examined jointly with an F test. Since several lags of the variables are included in each of the equations of the system, the coefficients on individual lags may not appear significant for all lags, and may have signs and degrees of significance that vary with the lag length. However F tests will be able to establish whether all of the lags of a particular variable are jointly significant.

3.10: Impulse Response Function and Variable Decomposition in VAR analysis

The F tests and an examination of causality in a VAR will suggest which of the variables in the model have statistically significant impacts on the future values of each of the variables in the system. But it will not be able to explain the sign of the relationship or how long it would take for the effect of that variable to work through the system. Such information will, however, be given by an examination of the VAR’s impulse responses and variance decompositions

The IRF traces out the response of the dependent variable in the VAR system to shocks in the error terms. If the error term in each VAR equation increases by a value of one standard deviation, such a shock or change makes a change in the endogenous variable in the current as well as future periods. The IRF traces out the impact of such shocks for several periods in the future. IRF is considered as the centerpiece of VAR analysis.

\[ IIP_t = \alpha + \sum_{i=1}^{k} \beta_1 \Delta LNFT_{t-i} + \sum_{i=1}^{k} \beta_2 \Delta TBR_{t-i} + \sum_{i=1}^{k} \beta_3 \Delta WPI_{t-i} + \sum_{i=1}^{k} \beta_{4i} FI_{t-i} + \sum_{i=1}^{k} \beta_5 IIP_{t-i} + \sum_{i=1}^{k} \beta_6 M_{3t-i} + \sum_{i=1}^{k} \beta_7 \Delta EXT_{t-i} + e_{1t} \]

\[ \text{------------------ (9)} \]
Variance decomposition is the alternative way which separates the variation in endogenous variable into the component shocks to VAR. Thus the variance decomposition which provides information about the relative importance of each random innovation in affecting the variables in the VAR has also been presented. In econometric literature, both Impulse recourse functions and Variance decomposition together are known as innovation accounting (Enders 1995).

3.11: Empirical results

3.11.1: Unit root test results

In order to check for the presence of random behavior of the series the study has used two prominent unit root tests – ADF and PP tests. The test procedure incorporates the presence of both trend and intercept in each series.

Table 3.3

Test results for Stationarity of variables

<table>
<thead>
<tr>
<th>Variables</th>
<th>Level(with trend and intercept)</th>
<th>First Difference (with trend and intercept)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ADF</td>
<td>PP</td>
</tr>
<tr>
<td>Nifty</td>
<td>-0.3918</td>
<td>-0.5912</td>
</tr>
<tr>
<td>Exchange rate</td>
<td>-3.5654</td>
<td>-2.3177</td>
</tr>
<tr>
<td>M₃</td>
<td>-1.1784</td>
<td>-1.5228</td>
</tr>
<tr>
<td>WPI</td>
<td>-3.1060</td>
<td>-2.1818</td>
</tr>
<tr>
<td>TBR</td>
<td>-1.6911</td>
<td>-1.8112</td>
</tr>
<tr>
<td>IIP</td>
<td>-1.2688</td>
<td>-6.0065*</td>
</tr>
<tr>
<td>FII</td>
<td>-8.8248*</td>
<td>-9.3701*</td>
</tr>
</tbody>
</table>

*Significant at one per cent level  

Table 3.3 summarizes the results of ADF and PP unit root tests. On the basis of ADF test statistics, all the series except Foreign Institutional Investment net flows are found to be non stationary at levels with intercept and linear trend. But PP test rejects the null hypothesis of unit root at the
level itself in series of both FII and IIP (at one per cent level of significance) with intercept and linear trend. On considering the relative merit of PP test over ADF test (automatic correction to the DF procedure to allow for auto correlated residuals) it is reasonable to believe that the variable IIP also is integrated order 0, hence $I(0)$ variable. But the remaining five variables (exchange rate, TBR, WPI, M3 and Nifty) are integrated of order one as they become stationary with intercept and trend at one per cent level of significance after their first differencing.

3.11.2: Causality between Stock returns and economic variables – VAR results

To explore the existence of causality between the stock market and the macroeconomic variables as hypothesized in the study The Vector Auto Regression (VAR) by Sims (1980) has been estimated. The primary step of the analysis is the determination of optimum lag with the system of Vector Auto Regression. The Akaike’s information criteria (AIC) and Schwarz criteria (SC) have been employed to determine the appropriate number of lags and the optimum lag length based on these criteria is 3 for the model.

Table 3.4 exhibits coefficients of the exogenous variables in each equation and the $F$ values of lagged terms up to three lags in the VAR system. The null hypothesis that macroeconomic variables do not jointly cause NSE Nifty is rejected at one per cent level of significance. Similar inference is drawn in the case of other simultaneous equations in the VAR system. In general the signs of all variables are in line with the theoretical predictions. In particular money supply, exchange rate, Interest rate and FII inflows cause stock market movement in India.

The result shows that the relationship between NSE Nifty and macroeconomic variables is statistically significant in the case of four variables only – interest rate, exchange rate, money supply (all these at 5 per cent level) and FII inflows which is at 10 per cent level.
## Table 3.4
Stock returns and macroeconomic variables – VAR results

<table>
<thead>
<tr>
<th></th>
<th>∆EXT</th>
<th>∆LNT</th>
<th>∆M0</th>
<th>∆TBR</th>
<th>∆WPI</th>
<th>M1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Constant</strong></td>
<td>-6.89435</td>
<td>0.093116</td>
<td>223.9146</td>
<td>3.367237</td>
<td>5.209481</td>
<td>-66.67671</td>
</tr>
<tr>
<td>∆EXT-1</td>
<td>1.07108</td>
<td>0.134442</td>
<td>2.150435</td>
<td>1.34858</td>
<td>0.67716</td>
<td>1.10283</td>
</tr>
<tr>
<td>∆EXT-2</td>
<td>0.245168</td>
<td>0.003363</td>
<td>83865.11</td>
<td>0.10769</td>
<td>0.107321</td>
<td>0.145065</td>
</tr>
<tr>
<td>∆EXT-3</td>
<td>0.07342</td>
<td>0.00296</td>
<td>13613.55</td>
<td>0.001671</td>
<td>0.038373</td>
<td>-1.0571</td>
</tr>
<tr>
<td>∆EXT-4</td>
<td>0.67011</td>
<td>0.15963</td>
<td>4.04877</td>
<td>0.20246</td>
<td>0.10563</td>
<td>0.54697</td>
</tr>
<tr>
<td>∆EXT-5</td>
<td>0.134649</td>
<td>0.001599</td>
<td>1777.84</td>
<td>0.031814</td>
<td>0.143994</td>
<td>0.44893</td>
</tr>
<tr>
<td>∆EXT-6</td>
<td>-1.32797</td>
<td>0.085661</td>
<td>0.24443</td>
<td>0.43953</td>
<td>0.64610</td>
<td>0.25615</td>
</tr>
<tr>
<td>∆EXT-7</td>
<td>0.009091</td>
<td>0.000263</td>
<td>3253.73</td>
<td>0.003092</td>
<td>0.029586</td>
<td>0.04353</td>
</tr>
<tr>
<td>∆EXT-8</td>
<td>0.048572</td>
<td>0.004138</td>
<td>1.01296</td>
<td>0.000256</td>
<td>0.003473</td>
<td>0.00345</td>
</tr>
<tr>
<td>∆EXT-9</td>
<td>0.010713</td>
<td>0.004576</td>
<td>0.17603</td>
<td>0.00039</td>
<td>0.004519</td>
<td>0.00451</td>
</tr>
<tr>
<td>∆EXT-10</td>
<td>0.003044</td>
<td>0.000738</td>
<td>11829.25</td>
<td>0.102286</td>
<td>0.102286</td>
<td>0.102286</td>
</tr>
<tr>
<td>∆EXT-11</td>
<td>0.007216</td>
<td>0.00406</td>
<td>0.29358</td>
<td>0.003473</td>
<td>0.003473</td>
<td>0.003473</td>
</tr>
<tr>
<td>∆EXT-12</td>
<td>0.004078</td>
<td>0.003937</td>
<td>1.14122</td>
<td>0.002689</td>
<td>0.002689</td>
<td>0.002689</td>
</tr>
<tr>
<td>∆EXT-13</td>
<td>0.002071</td>
<td>0.00012</td>
<td>29315.08</td>
<td>0.294185</td>
<td>0.294185</td>
<td>0.294185</td>
</tr>
<tr>
<td>∆EXT-14</td>
<td>0.000544</td>
<td>0.004754</td>
<td>13412.91</td>
<td>0.07519</td>
<td>0.07519</td>
<td>0.07519</td>
</tr>
<tr>
<td>∆EXT-15</td>
<td>0.001368</td>
<td>0.01362</td>
<td>2.68128</td>
<td>2.40664</td>
<td>2.40664</td>
<td>2.40664</td>
</tr>
<tr>
<td>∆EXT-16</td>
<td>0.001759</td>
<td>0.000361</td>
<td>2.65368</td>
<td>0.000342</td>
<td>0.000342</td>
<td>0.000342</td>
</tr>
<tr>
<td>∆EXT-17</td>
<td>0.00361</td>
<td>0.004767</td>
<td>1.42038</td>
<td>0.028258</td>
<td>0.028258</td>
<td>0.028258</td>
</tr>
<tr>
<td>∆EXT-18</td>
<td>0.001534</td>
<td>0.41605</td>
<td>7.53617</td>
<td>0.000355</td>
<td>0.000355</td>
<td>0.000355</td>
</tr>
<tr>
<td>∆EXT-19</td>
<td>2.868823</td>
<td>0.41734</td>
<td>7.52020</td>
<td>0.550042</td>
<td>0.550042</td>
<td>0.550042</td>
</tr>
<tr>
<td>∆EXT-20</td>
<td>0.003114</td>
<td>0.31329</td>
<td>2.57202</td>
<td>0.005674</td>
<td>0.005674</td>
<td>0.005674</td>
</tr>
<tr>
<td>∆EXT-21</td>
<td>0.000755</td>
<td>0.000112</td>
<td>763.808</td>
<td>0.000342</td>
<td>0.000342</td>
<td>0.000342</td>
</tr>
<tr>
<td>∆EXT-22</td>
<td>0.011681</td>
<td>0.015361</td>
<td>0.44143</td>
<td>0.079671</td>
<td>0.079671</td>
<td>0.079671</td>
</tr>
<tr>
<td>∆EXT-23</td>
<td>3.7706</td>
<td>1.8987</td>
<td>0.16160</td>
<td>1.30060</td>
<td>1.30060</td>
<td>1.30060</td>
</tr>
<tr>
<td>∆EXT-24</td>
<td>7.1941</td>
<td>4.2332</td>
<td>0.22238</td>
<td>1.52238</td>
<td>1.52238</td>
<td>1.52238</td>
</tr>
<tr>
<td>∆EXT-25</td>
<td>-0.4974</td>
<td>0.18291</td>
<td>0.1216</td>
<td>0.060098</td>
<td>0.060098</td>
<td>0.060098</td>
</tr>
<tr>
<td>∆EXT-26</td>
<td>-2.4321</td>
<td>0.11804</td>
<td>0.10843</td>
<td>0.07842</td>
<td>0.07842</td>
<td>0.07842</td>
</tr>
<tr>
<td>∆EXT-27</td>
<td>-1.17398</td>
<td>0.010174</td>
<td>0.08483</td>
<td>0.04282</td>
<td>0.04282</td>
<td>0.04282</td>
</tr>
<tr>
<td>∆EXT-28</td>
<td>0.274337</td>
<td>0.082429</td>
<td>0.120331</td>
<td>0.211365</td>
<td>0.211365</td>
<td>0.211365</td>
</tr>
<tr>
<td>∆EXT-29</td>
<td>3.286714</td>
<td>0.339142</td>
<td>1.82728</td>
<td>2.620756</td>
<td>2.620756</td>
<td>2.620756</td>
</tr>
</tbody>
</table>

* significant at one per cent level  ** significant at five per cent level  *** significant at ten per cent level
Bi-directional causality has been observed between NSE Nifty and interest rate in India. Interest rate has showed inverse relationship with the stock price movement. For the last few years the interest rate in the country has been softened considerably by RBI which must have made favorable impact on Indian stock market for two reasons. Firstly, the lower interest rate means lower cost of capital and better corporate earnings, which should have made positive impact on share prices. Secondly, the lower interest rate in the fixed income segment has made the investors fonder of equity investments which definitely have provided a boost to the stock market. On the other side development in stock market in the country has helped corporate a lot to mobilize capital from domestic as well as international market easily, which in turn makes the debt market redundant one and such lack of demand for debt fund made it cheaper. These could be the reasons for two way causality between interest rate and stock returns in India.

There is direct casual link between money supply and NSE Nifty. As hypothesized the stock prices in India is positively related to the changes in the money supply (M3) of the country. An increase in the money supply leads to economic expansion through increased cash inflows and the stock prices is benefitted from the economic growth lead by such expansionary monetary policy. Money supply is also affecting the stock index movement through its effect on interest rate also.

Further, results reveal that exchange rate causes Nifty, while there is no causality from Nifty to exchange rate. Currency depreciation leads to more export earnings and higher capital inflows to the country thereby increased foreign exchange. More supply of foreign currency increases the money supply and expanding stock market.
There is only unidirectional causality from FII inflows to NSE Nifty. This could be the outcome of positive effect of FII inflows on expectations regarding the growth prospects of the stock market in the country.

In case of NSE Nifty to Index of Industrial Production there is no causality in either direction. Similarly inflationary conditions in the country do not cause stock index at any level, however it might have affected the stock price movement through its upshot on interest rate, thereby money supply in the market.

The VAR results also indicate that all the three monetary variables – money supply, inflation rate and interest rate are highly integrated as there exists bidirectional causality between them. More over linkage is also visible between financial sector and real sector variables. When money supply has its effect on FII inflows to India, the FII inflow leads Industrial production of the country which in turn has direct impact on exchange rate. Such effects on exchange rate causes money supply thereby inflation also. From the linkages between the monetary variables and again its causality with the financial sector variables it can deduce that money supply is the prime economic variable which could make significant impact on stock return volatility in India. All these findings lead to a valid conclusion that any variable which has a negative effect on cash flows shall be in a negative relationship with the stock prices.

3.11.3: Impulse responses of NSE Nifty to innovation in Macroeconomic variables

Figure 3.1 to Figure 3.6 provides the impulse responses of stock returns in India for the one unit S.D innovation in macro economic variables of the country. The dotted lines represent a two standard band around the
estimates of impulse response. The effect can be significant if the band excludes zero. Considering the signs of the responses, innovations to exchange rate always have a negative impact on the stock prices and the effect of the shock does not die down, even after 10 months. A one standard deviation impulse in the Foreign Institutional Inflows innovation has a positive and significant effect on stock returns. But its effect is very short term and last only up to the 2\textsuperscript{nd} month, beyond that the shock appears to have worked its way out of the system. With a positive innovation in money supply, the expansionary monetary shock, the response of stock prices is positive as expected. The effects start immediately and decline marginally after the fourth month. However its effects persist there for a long period. The Nifty response to its own shock is both significant and positive throughout the period. The innovations in other variables – Inflation and Index of Industrial found no significant effect on stock returns.

![Figure 3.1: Impulse Response of NSE Nifty to Cholesky One S.DNSE Nifty Innovation](image)

---

78 Department of Applied Economics

---
Figure 3.2: Impulse Response of NSE Nifty to Cholesky One S.D Exchange Rate Innovation

Figure 3.3: Impulse Response of NSE Nifty to Cholesky One S.D Money Supply Innovation
Chapter 3

Figure 3.4: Impulse Response of NSE Nifty to Cholesky One S.D Interest Rate Innovation

Figure 3.5: Impulse Response of NSE Nifty to Cholesky One S.D Wholesale Price Index Innovation
Figure 3.6: Impulse Response of NSE Nifty to Cholesky One S.D FII Net Flow Innovation

Figure 3.7: Impulse Response of NSE Nifty to Cholesky One S.D IIP Innovation
Thus as indicated by the coefficients of variables in the framework of Vector Auto regression system, similar causality is also observed graphically using impulse response function. So it shows the stability the VAR system in capturing the causality of the variables.

### 3.11.4 Variance decomposition of NSE Nifty

Finally the study has employed variance decomposition and impulse response function to further examine the dynamic interaction between Nifty and the selected macro economic variables. Taking the variables at level the study stimulates how they react to their own shocks and the shocks in other variables. The variables follow the Cholesky factorization. The variance decomposition results at the end of the 10 periods are shown in Table 3. The columns provide the percentage of the forecast variance due to each innovation in VAR system with each row adding up to 100.

### Table 3.5

<table>
<thead>
<tr>
<th>Period</th>
<th>NFT</th>
<th>EXT</th>
<th>FII</th>
<th>TBR</th>
<th>IIP</th>
<th>M3</th>
<th>WPI</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>88.21059</td>
<td>2.256429</td>
<td>0.106641</td>
<td>1.484671</td>
<td>0.003356</td>
<td>7.914770</td>
<td>0.023544</td>
</tr>
<tr>
<td>3</td>
<td>80.73468</td>
<td>2.211762</td>
<td>0.288981</td>
<td>3.57139</td>
<td>1.043053</td>
<td>12.04941</td>
<td>0.096976</td>
</tr>
<tr>
<td>4</td>
<td>73.98080</td>
<td>2.202184</td>
<td>0.294278</td>
<td>5.247430</td>
<td>1.930216</td>
<td>15.66217</td>
<td>0.682916</td>
</tr>
<tr>
<td>5</td>
<td>68.47171</td>
<td>2.022792</td>
<td>0.276049</td>
<td>6.038532</td>
<td>3.356477</td>
<td>18.34158</td>
<td>1.492854</td>
</tr>
<tr>
<td>6</td>
<td>64.13169</td>
<td>1.833707</td>
<td>0.254827</td>
<td>6.302137</td>
<td>4.470155</td>
<td>20.43551</td>
<td>2.571976</td>
</tr>
<tr>
<td>7</td>
<td>60.44539</td>
<td>1.636392</td>
<td>0.227117</td>
<td>6.323346</td>
<td>5.414742</td>
<td>22.31814</td>
<td>3.634876</td>
</tr>
<tr>
<td>8</td>
<td>57.43833</td>
<td>1.463255</td>
<td>0.205341</td>
<td>6.239429</td>
<td>6.110177</td>
<td>23.98215</td>
<td>4.561320</td>
</tr>
<tr>
<td>9</td>
<td>54.90645</td>
<td>1.347027</td>
<td>0.187876</td>
<td>6.135628</td>
<td>6.627670</td>
<td>25.51425</td>
<td>5.281100</td>
</tr>
<tr>
<td>10</td>
<td>52.76776</td>
<td>1.317008</td>
<td>0.174387</td>
<td>6.038691</td>
<td>7.009419</td>
<td>26.90474</td>
<td>5.787993</td>
</tr>
</tbody>
</table>
From the analysis of Table 3.5 it is evident that NSE Nifty responds aptly to its own innovations, but the effects fade off over time. When NSE Nifty explained on an average 60 to 75 per cent of its forecast error variance, the other six macro economic variables together account for the remaining 25 to 35 per cent of the variation in NSE nifty series. Among these money supply has the strongest influence, which accounts for more than 20 per cent variation in Nifty index. Moreover it shows the increasing importance over time. Responses of exchange rate and interest rate are combatively better than that of other variables in the immediate future. But the importance of exchange rate is slowly absent after sometime. Even though the responses of Industrial production and inflation rate tend to be of slight importance/insignificant at the immediate lag, its effect is improving overtime. An interesting feature of the result is that the shocks by the FII do not cause any significant variation in the movement of the Nifty series.

The above analysis confirms the relationship between real economic variables and the stock market performance in India during its post financial liberalization period. The results suggest that monetary policy has a stronger and faster impact on both real and financial sectors in India including its stock market. In essence money supply, exchange rate and interest rate have significant impact on stock index. Even though the VAR analysis administered in the study has found statistically significant causality from FII net flows to NSE Nifty, the results of Impulse Response Function and Variance Decomposition tests failed to explain this finding. A few variables like inflation rate and Index of Industrial Production have shown very negligible influence on the stock market. In spite of these
inconsistencies in findings, on considering the dynamic interaction between the real economic variables with each other and its linkage with some of the financial sector variables it is rational to believe that the macro economic variables jointly cause stock market variations. But stock market cannot be characterized as leading indicator of economic activity, instead it lags economic activity. On account of this every investor in India must take these macroeconomic variables in to account for having better prediction of the future values of their stock investments. These results can be further examined by the policy makers in India while they are drafting the policies and guidelines governing the stock market in the country for achieving further development and growth in it.

References


