CHAPTER 7
SUMMARY & CONCLUSIONS

7.0 Introduction
Prediction of volatility of stock market is always a concern for the researchers, academicians and market analysts. The sensitivity of stock market is measured by different indices which check the health of equity market. Volatility has its connection with different variables which are responsible for its existence such as market information, global factors, market returns, investor sentiments etc. Stock market volatility has its existence from the long time but its complete eradication is not possible, the only thing which can be done is just to know its behaviour and pattern that how it behaves. Volatility is an essential part of the stock market because it checks the nerve of the market. As a coin has two sides, the same way market has two aspects the positive and the negative. Any information in the market will result into changes in prices of any stock which is the cause of fluctuations in the market and hence volatility. At present, stock market is much volatile because of the impact of weak rupee against dollar. Volatility increases during period of recession and it’s essential to know the causes and extent of volatility so that it can be controlled to some extent and future activity can be better. The present study is focusing on to understand the volatility behaviour of Indian stock market in the present times.

Volatility is a term in the stock market which has its concern for everyone who is interested to invest in the stock market. In India, stock market is affected by globalized factors as well as the domestic factors also. These factors make the market volatile and which in turn has its influence on the returns of the stock price. Returns of stock significantly affected by the fluctuations of the market. In the present era of liberalization, privatization and globalization, the international investments and diversification of portfolio internationally is an important issue, especially in the time period when stock markets are highly volatile. Normally, people invest in the stock market with the purpose of earning returns. An investor designs his portfolio in which he includes different stocks or group of stock on sectoral basis to achieve his purpose of maximum returns with minimum risk. International diversification can be an option as rationale behind this is that stock returns within a county can be highly correlated because of similar environment but internationally conditions can be different. The present study seeks into the behaviour of Indian stock market and interdependence of
Indian stock market and International stock markets. The objectives of the study are as follows:

1. To see the stock market volatility patterns in Indian stock market and behavior of volatility after the introduction of derivatives.
2. To study the stock price movements to show that any trend or movements in the market are interdependent and to understand the weak form efficiency of the Indian stock market.
3. To identify the day-of-the-week effect and month-of-the-year effect in the Indian stock market.
4. To investigate and compare the stock returns and volatility behavior of the Indian stock market as compared to International stock markets.

The present study is based on the four major indices of Indian stock market i.e. SENSEX, and BSE100 of Bombay Stock Exchange, while NIFTY and CNX500 of National Stock Exchange. The daily closing prices of the four indices is taken for the period of the study. To see the inter-dependence of Indian stock market with international, Brazil, Russia, India and China are selected as emerging economies and seven developed economies named as USA, UK, Australia, Japan, Germany, Hongkong stock market and Singapore are taken to understand their behaviour. The data for India stock market is collected from the official websites of National Stock Exchange and Bombay Stock Exchange i.e. www.nseindia.com and www.bseindia.com. The data of other countries is collected from www.moneycontrol.com, www.allstocks.com and www.yahoofinance.com.

7.1 Findings of the study

The main findings of the study are as follows:

- On the basis of results shown by all four series respectively, it was found that on an average the return of all series during this time period was 0.07% approx. After converting all the series into stationary series and checked that autocorrelation is in existence among all the series, GARCH family models were applied to look into volatility behavior of Indian stock market. There was evidence from all the indices of time varying volatility which exhibited the sign of clustering, high persistence and predictability in India stock market. Volatility is persistence in Indian stock market which means volatility stays in
the market for a long period of time. Joshi, 2010; Mehta and Sharma, 2011; supported this argument in their research work. It was seen that volatility is more when market is down as compared to boom periods which suggests that volatility is of asymmetric function. Karmakar, 2007; & Srinivasan and Ibrahim, 2010; is in consistent with the results as they suggested that volatility rises proportionally more during market declines.

- The E-GARCH and T-GARCH models outperformed the GARCH models. GARCH models proved to be best fitted and no arch effect left in the return series which is done with the help of ARCH-LM test, is in consistent with Kaur (2004).

- The other important result is that returns responded differently to the arrival of negative and positive shocks. It means bad news is more impactful in Indian stock market as compare to good news. These results are in consistent with the previous findings of Leon (2007), Kaur (2004) and Bordoloi and Shankar (2008).

- The results showed that during post-derivative period volatility has reduced, the impact of past information on volatility is reduced, and on the other hand, current information’s impact on volatility has increased. The leverage effect has also increased in Indian stock market. Mallikarjunappa and Afsal (2008) supported the results.

- During total time period, NIFTY has lowest return as well as more volatile whereas SENSEX has highest returns and less volatility. During period I, CNX500 has the highest returns and high volatility during this time but NIFTY has lowest return and high volatility. The volatility of SENSEX was least in this time period. During period II and III, NIFTY has the highest return and high volatility. CNX500 has the lowest returns but with least volatility, and, on the other hand SENSEX was highly volatile.

- All series were stationary during total time period and during period I, II and III separately, all selected markets under study did not show evidence of random walk. Gupta and Basu (2007) and Srinivasan (2010) supported these results, they proposed that BSE and NSE markets do not show sign of random walk and as such are not efficient in the weak form.
The results of Kolmogorov-Smirnov Test showed that during total time period as a whole and during time period I and II, Indian stock market does not follow random walk which means market is not weak form efficient and investor can take benefit on the basis of past information but during period III, Indian stock market follow random walk which means market is weak form efficient. Aggarwal (2012) supported the above mentioned results.

The result of runs test indicating that during total period and period I, Indian stock market does not follow random walk and are not weak form efficient whereas the results of period II and III are completely different as except one index BSE100 in period II and CNX500 in period III, all other indices are significant so the null hypothesis of random behavior is accepted and hence, Indian stock market is independent and are weak form efficient. It can be concluded from the long term perspective Indian stock market is weak form efficient, the non-random behavior of the market has only short term implications. The results are inconsistent with Khan et al. (2011) who concluded both BSE and NSE does not follow random walk model and Indian capital market is not weak form efficient. Poshakwale, 1996; Azarmi et. al., 2005; Gupta and Basu, 2007; Chander et al., 2008 Singh, 2008; Srinivasan, 2010; and Khan et al., 2011 were in consistent with the results. They suggested that the Indian stock market do not show characteristics of random walk and were not efficient in the weak form implying that stock prices remain predictable.

The results of autocorrelation represented mixed relations which means at few lags market is weak form efficient otherwise not. The L-jung Box represents the null hypothesis that there is no autocorrelation. All selected stock markets are significant at 1% level so the null hypothesis is rejected which suggests that there is dependence in returns and market is not weak efficient. The results of autocorrelation and Ljung Box statistic represented that during period 1, all selected stock markets are significant at 1% or 5% or 10% level so null hypothesis is rejected. It means there is dependency in returns and market is not weak efficient. During Period II and III, the selected stock markets are not significant at mostly lags so null hypothesis can be accepted which indicates there is no autocorrelation and series is random, hence weak form of efficient
market is in existence. The studies which were supporting that Indian stock market is weak form efficient were Sehgal and Gupta, 2007; Gupta, 2010; Singh et al., 2010; Aggarwal, 2012; and Rehman et al., 2012.

- The null hypothesis that variance ratio should be equal to one can’t not be accepted. All this points out that variance ratio is less than 1 and hence series are auto correlated. It is also seen that as VR ratio increases, z-stats also increases which means the chances of rejection becomes even stronger. From the above results it can be said that all selected markets, during whole period and period I, period II and period III, SENSEX, BSE100, NIFTY, CNX500 under study does not follow random walk and are not weak form efficient. Sekar and Arasu (2007) and Azarmi (2005) supported the above mentioned results.

- The summary statistics of daily returns revealed that the mean returns of SENSEX, and BSE100 of Bombay Stock Exchange, and NIFTY and CNX500 of National Stock Exchange were positive for all trading days and these were higher on Friday and lower on Tuesday.

- The highest volatility of SENSEX was noticed on Thursday, followed by Monday and the least volatile day was Wednesday. The standard deviation of returns of BSE100 was highest on Tuesday and Monday and the lowest on Thursday and Friday. The volatility was high on Monday and lesser on Friday for the NIFTY index. The Standard Deviation of Returns was highest on Thursday and the lowest on Monday for CNX500.

- The OLS regression was used with dummy variables to seek the day of the week effect in SENSEX, and BSE100 indices of Bombay Stock Exchange, and NIFTY and CNX500 indices of National Stock Exchange and it was found that none of the day was significant at 5 percent level which indicated that there was no weekend effect in SENSEX returns.

- GARCH model was used and result focused that after correcting for serial autocorrelation and ARCH effect, none of returns were significantly different except Thursday which indicated week effect in BSE100 returns. Thursday returns were highest as compared to the returns of other days. In a nutshell, day-of-the-week-effect was present in the BSE100. The GARCH model
corrected serial autocorrelation and ARCH effect, and it was found that returns of Friday were significantly different at 5% level which indicated week effect in NIFTY and CNX500 returns. Friday returns were highest as compared to the returns of other days. Abdalla (2012) concluded that coefficients of five day of week are statistically insignificant. Berument and Kiymaz, 2001; Kiymaz and Berument, 2003; and Sarma, 2004; supported the above mentioned results. They found that significant day-of-the-week effect is present in Indian bourses. These patterns are useful to understand the time to invest in the market and to earn benefit out of market irregularities. Chander & Mehta, 2007; Sah, 2010; and Chia & Liew, 2010; also in the favor of these results and suggested that significant Monday and Friday effect was seen. But there are some studies which are not supporting these results. Pandey, 2002; Kaur, 2004; Mittal & Jain, 2009; Abdall, 2012; and Nageswari & Selvam, 2012; their studies are not in the favor of above mentioned results as according to them there were little evidence of seasonality or day-of-the-week effect. Monday and Friday effect was present but not significant enough.

- The summary statistics of monthly returns revealed that the highest return was on the month of April which is followed by February and least returns are with the month of December for the all indices SENSEX, and BSE100 of Bombay Stock Exchange, and NIFTY and CNX500 of National Stock Exchange.

- The highest volatile month is January, followed by February whereas least volatility occurs in August and September for all indices i.e. SENSEX, and BSE100 of Bombay Stock Exchange, and NIFTY and CNX500 of National Stock Exchange.

- The OLS regression on monthly returns found that none of the coefficients were significant in SENSEX, and BSE100 of Bombay Stock Exchange, and NIFTY and CNX500 of National Stock Exchange monthly returns, so the null hypothesis was accepted that there is no month of the year effect. Keong et al, (2010) is in consistent with the results.

- GARCH model applied to correct the arch effect and after that March, May, June, Sep, Nov and December effect was found in SENSEX, and BSE100 of Bombay Stock Exchange, and NIFTY of National Stock Exchange returns.
The return of the month September was found statistically significant at 5 percent. So, there was September effect prevalent in the CNX500. The Ljung-Box Q statistic showed that there was no pattern in residual. ARCH LM test also indicated that there was no ARCH effect in residual now. Keong et al., 2010; was in the favor and examined December effect in Hongkong, India, Malyaisa and Japan whereas significant May effect was observed by them in few countries. Sewraj et al., 2010; and Swami, 2011; were in favor of the month-of-the-year effect existence in Indian stock market. The findings of the Pandey, 2002; Kaur, 2004; and Deb et al., 2007; were against the above results as they proved that there is not any significant month-of-the-year effect prevalent in Indian stock market.

In total time period, emerging economies returns were with high returns ranging from 5 to 7% except China but developed economies returns were lesser ranging from 1 to 2%. Volatility in emerging economies was high. During period I, there was lot of difference between the returns of emerging and developed economies. Emerging economies has a return in the range of 15 to 17% except China with very low return, on the other hand, developed economies have returns in range of 3 to 8%. As far as volatility is concerned it was again high in emerging economies more than 1% whereas it was lesser than 1 in most of the developed economies. The results of period II were somewhat similar to results of period I as returns of emerging economies were high as compared to the returns of developed economies except Japan. Volatility was less in developed economies except Hongkong and Japan. The situation changed in period III, during this time the returns of developed economies were higher as compared to emerging economies except Russia which has the highest return in this period. Volatility was high in emerging economies. Lucey and Muckley (2010) supported this and found that as regards diversification opportunities were concerned developed stock markets provided better long-term diversification opportunities as compared to the emerging stock markets.

The result of unit root test showed that all the series values were insignificant at 5% level so null hypothesis that series has a unit root problem was accepted so it can be concluded that series were non-stationary except FTSE whose
value for Period III is significant suggesting that this series was significant for this time period. It was found that all series were significant at 5% level at first difference suggesting that null hypothesis that series has a unit root problem was rejected which means series were stationary. Paramati et al. (2012) supported the above mentioned results.

The results of correlation test found that when whole period was taken, Indian stock market was closely related with Brazil and Hongkong stock market. It was least correlated with Japanese stock market. During Period I, Indian stock market was again closely related with, Brazil stock market and Germany stock market. It was very less correlated with Chinese stock index. It was moderately correlated with DJIA and FTSE. During Period II, Indian stock market was again closely related with, Hong Kong stock market, and Brazil stock market. It was least correlated with Japanese stock market. It was moderately correlated with DJIA and FTSE. During Period III, Indian stock market was closely related with developed economies and its correlation with emerging economies was less. Highest correlation is with Hongkong stock market. Overall, developed economies such as Hongkong, Germany, and emerging economy Brazil has correlation with Indian stock market. Kumar and Dhankar, 2009; and Ranpura et al., 2012; supported the above results.

The analysis of co-integration test showed that during whole period, India co-integration was found with Australia, Brazil, Germany, Hongkong, Singapore and Russian stock market. In recent years, the trading relationship between India and Australia has remarkably increased. During period I, India was found related with developed economies Germany and UK. As far as emerging countries are concerned, Indian stock market was found integrated with Brazilian and Russian stock market. No other country was co-integrated with India during that time period. Results of period II reports that India co-integration was found with Hongkong and Russian stock market. No other country was co-integrated with India during that time period. Results of period III reports that Indian stock market was found integrated with Australia, Germany, USA, UK, Hongkong, Singapore and Russian stock market. So, it can be said that during this period India trade relations with mostly developed economies were getting better as all these economies were co-integrated with
India. Overall, there is long term relationship between Indian stock market with Germany and Hongkong. Among emerging economies, Brazil and Russian stock market bear a long term relationship with Indian stock market. Tripathi and Sethi (2012) supported the above mentioned results.

The results of granger causality test found that during total time period, there was bidirectional causality between Indian stock market and Australian stock market. Australian stock market was causing Indian stock market, and Indian stock market was causing Australian stock market. Hongkong caused India but India did not granger cause Hongkong. Russia and India has bidirectional causality. Russia was causing India and India was causing Russia. In period I, Australia, Hongkong and Singapore was causing India and India was causing Brazil. In period II, Brazil, Russia, USA and Japanese stock market has a unidirectional causality with Indian stock market as these economies were causing India but India did not cause these economies. In period III, there was unidirectional causality between India and developed economies USA, Germany and Japan. The emerging country Brazil has bidirectional causality as Brazil was causing India and India was also causing Brazil. In emerging economies Brazil and Russia were causing India. Emerging economies Brazil and Russia were causing Indian stock market and India was also causing these but there was no causal relationship between Indian and Chinese stock markets. Developed economies Australia, Hongkong, Germany, USA, Japan and Singapore stock market have a causal relationship with Indian stock market but Indian stock market was not causing any developed economy. During Total Period and Period I, Hongkong and Australia were causing India more but after that USA, Japan and Germany were causing India. Mariani et al., 2008, Gangadharan & Yoonus, 2012; and Guidi & Ugur, 2014; examined that US have an influence on Indian stock market. On the other hand, Guidi & Ugur, 2014; and Ahmad et al., 2005; found against it and concluded that the influence of USA on other stock markets was decreasing.

The results of VAR test showed that Indian stock market influenced Singapore during total time period, USA, Hongkong, Japan and Singapore stock market during period I, Germany, Singapore, Japan and Russian stock market during period II, Japan, USA and Brazilian stock market during period III. So,
developed economies which significantly impacting India were USA, Singapore, Japan. In case of emerging economies, Russia and Brazilian stock market has influence on Indian stock market. Although there was no stable lead-lag relationship of India with developed and emerging economies. Rejeb & Salha (2013) and Kuo (2013) supported that there was an integration of world stock markets.

- Variance Decomposition showed that during total time period most of the return of Indian stock market was composed of by itself and not other country has impact on Indian stock market. Hongkong has visible impact on the Indian stock market, otherwise, no other country has much impact during period I. During period II, Germany and Hongkong has impact on Indian stock market. During time period III, Germany has impact on Indian stock market. While the forecast error variance decomposition reveals how strongly the markets are linked, the impulse response analysis can be used to further examine these linkages and the efficiency with which innovations are transmitted between markets. The impulse response found that the shock in other markets did not have any much impact on the Indian stock market. Dasgupta (2014) supported the above mentioned results.

7.2 Conclusions
There was evidence from all the indices of time varying volatility which exhibited the sign of clustering, high persistence and predictability in India stock market. The other important result is that returns responded differently to the arrival of negative and positive shocks. It means bad news is more impactful in Indian stock market as compare to good news. These results are in consistent with the previous findings of Leon (2007), Kaur (2004) and Bordoloi and Shankar (2008), Madhavi (2014). The results showed that during post-derivative period volatility has reduced, the impact of past information on volatility is reduced, on the other hand, current information’s impact on volatility has increased. The leverage effect has also increased in Indian stock market. Mallikarjunappa and Afsal (2008) supported the results. Merton (1995) argues that the volatility’s asymmetric response to the arrival of news is reduced in the presence of futures markets. It is seen that Indian stock market are volatile due to many reasons like investors get frightened and pull investment out of the market, company news, a popular IPO, government intervention, booming and bursting
bubbles, settlement of Future and Options contract which happens at the end of every month and participants either buy or sell these on the basis of their perception. As there are many types of investors in the markets, it is possible that their views contradict with some of them being very optimistic about the future whereas other being very pessimistic. All positions in the F&O segment are hence a collection of the views of market participants as indicated by put-call ratio and open interest position. As the month draws to a close some views would be proved right leading to profit booking. Others have the option of rolling over their positions to the next month or terminating their contracts. This leads to high volume of trading at the end of the month. If some participants were expecting the markets to fall and it does not, they will have to cover their positions, accelerating the rise in the markets. Similarly, if people were expecting the markets to go up and it falls instead, they will have to sell their positions, propelling the fall further. Hence, F&O settlement contributes to a high level of volatility due to settlement and roll over of contracts. The movement of Foreign Institution Investment (FII) in Indian stock market also has increased the volatility. The Indian stock market has reached new heights and became more volatile due to FII, Loomba (2012).

On the basis of results of various tests, it can be concluded that Indian stock market is not weak form efficient and does not follow random walk during whole period and period I. However, the results of period II and period III shows that Indian stock market is approaching towards the state of fairly weak efficient market. Mobarek and Fiorante (2014) and Bhat et al. (2014) supported these results. It is seen that emerging economies are less efficient as compared to developed economies. There are many reasons behind this like market participants are not so informed and behaving irrationally in comparison to developed markets. The main reason is less developed capital markets resulting in non-availability of timely information, higher transaction costs, difficulty in getting new information and uncertain future (Goldsmith, 1971; and Wai & Patrich, 1973). Some significant regulatory and policy changes have a noticeable impact on the efficiency of Indian stock market. The whole time period from January 2003 to December 2012 will not be able to capture the impact of all reforms over a period of time on the Indian stock market efficiency, so the bifurcation of whole time into three sub-periods has proved to be beneficial in understanding the same. As per the results, during period II and III (2006 onwards), stock market efficiency is improving which can be the results of improvement in
technology, regulation regarding disclosures, and the amount of retail participation etc. Various reforms were seen like, reporting platform for corporate bonds (2006), trading platform for corporate bonds (2007), direct market access (2008), market access through authorized persons (2009), small order routing (2010), etc. Foreign Institutional Investors were allowed to invest in various securities like units of CIS (2008), IDRs (2009), repos in corporate debt securities etc. So, it can be said that after 2006 due to regulatory reforms and technological advancements, after 2006, efficiency of Indian stock market is improving gradually. Jethwani and Achuthan (2013) are in favor of above mentioned results.

Day-of-the-week-effect found prevalent in Indian stock market and it was Friday and Thursday effect mostly whose returns were significantly different from the returns of other days. Monthly returns were also analyzed and found that April is the month with highest returns followed by February. The high return in April is due to starting of new financial year as people can plan their next year tax payments and in this hope invests in the market. The one of the reason of high return after holi is may be that the market gives corrective action to the government and economic action that has been announced during the February to April as during this period the annual budget is presented in the parliament (Maheta, 2014). Negative mean returns for March and positive returns for the month of April are consistent with tax-loss-selling hypothesis. (Sharma and Deo, 2014). The least returns months were in the month of December, the reason behind this lies in the fact that in the month of December, most of the people are in the mood of come out with their bad investments and sell all their stock in the hope of buying new stocks in the new year. Tax-loss-selling-hypothesis emerges here. Siddiqui and Narula (2013) supported this result. The March, April, May, June, Sep, Nov and December effect was found prevalent in Indian stock market as returns of these months were significantly different from the returns of other days. It can be because of interim Information hypothesis and risk aversion hypothesis (Anuradha and Rajendran, 2012). In the end, it can be said that seasonality anomalies exist in Indian stock market in terms of day-of-the-week-effect and month-of-the-year effect. Seasonal Anomalies is used for the purpose of investment planning by institutional and retail investors in all stock markets. The reason for seasonal anomalies is the uneven investments made during the whole calendar year. There are various causes of these seasonal anomalies like differential tax treatments, cash flow
adjustments, new information is not easily absorbed in the market and sentiments of investors also play a big role (Su Han Chan et al, 2004).

Indian stock market has a short-run relationship with the developed economies but no long-run relationship exits. After 1991, Indian stock market has grown significantly due to various economic measures taken by the government. After liberalization, foreign capital was invited into different sectors resulted into market integration. But, even after this, lots of hurdles during investment in the stock market. Individual investors can not invest in the foreign markets. Some domestic corporate can raise funds through ADRs/GDRs in the foreign market. In the nutshell, with the growth of technical facilities in the capital market and removal of investment barriers, the integration of Indian stock market along with international stock markets will increase in future. Chattopadhyay and Beherat (2008) was in favor of these results.

7.3 Implications of the study
The present study throws light on the volatility behaviour in the Indian stock market. It can be seen that volatility has its long term impact in the market so an investor is required to take all possible measures to design his portfolio. Stock returns bear a good relationship with volatility as with increase in financial volatility stock prices goes down. According to one study, an average investor gets very less returns as compared to the average market returns. So, he is required to understand the fluctuations in the bourses to earn the maximum profits out of his investment. Conditional models as suggested by the study can be used to foresee the future volatility as well by the investor. Calendar anomalies and international stock market behavior are widely studied phenomenon because of their universal acceptability. At what time and at which place money should be invested in financial assets is very important for an investor so seasonality should be taken care by him, accordingly he can decide the correct time to invest.

7.4 Scope for Future Research Work
The present study is based on the daily and monthly closing price data, high frequency, hourly and minute data can be taken for further research work. Secondly, some other seasonal anomalies like turn-of-the-month effect and holiday effect can be examined for future research work.
Thirdly, FII has very important impact on the Indian stock market so the impact of FII on the Indian stock market volatility can be an important issue for future studies.

Fourthly, beyond the present data in this study, some other data types may be used like individual stocks or some other significant indices may be undertaken.

Lastly, Indian stock market is facing different problems and challenges which may be the result of political issue, economic variable, or environment issues so there is a room for different other political or economic studies which explore these factors.