MAJOR FINDING AND CONCLUSION

In today scenario volatility is calculated for various type of financial variable such as stock return, interest rate, exchange rate, etc. Stock return volatility measure the variability of the stock return around the average value of the return. More specifically it is the standard deviation of the stock return. We found the volatility prevails in all the stock market around the world. Due to the arrival of the new information, which are available publicly or privately, the expected value of the stock change. This will result into either increase or decrease in the prices and thereby volatility enters in the stock return.

Volatility is natural phenomenon in the stock market but excessive volatility is a matter of concern which arises due to the irrational behavior of the trader, investor and lack of transparency in the operations of the stock market. The excessive volatility may lead to loss of the investor’s life time savings and trader’s insolvent. The high level of volatility in the equity
market is also a matter of concern because this will create the low confidence among the investor regarding the capital market and decrease the flow of capital in the equity market. It is perceived as market inefficiency and a potential threat to the very integrity of the market mechanism. This concern in the marketplace has underlined the importance of measuring and predicting the stock market volatility. Only then effective monitoring mechanism can be implemented and will help in the preventions of such scam.

In today era BRICMs (Brazil, Russia, India, China, and Mexico) are the most emerging countries in the world but no systematic study has been done on the extent and behavior of stock market volatility in these countries collectively. The present study is an attempt in this direction and aim to empirically investigate the stock market volatility in these selected developing countries. The objectives of the study are as follows:

- To measure the extent of stock market volatility in selected developing countries.
- To examine the presence of the day of the week effect on stock return and their volatility.
- To examine the effect of portfolio size on stock return and their volatility.
- To examine the impact of macroeconomic variable on stock market return and their volatility.
- To compare the volatility of Indian stock market with other developing countries stock market.

The sample population of the study consist five fast growing countries Brazil, Russia, India, China, Mexico, collectively known as BRICM. It was predicted that together their economies would overtake those of the current six richest countries within 50 years. , BRIC’s economy has recorded impressive growth in the last decade. To study stock market volatility in these countries their respective stock exchange and stock indices has been taken. BSE-Bombay stock exchange is the leading stock exchange of India. BSE Sensex represents the thirty most liquid stocks which represents the different sector of our economy. Therefore BSE sensex has been taken as the proxy for the Indian capital market. In case of Brazil BM&FBOVESPA act as a driver for the Brazilian capital market. Bovespa index has been taken for the BM&FBOVESPA. RTSI represents the Russian Trading System stock exchange in Russia. In case of China SSE Composite index represents the Shanghai Stock Exchange. Lastly IPC index has been taken for the Mexican Stock Exchange.

**Statistical and Econometric Tools:** The statistical tools applied to analyze the data include percentage, arithmetic mean, standard deviation, maximum, minimum, kurtosis, skewness, simple and multiple regression, two-tailed T-test, Kruskal wallis test and Levene’test . ADF and PP Unit Root Test, Co-integration test, VAR Granger Causality test, GARCH, EGARCH, TGARCH model are the econometric tools applied for the analysis.

The following paragraphs present the main empirical findings of the study.

### 8.1 Main Empirical Findings

#### 8.1.1 Extent of Historical Stock Market Volatility in Selected Developing Countries

**Brazil:** In Brazil Volatility was highest in the year 2008. Overall volatility and return during the study period were 2.11% and 0.08% respectively. Annualized Volatility was in the range of 14%-52%. It was found a sudden fall in the volatility after the year 1999 and in the year volatility looked up again since the year 2007 and year 2008 become the highest volatile year.
**Russia:** In Russia year 2008 recorded the highest volatile year and overall volatility was at the level of 2.8%. Range of the annualized volatility was 19%-66%. There was declining trend in the level of volatility since 1999 to 2005. Volatility in Russia was highest in the year 2008 and after that it marked a sharp decline in the year 2009 and 2010.

**India:** In India also same year as in the case of Brazil and Russia year 2008 observed as the highest volatile year. 1.78% Overall volatility was recorded during the study period. Annualized volatility was in the range of 10%-45%. This is lower than above mentioned countries. After the year 2008 volatility suddenly came down to 1.1% in the year 2010.

**China:** In China volatility was stable since 1999 to 2006 (1% to 1.5%) but after that it starts rising and year 2008 become the highest volatile year. It means in china impact of recession has been seen in the year 2007. After 2008 volatility came to lower level. Overall volatility was 1.67% and the range of annualized volatility was 14%-45%.

**Mexico:** In Mexico overall volatility was 1.56% and annualized volatility was in the range of 10%-37%. Year 2008 recorded the highest volatile year followed by the year 2000. There is decline in the volatility after the year 2000 and then looked up again in the year 2006. After the highest volatile year, there was a sharp decline in the level of volatility.

### 8.1.2 Modeling Stock Market Volatility:

**Brazil:** It was found that impact of recent past information and past volatility on the current volatility is highly statistically significant. Impact of historical volatility is higher than the recent news impact. It means in Brazil past volatility takes long time to wipe out. GARCH-M model shows that by including the variance term in mean equation as a independent variable, it was found that there is linear relationship between risk and return. Results of EGARCH and TGARCH model shows that coefficient of asymmetry is -.0879 (t = 9.33) and .1230 (t = 8.59) respectively. Both the value is highly statistically significant at 5% level of significance which indicates the strong presence of asymmetry effect in the volatility.

**Russia:** Results indicate that Russia shows the same results as in Brazil, impact of past volatility and recent news is positive and statistically significant and impact of past volatility is larger than
recent news impact. Coefficient of variance in mean equation is positive but not statistically significant; it means investors are not rewarded for their risk. Coefficient of EGARCH and TGARCH (-.0444), 0.0590 respectively, presented a asymmetrical relationship between return shock and volatility adjustment.

**India:** It was observed that coefficient of lagged squared residual and conditional variance is significant in the conditional variance equation. This states that in Indian market also shocks to the conditional variance will be highly persistent. Results of the GARCH-M model shown a negative relationship between risk and return which is quite contrary to suggestion of ICAPM model. The coefficient of EGARCH and TGARCH speak about the asymmetry response of volatility to positive and negative shocks.

**China:** It was found that coefficient of both ARCH and GARCH terms are positive and statistically significant. It shows the persistent behavior of the volatility in Chinese market. Coefficient of variance term in mean equation is positive which indicate a positive relation with return. Coefficient of asymmetry in EGARCH and TGARCH is -0.0257 and 0.0439, respectively which is statistically significant. It means volatility of Chinese stock market respond asymmetrically toward bad news and good news.

**Mexico:** In Mexican market impact of past volatility and recent news both are statistically significant. It specifies volatility is persistent in Mexican market. GARCH-M model shows positive relationship between risk and return but it was not statistically significant. The asymmetry coefficient of EGARCH model (δ) is -0.1026 (t = -5.7102). The coefficient is negative and highly significant which indicates that volatility in Mexican market reacts more to the negative shocks rather than positive shocks. The same has been suggested by the asymmetric effect δ in TGARCH model as it is 0.1239 (t = 9.5364) and statistically significant at 5 per cent level.

**8.1.3: Volatility of Indian Stock Market Compared with Other Stock Markets:**

Annualized volatility of the India was 27.22% during the study period which is less than Brazil and Russia but more than China and Mexico. Return and the volatility was highest in the country Russia which prove the thumb rule that high risk lead to high return. Brazil is second to Russia in
terms of annualized volatility. In case of modeling the stock market volatility it was found that in all the selected developing countries excepting India there was positive relationship between risk and return but in case of India is not so. Perhaps that could be attributed to market imperfection and anomalies behavior of traders over there. Like other selected countries India also respond responds asymmetrically to bad and good news and also having a persistent behavior of volatility.

8.1.4: Presence of Day of the Week Effect on Stock Market Return and Volatility:

**Brazil:** In Brazil average return was highest on Wednesday and Friday but lowest on Monday. Volatility was highest on Monday. Return in Brazil country was distributed uniformly across the weekday which is proved by the different parametric and non parametric test. There is no day of the week effect in stock return of Brazil. But in case of stock market volatility, Friday show a significant impact on the volatility as shown by the results of the GARCH model. Levene’s statistics also shows the inequality of variance across weekday. So there is presence of day of the week effect in volatility of the Brazilian stock return.

**Russia:** It is found that mean return was highest on Thursday and lowest (negative) on Wednesday and volatility was highest on Monday. Result of T test reject the null hypothesis that average daily return of every working day of the week is not statistically different from the rest of the days of the week because on Wednesday return is significantly low. Same has been proved by the Krukal Wallis test which reject the null hypothesis of equality of mean among all the weekdays and by the regression model which also represents the significant low impact of Wednesday return. Levene’s test rejects the null hypothesis of equality of variance in Russia whereas GARCH model presents the significant impact of Monday and Tuesday on volatility of Russian stock market. In Russia there is presence of day of the week effect in return as well as volatility.

**India:** In India mean return was highest on Wednesday and volatility was highest on Monday. Result of T test and Kruskal wallis test of equality of mean accept the null hypothesis of equality of mean return among weekday of the week and prove that in India returns are uniformly distributed. Regression model also provides the same results and confirm that there is no significant day impact on the return of the BSE. But Levene’s test rejects the null hypothesis of
equality of variance across the week days in India. GARCH model presents the significant impact of Monday and Tuesday on Indian stock market volatility. It means in India there is presence of the day of the week effect only in case of Volatility.

**China:** china presented the highest return and highest volatility on the same day which is Monday that prove basic rule highest volatility lead to highest return. Result of T test found that Thursday return is significantly different from the return of the rest of the days. Regression result also provides the same result significant low impact of Thursday return on BSE return. Kruskal wallis test also reject the null hypothesis of equality of mean return in China. In case of volatility hypothesis of equality variance is rejected and same has been proved by the result of the GARCH model which indicates significant impact of Monday and Tuesday on volatility. Results proved that China presents the day of the week effect in both return as well as volatility.

**Mexico:** In Mexico mean return was highest on Thursday and volatility on Monday. T test, Kruskal Wallis test , Regression model provide the same result that in Mexico return are distributed uniformly but in case of volatility there is significant impact of Monday and Friday. Like Brazil and India, Mexico also shows the presence of day of the week effect in volatility only.

### 8.1.5 Impact of Portfolio Size on Stock Market Return and Volatility:

It was found that in Indian capital market as the size of the portfolio increase the average rate of return also increase and vice-versa but in the case of volatility such relationship is opposite when portfolio size increase volatility of the index decrease due to the effect of diversification. Such relationship between return and portfolio size and between volatility and portfolio size is not statistically significant according to the results of independent sample T test, KW test and Levene’s test. It means return and volatility of the portfolio of different size are same. Therefore it can be concluded that there is no impact of portfolio size on stock market return and stock market volatility.

### 8.1.6 Impact of Macroeconomic Variable on Stock Return and Volatility:
It was found that developed market have a significant bearing on the Indian capital market and work as a leading indicator for the Indian capital market. MSCI explain the 40% of the variance of the BSE sensex return. MSCI shows a positive relationship with BSE sensex. Treasury bill interest rate of federal bank and India also also cause change in BSE return. The impact of the inflation is also statistically significant while explaining the BSE return. Some other variable like FII, exchange rate, money supply, average call money market rate, gold rate, volume and volatility of BSE have no significant impact on the the Indian capital market. In the case of volatility no one variable is found to be statistically significant.

The finding that the foreign institutional investment has been a very insignificant factor in moving the stock market is very surprising because it is contrary to the common perception that it is the foreign portfolio investment that moves the stock market. The finding can be considered as a reassurance for domestic market’s strength. It becomes a crucial input for our policy makers as well as the regulators.

**8.2: Main Conclusion of the study**

1. Overall volatility was highest in Russia (2.80%) followed by the countries Brazil (2.11%), India (1.78%), china (1.67%) and Mexico (1.56%). volatility was lowest in the Mexico. India and china follow the same pattern of volatility during the study period. For the risk taking investors Russia and Brazil are the best markets to invest where they can earn highest return for the award of bearing high risk. For safe playing investors Mexican and Indian markets seems to be the best options for investment. China is the market where investor will get less amount of return for high degree of risk. Volatility was highest in the year 2008 in all the developing countries taken in the sample. (i.e. Brazil, Russia, India, china, Mexico). In the year 2008 there was global recession which marks its impact in all the developing countries. Thus it can be concluded that recession brought the volatility at highest level in the year 2008 in all the developing countries as shown by the sample of five developing countries taken for the study.

2. In case of all five markets ARCH and GARCH terms in GARCH (1, 1) model representing the impact of recent news and historical volatility respectively are statistically significant at a level of 5 per cent. In all above cases impact of GARCH
terms on current market volatility are much higher than the ARCH terms as $\beta_1$ coefficients in various GARCH equations are ranging from 0.85 to 0.92 in comparison of $\alpha_1$ coefficients ranging from 0.066 to 0.13. The variance intercept in all cases are very small and the sum of the both others coefficients are near to 0.99, which indicate that shocks to the conditional variance will be highly persistent in all five markets. Brazilian, Russian, Chinese and Mexican stock markets’ return is positively related with volatility in the respective stock markets. But out of all four markets only in case of Brazil that relation is statistically significant. This study is also found that Indian stock market return is negatively related with stock market volatility but statistically insignificant. It implies that Indian market penalize the investors for bearing irrelevant local market risk. In all five markets conditional volatility increase in a higher proportion after a negative return innovation rather than an increase after a positive innovation in the same. So on the bases of that, investors are advised to be more conscious about the negative news in the market.

3. As far as day of the week effect in return is concerned all test revealed that there is negative Wednesday affect and negative Thursday effect have been found in Russian, Chinese and market, respectively. Negative Thursday affect is also can be link with the same as all good or bad news are supposed to arrive on Friday, in expectations of that the negative impact can be experienced. In case of all three others markets i.e Brazil, India and Mexico no week day effect in return has been found. In case of day wise volatility all markets shown anomalous behave as volatility is very much low on Fridays in case of Brazilian and Mexican Markets and low on Tuesdays in Chinese and Indian markets. Chinese and Indian both the markets have shown same kind of pattern as volatility is significantly high on Mondays and significantly low in Tuesday that can be associated with beginning of the week effect. Results are just opposite in case of Russian market. From the findings, thus it is obvious that some seasonal anomalies either in return or in risk pattern are persistent in all emerging markets.

4. Portfolio size makes no difference in the level of volatility and return in India. There is equality of mean return and equality of variance among the different sized portfolio.
5. Developed markets have a significant impact on the return of the BSE sensex as MSCI explain the 40% variance of the BSE sensex return. It is an important determinant of the BSE return and proved as leading indicator of the Indian capital market. Treasury bill interest rate of federal bank and India also also cause change in BSE return. Results of the regression model shows that inflation is also a important factor which affect the BSE return. but there was no variable found significant which affect the volatility of the Indian stock market return.

8.3 Implication and Suggestion of the Study

8.3.1 Implication for investor:

Findings of the present study would be useful for investor because it provide the empirical evidence on the stock market volatility of BRICM (Brazil, Russia, India, China and Mexico) countries which are the fast growing developing countries in the world. These are expected to outperform the developed countries in the coming time and having a strong consumer market. Therefore this study provides a new area of investment for the investors but before taking investment decision it is essential to analyze volatility of the stock market. It is found that Brazil and Russia provides high return for high risk so for risk taker investor these two countries are the best option among the developing countries. Investors who do not want to take risk they can chose either India or China which provide the good return at moderate level of risk. Simultaneously investors need to be cautious about the bad news in all the market as volatility increase in higher proportion after the bad news in the market than increase in volatility after the good news.

The existence of anomalies may provide opportunities to formulate profitable trading strategies so as to earn the increased return that is not commensurate with the risk. It would improve the performance of portfolios maintained by both individuals and institutional investors. This would result in profit making only in the short run. In the long run, countervailing arbitrage and forces of demand and supply will exploit the excess return leaving no future scope for such anomalies.
8.3.2 Implication for Policy makers and Stock Exchange Regulatory Authorities:

The knowledge of volatility of stock market is of utmost important for the policy maker of a nation to drive the economy smoothly on the way of development and for the regulatory authority for smooth working of the stock exchange. To design an effective monitoring mechanism, it is necessary to measure and predict the stock market volatility. Simultaneously understand the behavior of stock market volatility such as how it respond to change in the macroeconomic variable, volatility persistency, asymmetric effect and risk-return relationship etc. etc. After measuring, predicting and understanding the behavior of stock market volatility an effective mechanism can be developed for the capital market and fear associated with the excessive volatile market can be removed. The findings of this study can be helpful in this direction. This study will be helpful for policy maker to frame the appropriate guideline for the benefit of the investor and for the smooth running of the stock market.

Based on the above analysis following suggestion are made:

Investor should have systematic investment plan as systematic investment plan is one of the most efficient ways to benefit from the volatility. The markets move up and down over a period of time. By investing through systematic investment plan, one has the opportunity to enter at every stage of the market and can earn good return. There should be diversification in the investment such as rather than investing the whole money in single country investor should invest in two or more than two countries as this study found each country is having different risk-return level, different pattern of volatility and different economic environment. Investment should be made for the long time and in the quality assets to earn the maximum return at low level of risk.

A more liberalized regime in the emerging market economies should be accompanied by the further improvements in the regulatory system of the financial sector. Because a little increases in the volatility of return in the equity market may result in sudden massive withdrawals of FII, which may result in quite disturbing consequence on the country’s economy.
The government of the emerging countries must have a stable economic policy because frequent changes in the economic policy may cause excessive volatility in the market which loses the investor confidence in the equity market.

**8.3.3 Suggestion for Further work:**

In the globalization era where the countries are integrated with other economies in the world, firstly it would be useful to study level of integration between the Indian stock market and other developing countries.

Secondly this study is based on daily closing price; further research work can be done on the high frequency data.

Thirdly the present study is restricted to developing countries only. A comparative study of stock market volatility between developing countries and developed countries can be undertaken for the future work.

Fourthly further research can be done on the intraday and interday behavior of the stock market volatility in developing countries by using the family of GARCH models. This study would be helpful for investor for framing the strategies to earn short term benefit.