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"ANALYSIS OF VOLATILITY IN INDIAN STOCK MARKET AND OTHER FOREIGN COUNTRIES"

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Abstract

Volatility refers to the amount of uncertainty or risk about the size of changes in a security value. Volatility in the stock market has major impacts on the stock returns, if it is not estimated in advance it can result into huge losses in the returns of the stock, so by predicting volatility in the stock market on can minimize risk and can also generate good returns. Our aims to measure the volatility level in the Indian Stock market in the time period of February 2008 to February 2017 and also to identify causal relationship amongst the variables. For the achieving objectives, we have used Descriptive research study on the data of indices which were taken from February 2008 to February 2017. We have used following test namelyUnit root test, Ganger test, GARCH model and other residual test. In order to measure volatility in the Indian stock market GARCH model is used, the GARCH (1, 1) model is best fitted because it is a significant model to explain volatility. To state whether the indices are volatile or not, GARCH (1, 1) model is well significant to recognize it. The output states that the GARCH and ARCH term is significant so it states that it has impact of volatility on Indian stock market and other foreign countries

Keywords:*Volatility, Unit Root, Ganger test, ARCH and GARCH.*

Introduction

Volatility refers to the amount of uncertainty or risk about the size of changes in a security's value. A higher volatility means that a security's value can potentially be spread out over a larger range of values. This means that the price of the security can change dramatically over a short time period in either direction. A lower volatility means that a security's value does not fluctuate dramatically, but changes at a steady pace over a period of time.(Retrieved from Investopedia - https://www.investopedia.com/terms/v/volatility.asp)

Investors perceive high volatility as a sign of investor nervousness and low volatility as a sign of confidence (Jain and Dash, 2012). With the advent of globalization, world financial markets and economies are increasingly integrated due to free flow capital and international trade. Globalization has also increased co-movement in stock prices across international markets. This co-movement stimulates vulnerability to market shocks. Therefore, shocks originating in one market not only affect its own market but are also transmitted to other equity markets. Before investing in an asset, investors incorporate information about price movements and volatility in the same asset and related assets listed in different countries. This issue is an important concern for portfolio investors because greater integration among world markets implies stronger co-movements between markets, thereby nullifying much of the gain out of diversification across borders.

Retrieved from (http://www.apeejay.edu/aimtc/journal/docs/issue2/article_2.pdf)

Factors affecting to Volatility

Region and country economic factors, such as tax and interest rate policy, contribute to the directional change of the market and thus volatility. For example, in many countries, the central bank sets the short-term interest rates for overnight borrowing by banks. When they change the overnight rate, it can cause stock markets to react.

Changes in inflation trends influence the long-term stock market trends and volatility. Expanding price-earnings ratios (P/E ratio) tend to correspond to economic periods when inflation is either falling or is low and stable.. This tends to cause the stock markets to decline and experience higher volatility industry and sector factors can also cause increased stock market volatility. For example, in the oil sector, a major weather storm in an important producing area can cause prices of oil to jump up.

Literature Review

Aparna Bhatia and Binny (2017) has conducted research on "Analysis of Stock Market Volatility: Comparative Study of India and China". Their main objective of study was to determine the trend in volatility in BSE Sensex and SSE and to determine the causal relation between BSE Sensex and SSE Composite. They have collected Monthly returns from Bombay Stock Exchange (BSE Sensex) for Indian stock market and Shanghai Stock Exchange (SSE COMPOSITE) for Chinese stock market respectively from April 01, 2004 to March 31, 2012. In order to fulfil this study they have used Ganger causality test and concluded that volatility was at its highest level in the year 2008 in both the countries. However, the Indian stock market is found to be more volatile than Chinese stock market but returns in Indian stock market were comparatively more than in China.

Karunanithy Banumathy and Ramachandran Azhagaiah (2015) have conducted research on "Modelling Stock Market Volatility". Theirs aim of study was to investigate the volatility pattern of emerging Indian stock market using symmetric and asymmetric models. The study is based on the secondary data that were collected from s&p cnx Nifty indices. The daily closing prices of Nifty indices over the period of ten years from 1st January 2003 to 31st December 2012 were collected and used for analysis. The present study employed garch (1, 1) and garch-m (1,1) for modelling conditional volatility and for Modelling asymmetric volatility egarch (1, 1) and tgarch (1, 1) were applied. The study conclude that increased risk did not increase the returns since the coefficient is insignificant for the selected variables for the study period.

Nawal Kishor and Raman Preet Singh (2014) have conducted research on "Stock Return Volatility Effect: Study of BRICS". Their main objective of study was to estimate the market volatility based on the market Indices return of BRICS stock market. They have collected data of BRICS countries Stock Indices over the period of four years starting from 1stJanuary 2007 to 31st December 2013. In order to fulfil this study they have used GARCH model and concluded that BRICS stock market except Brazil and Chinese stock market have been significantly affected by the news of US stock market and clearly indicates the impact of the global financial crisis on the BRICS stock returns.

Jian zhang and Juan wang (2013) has conducted research on "Volatility Spill overs between Equity and Bond Markets: Evidence from G7 and BRICS". Their main objective of study was to investigate the volatility spill overs between domestic equity and bond markets in the G7 and BRICS countries. In order to conduct this study they have collected data of equity indices and bond indices of G7 (i.e., the US, the UK, Japan, France, Germany, Italy, Canada) and BRICS countries (i.e., Brazil, Russian Federation, India, China, South Africa) from 1988 to 2012. In order to fulfil this study they have used LM GARCH model and concluded that bidirectional volatility spill over between the equity and bond markets in France, Brazil and South Africa, unidirectional spill over from the bond to the equity in the US, the UK and Germany at the significance of 1%, while in the case of Russian Federation, there is little evidence of spill over in either direction.

M. Thenmozhi and Abhijeet Chandra (2013) have conducted research on "India Volatility Index (India VIX) and Risk Management in the Indian Stock Market". Their main objective of study was to examine the asymmetric relationship between the India Volatility Index (India VIX) and stock market returns, and demonstrates that Nifty returns are negatively related to the changes in the India VIX levels. They have used regression-based models to study the India VIX and its association with the Nifty returns. Using daily data from the National Stock Exchange (NSE). For volatility estimates they have considered three different measures such as the standard deviation of historical returns, the daily variance estimates, and the monthly sum of stock returns. They have also compare the India VIX performance with the performance of two measures of conditional volatility, namely, the GARCH (1, 1)-based conditional volatility measure and the EGARCH conditional volatility measure. They conclude that the India VIX can be used as a tool for portfolio insurance against risks caused by steep downward movements in the market; it can also be used as an indicator for market timing.

Manex Yonis (2011) has conducted research on "Stock Market Co-Movement and Volatility Spill over between USA and South Africa". His main objective of study was to examine the existence of volatility spill over between USA and South Africa. The data collected for the study was daily stock indices of the New York and Johannesburg stock markets, April 1, 2005 to May 31, 2011. In order to undertake this study he has used GARCH model and VAR model. From the study he has concluded that own past shocks and past volatility persistence impact on the current return fluctuation of both markets. There is uni-directional volatility transmission between these two markets. This is due to the existence of significant and positive shocks and volatility spill overs from USA to SA.

Prashant Joshi (2010) has conducted research on "Modelling volatility in emerging stock markets of India and China". The main objective of study was to investigate the stock market volatility in the emerging stock markets of India and China. The data of daily closing price has been collected from 1st January, 2005 to 12th May, 2009. The statistical tools for the analysis were BDSL test, ARCH-LM test, GARCH (1,1) model. The paper concluded that daily returns in the stock markets exhibit nonlinearity and volatility clustering which are satisfactorily captured by the GARCH models. In both the markets, volatility tends to die out slowly. Results suggested that the volatility is more persistent in the Chinese stock market than the Indian stock market.

K. Kiran Kumar and Chiranjit Mukhopadyay (2002) have conducted research on "A case of India and U.S. Their main objective of study was to investigate the short run linkages between NSE Nifty in India and NASDAQ Composite in US during the 1999-2001. The data of S & P 500 and NASDAQ were collected from the year 1999 to 2001. To fulfil the study they have used Ganger Causality test and GARCH Model. From the analysis it was conclude that the granger causality results indicate unidirectional granger causality between US stock market and Indian stock market, the volatility spill over effects are significant only from NASDAQ, on an average the effect of NASDAQ return volatility shocks on Nifty return volatility is 9.5%.

Research Methodology

Problem Statement

Volatility in the stock market has major impacts on the stock returns, if it is not estimated in advance it can result into big losses in the returns of the stock, so by predicting volatility in the stock market on can minimize risk and can also generate good returns.

Objective of study

- To measure the volatility level in the Indian Stock market and Foreign Stock Market in the time period of February 2008 to February 2017.
- To identify the causal relationship amongst the variables.

Research design

Here in this study, we have used Descriptive method.

Descriptive study will help to describe the level of volatility in the Indian stock market and allow measuring its impact on the stock market

Data Collection

Data are collected for the time period of last 10 years i.e. February 2008 to February 2017.
The data were collected from the NSE (Nation Stock Exchange of India) and BSE (Bombay Stock Exchange) and Yahoo Finance.

Research Tools

- EVIEWS

Test for analysis

- Unit root test
- Granger causality test
- ARMA
- GARCH (1,1) Model
- Normality test
- Correlogram Q – Statistics
- Hetroskedasticity test

Result and Discussion

Unit root test

Refer **Table No. 1**

Interpretation:

- **BSE**

  H0= BSE has unit root

  H1= BSE does not have unit root

From Table 1, it can be interpreted that the P-value of ADF Statistics at constant is 0.8860 and 0.1243 at constant and trend, which means P value is more than 0.05 so we accept null and can say that data has unit root problem at level. But P-value of ADF Statistics at constant and constant and trend for 1st difference is 0.00 which states that it is less than 0.05 so we reject null and accept alternative, So it can be said that data becomes Stationary at 1st difference.

- **NIFTY 50**

H0= NIFTY 50 has unit root

H1= NIFTY 50 does not have unit root

From Table 1, it can be interpreted that the P-value of ADF Statistics at constant is 0.89 and constant and trend is 0.09, which means P value is more than 0.05 so we accept null and can say that data has unit root problem at level. But P-value of ADF Statistics at constant and at constant and trend for 1st difference is 0.00 which states that it is less than 0.05 so we reject null and accept alternative, So it can be said that data becomes Stationary at 1st difference.

- **NASDAQ**

H0= NASDAQ has unit root

H1= NASDAQ does not have unit root

From Table 1, it can be interpreted that the P-value of ADF Statistics at constant is 0.98 and at constant and trend is 0.11, which means P value is more than 0.05 so we accept null and can say that data has unit root problem at level. But P-value of ADF Statistics at constant and constant and trend for 1st difference is 0.00 which states that it is less than 0.05 so we reject null and accept alternative, So it can be said that data becomes Stationary at 1st difference.

- **NIKKEI**

H0= NIKKEI has unit root
H1= NIKKEI does not have unit root
From Table 1, it can be interpreted that the P-value of ADF Statistics at constant is 0.90 and at constant and trend is 0.19, which means P value is more than 0.05 so we accept null and can say that data has unit root problem at level. But P-value of ADF Statistics at constant and constant and trend for 1st difference is 0.00 which states that it is less than 0.05 so we reject null and accept alternative, So it can be said that data becomes Stationary at 1st difference.

Ganger Causality Test
Refer **Table No. 2**

Interpretation:

1)

H0= NIFTY 50 does not granger cause BSE

H1= NIFTY 50 granger cause BSE

The P value of NIFTY 50 is more than 0.05, so it can be said that null is accepted and can be said that NIFTY 50 return does not Granger cause BSE return.

2)

H0= NASDAQ does not granger cause BSE

H1= NASDAQ granger cause BSE

The P value of NASDAQ is more than 0.05, so it can be said that null is accepted and can be said that NASDAQ return does not Granger cause BSE return.

3)

H0= NIKKEI does not granger cause BSE

H1= NIKKEI granger cause BSE

The P value of NIKKEI is less than 0.05, so it can be said that alternative is accepted and can be said that NIKKEI return Granger cause BSE return.

4)

H0= BSE does not granger cause NIFTY 50

H1= BSE granger cause NIFTY 50

The P value of BSE is more than 0.05, so it can be said that null is accepted and can be said that BSE return does not Granger cause NIFTY 50 return.

5)

H0= NIKKEI does not granger cause NIFTY 50

H1= NIKKEI granger cause NIFTY 50

The P value of NIKKEI is less than 0.05, so it can be said that alternative is accepted and can be said that NIKKEI return Granger cause NIFTY 50 return.

6)

H0= NASDAQ does not granger cause NIFTY 50

H1= NASDAQ granger cause NIFTY 50

The P value of NASDAQ is more than 0.05, so it can be said that null is accepted and can be said that NASDAQ return does not Granger cause NIFTY 50 return.

7)

H0= BSE does not granger cause NIKKEI

H1= BSE granger cause NIKKEI

The P value of BSE is more than 0.05, so it can be said that null is accepted and can be said that BSE return does not Granger cause NIKKEI return.

8)

H0= NIFTY 50 does not granger cause NIKKEI

H1= NIFTY 50 granger cause NIKKEI

The P value of NIFTY 50 is more than 0.05, so it can be said that null is accepted and can be said that NIFTY 50 return does not Granger cause NIKKEI return.

9)

H0= NASDAQ does not granger cause NIKKEI

H1= NASDAQ granger cause NIKKEI

The P value of NASDAQ is more than 0.05, so it can be said that null is accepted and can be said that NASDAQ return does not Granger cause NIKKEI return.

10)

H0= BSE does not granger cause NASDAQ

H1= BSE granger cause NASDAQ

The P value of BSE is less than 0.05, so it can be said that alternative is accepted and can be said that BSE return Granger cause NASDAQ return.

11)

H0= NIFTY 50 does not granger cause NASDAQ

H1= NIFTY 50 granger cause NASDAQ

The P value of NIFTY 50 is less than 0.05, so it can be said that alternative is accepted and can be said that NIFTY 50 return Granger cause NASDAQ return.

12)

H0= NIKKEI does not granger cause NASDAQ

H1= NIKKEI granger cause NASDAQ

The P value of NIKKEI is less than 0.05, so it can be said that alternative is accepted and can be said that NIKKEI return Granger cause NASDAQ return.

Summary Table of Granger Causality Test

Refer **Table No. 3**

The P value of NIKKEI is less than 0.05, so it can be said that alternative is accepted and can be said that NIKKEI return Granger cause NASDAQ return.

So the analysis concludes that NIKKEI Granger cause to the variables namely BSE and NIFTY 50 but the variables namely BSE and NIFTY 50 does not Granger cause NIKKEI, so uni-directional causality relationship was found. While NIKKEI Granger cause NASDAQ and NASDAQ does not Granger cause NIKKEI, So uni-directional causality was found. BSE and NIFTY 50 Granger cause to the NASDAQ while NASDAQ does not Granger cause BSE and NIFTY 50 so uni-directional causality was found.

GARCH (1, 1) Model

Refer **Table No. 4**

BSE

GARCH= C (3) + C (4)* RESID (-1) ^2 + C (5)* GARCH (-1) + C (6)*LOGNSDQ + C (7)* LOGNIK

Interpretation

The Table No. 4 is an output of a GARCH (1, 1) model, which includes mean equation and variance equation.

The p value of ARCH is 0.00 whereas the p value of GARCH is 0.00 so it can be said that both the term are significant because the p value is less than 0.05. If ARCH is significant at that time it can be said that he previous day BSE return information has impact on the today's BSE return Volatility. While if GARCH is significant than it states that the previous days BSE return volatility has impact on today's BSE volatility return. The coefficient value of ARCH and GARCH is positive which states that it has positive impact on present day return, while the value of NASDAQ and NIKKEI is negative so it can be said that they have negative impact on present day return.

The p value of NASDAQ is 0.00 whereas the p value of NIKKEI is 0.007, so we can say that both are significant because the p value of both are less than 0.05 so it can be said that both has capability to impact on the BSE return. The value of Durbin Watson is 2.40 which is near to 2 so we can say that there is no problem of autocorrelation.

NIFTY 50

Refer **Table No. 5**

GARCH= C (3) + C (4)* RESID (-1) ^2 + C (5)* GARCH (-1) + C (6)*LOGNSDQ + C (7)* LOGNIK

Interpretation

The Table No. 5 is an output of a GARCH (1, 1) model, which includes mean equation and variance equation.

The p value of ARCH is 0.16 whereas the p value of GARCH is 0.00 so it be can said that both ARCH term is not significant because the p value is more than 0.05 and value of GARCH term is significant because p value is less than 0.05. If GARCH is significant than it states that the previous days NIFTY 50 return volatility has impact on today's NIFTY 50 volatility return. The coefficient value of ARCH and GARCH is positive which states that it has positive impact on present day return, while the value of NASDAQ and NIKKEI is negative so it can be said that they have negative impact on present day return. So we can say that past return information does not affect today's volatility but the past volatility in return affects to today volatility.

The p value of NASDAQ is 0.02 whereas the p value of NIKKEI is 0.17, so we can say that NASDAQ is significant because p value is less than 0.05 and NIKKEI is not significant because p value is more than 0.05, so it can be said that NASDAQ has impact on the return of NIFTY 50 whereas NIKKEI does not cause to the NIFTY 50 return. The Durbin Watson value is 2.48 so we can say that there is no problem of autocorrelation.

NASDAQ

Refer **Table No. 6**

GARCH= C(3) + C(4)* RESID(-1)^2 + C(5)* GARCH(-1) + C(6)*LOGNIFTY+ C(7)* LOGBSE

Interpretation

The Table No. 6 is an output of a GARCH (1, 1) model, which includes mean equation and variance equation.

The p value of ARCH is 0.22 whereas the p value of GARCH is 0.00 so it can be said that the ARCH term is not significant because the p value is more than 0.05 while GARCH is significant because the p value is less than 0.05. If GARCH is significant than it states that the previous days BSE return volatility has impact on today's BSE volatility return. The coefficient value of ARCH, GARCH and NIFTY 50 is positive which states that it has positive impact on present day return, while the value of BSE is negative so it can be said that they have negative impact on present day return. So we can say that past return information does not affect today's volatility but the past volatility in return affects to today volatility. So we can say that past return information does not affect today's volatility but the past volatility in return affects to today volatility.

The p value of NIFTY 50 is 0.67 whereas the p value of BSE is 0.57, so we can say that both are not significant because the p value of both are more than 0.05 so it can be said that both does not have capability to impact on the NASDAQ return. The value of Durbin Watson is 1.85 which is near to 2 so we can say that there is no problem of autocorrelation.

NIKKEI

Refer **Table No. 7**

GARCH= C (3) + C (4)* RESID (-1) ^2 + C (5)* GARCH (-1) + C (6)*LOGBSE+ C (7)* LOGNSDQ

Interpretation

The Table No. 5 is an output of a GARCH (1, 1) model, which includes mean equation and variance equation.

The p value of ARCH is 0.00 whereas the p value of GARCH is 0.00 so it can be said that both the term are significant because the p value is less than 0.05. If ARCH is significant at that time it can be said that he previous day NIKKEI return information has impact on the today's NIKKEI return Volatility. While if GARCH is significant than it states that the previous days

NIKKEI return volatility has impact on today's NIKKEI volatility return. The coefficient value of ARCH and GARCH is positive which states that it has positive impact on present day return, while the value of BSE and NIFTY 50 is negative so it can be said that they have negative impact on present day return.

The p value of BSE is 0.02 whereas the p value of NIFTY 50 is 0.00, so we can say that both are significant because the p value of both are less than 0.05 so it can be said that both has capability to impact on the BSE return. The value of Durbin Watson is 1.75 which is near to 2 so we can say that there is no problem of autocorrelation.

Normality Test

BSE
Refer **Graph No.1**
Interpretation:
From Table 8, it can be interpreted that the mean value of residual is -0.009, Median value is -0.022, and maximum value is 3.58 and minimum value is -2.094. The value of standard deviation is 0.79 which states that if any additional variable is entered the mean value will deviate by 0.79 unit. The value of Skewness is 0.78 which state that it is positively skewed. The value of Kurtosis is 7.14, which is not near to 3 so we can say that data is not normal.

The **Jarque-Bera** probability is 0.00

H0= Data of BSE is Normal

H1 = Data of BSE is not normal

From the p value we can say that it is 0.00 which is less than 0.05, so null is rejected and we can say that data is not normal.

NIFTY 50

Refer **Graph No.2**
Interpretation:
From Table 9, it can be interpreted that the mean value of residual is -0.0003, Median value is 0.03, and maximum value is 1.63 and minimum value is -3.66. The value of standard deviation is 0.758 which states that if any additional variable is entered the mean value will deviate by 0.758 unit. The value of Skewness is -1.26 which state that it is negatively skewed. The value of Kurtosis is 7.81, which is not near to 3 so we can say that data is not normal.

The **Jarque-Bera** probability is 0.00

H0= Data of NIFTY 50 is Normal

H1 = Data of NIFTY 50 is not normal

From the p value we can say that it is 0.00 which is less than 0.05, so null is rejected and we can say that data is not normal

NASDAQ

Refer **Graph No.3**
Interpretation:

From Table 10, it can be interpreted that the mean value of residual is -0.034, Median value is 0.117, and maximum value is 1.82 and minimum value is -2.35. The value of standard deviation is 1.00 which states that if any additional variable is entered the mean value will deviate by 1.00 unit. The value of Skewness is -0.30 which state that it is negatively skewed. The value of Kurtosis is 2.20 which is near to 3 so we can say that data is normal.

The **Jarque-Bera** probability is 0.11

H0= Data of NASDAQ is Normal

H1 = Data of NASDAQ is not normal

From the p value we can say that it is 0.11 which is more than 0.05, so null is accepted and alternative is rejected and we can say that data is normal.

NIKKEI
Refer **Graph No.4**
Interpretation:
From Table 11, it can be interpreted that the mean value of residual is 0.03, Median value is 0.137, and maximum value is 2.11 and minimum value is -2.245. The value of standard deviation is 0.85 which states that if any additional variable is entered the mean value will deviate by 0.85 unit. The value of Skewness is -0.28 which state that it is negatively skewed. The value of Kurtosis is 2.85 which is near to 3 so we can say that data is normal.

The **Jarque-Bera** probability is 0.459

H0= Data of NIKKEI is Normal

H1 = Data of NIKKEI is not normal

From the p value we can say that it is 0.459 which is more than 0.05, so null is accepted and alternative is rejected and we can say that data is normal.

Correlogram Q Statistics
Refer **Table No. 8**

Interpretation

The above Table No. 6, which is an output of the Correlogram that states that whether data is having serial correlation or not.

H0= Data is not serially correlated

H1= Data is serially correlated

From the above table, It can be interpreted that the p value of the variables are more than 0.05 till the 3 lags so we can say that till 3rd lag there is no problem of Serial correlation between the variables.

NIFTY 50

Interpretation

H0= Data is not serially correlated

H1= Data is serially correlated

From the above Table No. 6, It can be interpreted that the p value of the variables are more than 0.05 till the 3 lags so we can say that till 3rd lag there is no problem of Serial correlation between the variables.

NASDAQ

Interpretation

H0= Data is not serially correlated

H1= Data is serially correlated

From the above Table No. 6, It can be interpreted that the p value of the variables are more than 0.05 till the all lags so we can say that there is no problem of Serial correlation between the variables.

NIKKEI

Interpretation

H0= Data is not serially correlated

H1= Data is serially correlated

From the above Table No. 6, It can be interpreted that the p value of the variables are more than 0.05 till the all lags so we can say that there is no problem of Serial correlation between the variables.

Hetroskedasticity Test by ARCH

BSE

Refer **Graph No.5**

Interpretation

H0= BSE does not have Hetroskedasticity

H1= BSE have Hetroskedasticity

From the table we can say that the probability value of chi-square is 0.7567 which is more than 0.05, so we can say than null is accepted and alternative is rejected and we can say that BSE does not have problem of Hetroskedasticity.

NIFTY 50

Refer **Graph No.6**

Interpretation

H0= NIFTY 50 does not have Hetroskedasticity

H1= NIFTY 50 have Hetroskedasticity

From the table we can say that the probability value of chi-square is 0.8962 which is more than 0.05, so we can say than null is accepted and alternative is rejected and we can say that NIFTY 50 does not have problem of Hetroskedasticity.

NASDAQ

Refer **Graph No.7**

Interpretation

H0= NASDAQ does not have Hetroskedasticity

H1= NASDAQ have Hetroskedasticity

From the table we can say that the probability value of chi-square is 0.1505 which is more than 0.05, so we can say than null is accepted and alternative is rejected and we can say that NASDAQ does not have problem of Hetroskedasticity.

NIKKEI

Refer **Graph No.8**

Interpretation

H0= NIKKEI does not have Hetroskedasticity

H1= NIKKEI have Hetroskedasticity

From the table we can say that the probability value of chi-square is 0.1422 which is more than 0.05, so we can say than null is accepted and alternative is rejected and we can say that NIKKEI does not have problem of Hetroskedasticity.

Findings

- From Unit root test it was found that data has unit root at the level, so after testing at 1st level difference the data of BSE, NIFTY 50, NASDAQ and NIKKEI become significant and it states that data does not have unit root problem.
- From the analysis of Granger Causality test it was found that NIKKEI Granger cause to the variables namely BSE, NASDAQ and NIFTY 50 but the variables namely BSE, NASDAQ and NIFTY 50 does not Granger cause NIKKEI, so uni-directional causality relationship was found. BSE and NIFTY 50 Granger cause to the NASDAQ while NASDAQ does not Granger cause BSE and NIFTY 50 so uni-directional causality was found.

  From GARCH (1, 1) model it was found that:

- The value of ARCH and GARCH were found to be significant is BSE, so it can be said that there are presences of volatility cluster in variable BSE. The GARCH has major impact as compared to ARCH, while NASDAQ, NIKKEI and NIFTY also has impact on BSE return.
- The value of GARCH is only found significant in NIFTY 50, so only previous day volatility has impact on today's return, while only NASDAQ and BSE cause to the return of the NIFTY 50.
- The value of GARCH is only found significant in NASDAQ, so only previous day volatility has impact on today's return, while none of the variables causes to change the return of NASDAQ.

- The value of ARCH and GARCH were found to be significant for NIKKEI which states that both previous day return information as well as previous day volatility in return affects today return. While the value of BSE, NIFTY 50 and NASDAQ is significant which states that both the variables affects to the NIKKEI return.
- From the analysis of normality test it was found that the data of BSE and NIFTY 50 were not normal while the data of NASDAQ and NIKKEI were found to be normal.
- From analysis of Correlation Q statistics, it was found that data or model does not have problem of autocorrelation. Analysis of Hetroskedasticity it was found that model does not have problem of Hetroskedasticity.

Conclusion

The study on "Analysis of Volatility in Indian stock market and foreign countries using GARCH Model" is conducted from the time period of January 2008 to December 2017. The study includes various indices data such as BSE, NIFTY 50, NASDAQ and NIKKEI. The data were analysed using GARCH (1, 1) Model as a core test of study the other tools for the analysis were Regression analysis, Normality test, Residual test, Unit root test, Ganger test and ARMA test.

From the analysis of Unit root test it was found that the data has problem of unit root at the level while the data becomes stationary when converting it into the 1st differenceFrom the analysis of Ganger test it can be conclude that there is Uni-directional causality amongst the variables.

The best model that explains the variation is GARCH (1, 1) model that can be also stated by ARMA model. The model clearly explains the impact of past information as well as the past volatility in return has impact on today's return. This model also state the impact of the foreign stock on the domestic stock

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Literature Review

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E- Views

http://forums.eviews.com/viewtopic.php?t=6579

YouTube

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Annexure

Table No.1

	Level		1st Difference	
	Constant	Intercept and Trend	Constant	Intercept and Trend
Name of Variables	**ADF Test value**	**ADF Test value**	**ADF Test value**	**ADF Test value**
BSE	0.886**	0.1243**	0.00***	0.00***
NIFTY 50	0.8984**	0.09**	0.00***	0.00***
NASDAQ	0.9826**	0.11**	0.00***	0.00***
NIKKEI	0.904**	0.19**	0.00***	0.00***

Table No.2

Dependent variable DLOGBSE			
Variable	Chi square	DF	Probability
D(Log NIFTY)	2.13	2	0.34
D(Log NIKKEI)	12.97	2	0.00
D(Log NASDAQ)	2.03	2	0.36
Dependent variable DLOGNIFTY			
Variable	Chi square	DF	Probability
D(Log BSE)	0.59	2	0.74
D(Log NIKKEI)	14.9	2	0.00
D(Log NASDAQ)	2.93	2	0.23
Dependent variable DLOGNIK			
Variable	Chi square	DF	Probability
D(Log BSE)	1.22	2	0.54
D(Log NIFTY)	1.46	2	0.48
D(Log NASDAQ)	4.91	2	0.08
Dependent variable DLOGNASDAQ			
Variable	Chi square	DF	Probability
D(Log BSE)	27.16	2	0.00
D(Log NIFTY)	25.99	2	0.00
D(Log NIKKEI)	9.5	2	0.00

Table No.3

Variable	**Coefficient**		**Prob.**
LOGNIFTY	0.976335		0.0000
C	-0.000393		0.7532
VARIANCE EQUATION			
C	4.18E-05		0.0000
RESID(-1)^2	0.136380		0.0013
GARCH(-1)	0.561646		0.0000
LOGNSDQ	-0.000760		0.0000
LOGNIK	-0.000265		0.0075
Durbin-Watson Stat	2.408186	Schwarz Criterion	-6.854919
Akaike Info Criterion	-7.030807	Hannan-Quinn Criterion	-6.959519

Table No.4

Sr.No.	**Particular**	**Outcome**
1	Log NIKKEI → Log BSE	Uni-directional Relationship
2	Log NIKKEI → Log NIFTY	Uni-directional Relationship
3	Log BSE → Log NASDAQ	Uni-directional Relationship
4	Log NIFTY→ Log NASDAQ	Uni-directional Relationship
5	Log NIKKEI → Log NASDAQ	Uni-directional Relationship

Table No.5

Variable	Coefficient		Prob.
C	9.31E-05		0.9368
LOGBSE	1.012985		0.0000
VARIANCE EQUATION			
C	4.28E-05		0.0043
RESID(-1)^2	0.144176		0.1698
GARCH(-1)	0.559428		0.0001
LOGNSDQ	-0.000836		0.0262
LOGNIK	-0.000169		0.1790
Durbin-Watson Stat	2.488171	Schwarz Criterion	-6.861147
Akaike Info Criterion	-7.037035	Hannan-Quinn Criterion	-6.965747

Table No.6

Variable	Coefficient		Prob.
LOGNIK	0.068414		0.3812
C	0.011583		0.0063
VARIANCE EQUATION			
C	0.000239		0.2438
RESID(-1)^2	0.168395		0.2228
GARCH(-1)	0.730656		0.0000
LOGNIFTY 50	0.018912		0.6795
LOGBSE	-0.026475		0.5680
Durbin-Watson Stat	1.852263	Schwarz Criterion	-3.049151
Akaike Info Criterion	-3.225039	Hannan-Quinn Criterion	-3.153751

Table No.7

Variable	**Coefficient**		**Prob.**
C	0.010703		0.0531
LOGBSE	0.406178		0.0000
VARIANCE EQUATION			
C	0.001680		0.0045
RESID(-1)^2	-0.137202		0.0007
GARCH(-1)	0.566619		0.0019
LOGBSE	-0.011365		0.0200
LOGNIFTY 50	-0.008834		0.0004
Durbin-Watson Stat	1.743221	Schwarz Criterion	-2.943954
Akaike Info Criterion	-3.119841	Hannan-Quinn Criterion	-3.048553

Table No.8

Variable Name	**Lags**	**Prob.**
BSE	1	0.438
	2	0.604
	3	0.655
NIFTY50	1	0.246
	2	0.453
	3	0.444
NASDAQ	1	0.603
	2	0.853
	3	0.888
NIKKEI	1	0.915
	2	0.944
	3	0.965

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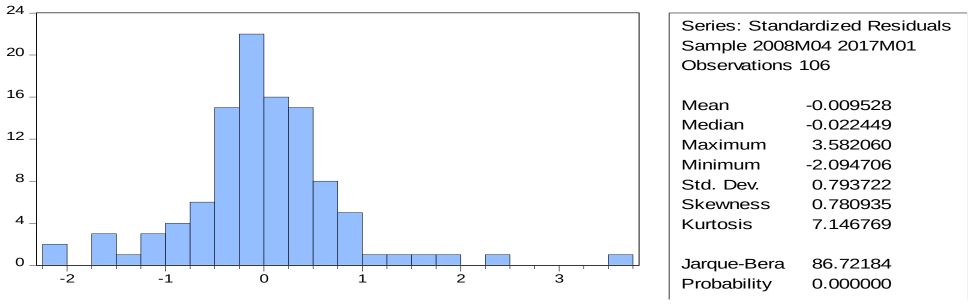
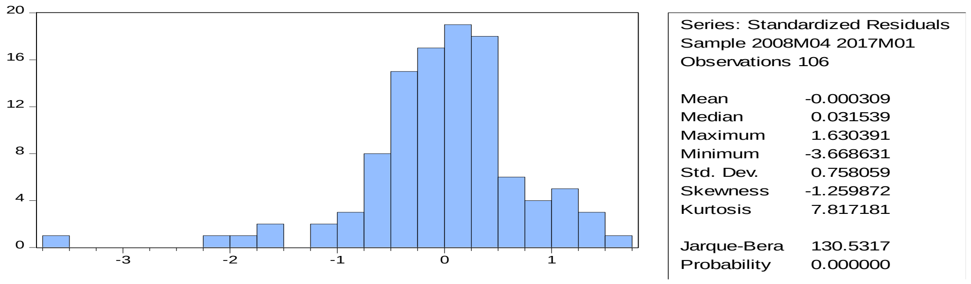
Graph 1



Graph 2



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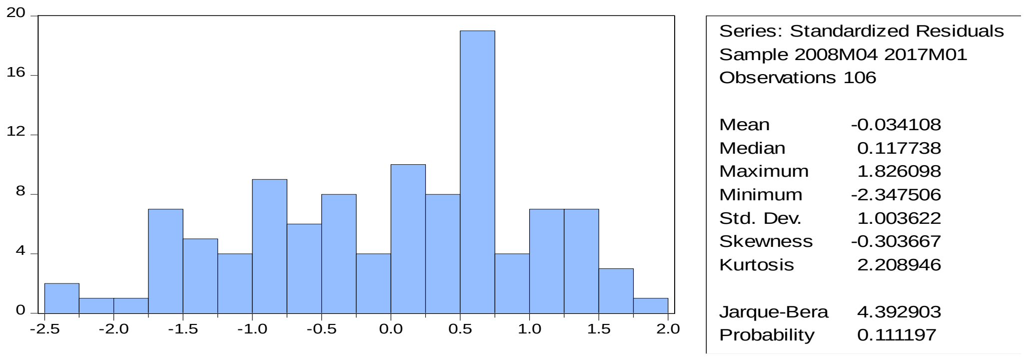
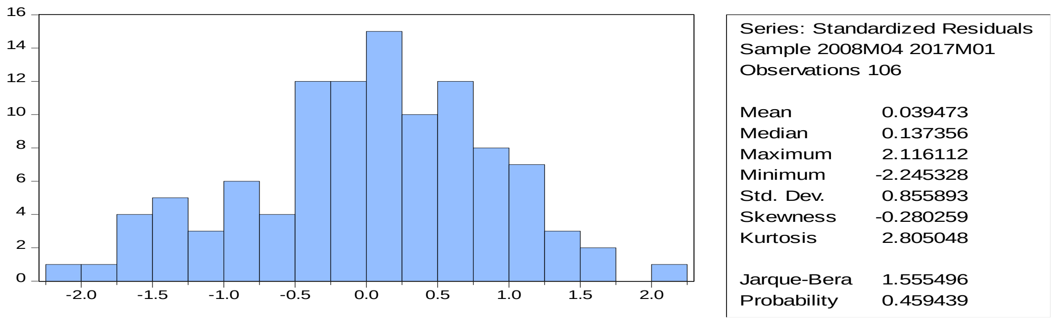


Graph 4



Graph 5

Heteroskedasticity Test: ARCH

F-statistic	0.094228	Prob. F(1,103)	0.7595
Obs*R-squared	0.095970	Prob. Chi-Square(1)	0.7567

Graph 6

Heteroskedasticity Test: ARCH

F-statistic	0.016714	Prob. F(1,103)	0.8974
Obs*R-squared	0.017036	Prob. Chi-Square(1)	0.8962

Graph 7

Heteroskedasticity Test: ARCH

F-statistic	2.068830	Prob. F(1,103)	0.1534
Obs*R-squared	2.067474	Prob. Chi-Square(1)	0.1505

Graph 8

Heteroskedasticity Test: ARCH

F-statistic	2.157273	Prob. F(1,103)	0.1449
Obs*R-squared	2.154047	Prob. Chi-Square(1)	0.1422