

# Effect of Global Economic Crisis on the Price Behavior of Realty Sector Index Stocks of NSE

M.Muthukamu, S.Rajamohan



**Abstract:** *This study has been conducted to understand whether the global economic crisis triggered by sub - prime crisis, which was happened due to burst in asset price of housing sector in United States have made any significant negative impact on the price behavior of the housing sector stocks of Indian equity market ? and if yes, whether this negative impact has brought volatility, more specifically asymmetric volatility (Leverage effect) to the Indian equity market?. In the process finding out the answer to these questions, we have collected data relating to the price behavior of the constituent stocks of Realty sector index of NSE for the period from 9<sup>th</sup> January 2008 to 5<sup>th</sup> November 2010, the period where the Indian equity market index -NIFTY has travelled from its peak 6287 mark to 2573 mark and bounced smartly from this low to again its previous high (around 6300) and the price behavior data were collected from the official web site of NSE. The GARCH family models viz. GARCH (1,1) and EGARCH (1,1) were employed to understand the symmetric and asymmetric volatility and found that realty sector stocks were negatively influenced by the sub-prime crisis and has triggered the volatility of both symmetric and asymmetric volatility.*

**Key words:** *Volatility, Sub- prime crisis, GARCH family models, Leverage effect.*

## I. INTRODUCTION

The global economic crisis was surfaced during the later part of the year 2007 and the origin was from the sub-prime crisis in the United States. The initial effect of this crisis was profound only on the lending institutions of US and to the lesser extent on the European financial institutions and the adverse effect on the emerging economies was less serious. But withdrawal of capital flows by foreign institutional investors to replenish their cash balances brought some severe hiccups in the emerging economies during the early period of 2008. Following the collapse of the US based lending giant Lehman Brothers in the mid of September 2008 has created a panic situation among the investors and

developed a crisis of confidence among them and precipitated the crisis. The spillover effect of collapse in the US money and credit market has significant impact on the performance of the equity market across the world. Money and credit market across the world have been affected significantly due to the dynamic linkages, drying up of liquidity, fallout of repatriation of portfolio investments by the Foreign Institutional Investors. Indian money and credit market too experienced the same. The excessive dependence on the foreign investments and subsequent deleveraging and the risk aversion have affected the Indian economy leading to slowing the growth momentum.

The global market has witnessed DOT COM (.com) bubble burst in the beginning of 1990s and in the process of addressing this crisis countries had been started following the liberal monetary policies. During this period, the US economy has witnessed the growing current account deficit which was addressed by capital flows from the exporting countries. This global imbalance has contributed the low interest phase in the US and which has resulted the real estate assets bubble. The relaxing standard for mortgaged loans and innovative financial products has helped them to mask the risk of their portfolio risks. During the early period of 2000s, the Federal Reserve Bank of United States started tightening the money and credit market activities by raising the interest rates to address the higher inflation phase in their economy. This raising trend in the interest rate has developed the crisis in the sub-prime mortgage market and which led to the free fall in the real estate asset prices. This had result a severe cash crunch in the banking system of United States and this contagion in the banking sector caused hiccups in the US credit markets and the US economy went into a severe recession phase which reflected in the security market of US and quickly spread to all other emerging markets through both real and financial channels. The growth trajectory of India was started during the early periods of 1990s and was in uptrend till 2008. Almost all the sector in India has delivered an exponential growth during this period. But the economic meltdown started in the year 2008, which was originated in United States has negatively influenced the growth story of the nation. More specifically, the real estate sector in India has lost its growth momentum and it was struggling to come up and find growth rate in line with the other sectors of the economy. The performance history of the realty sector index of NSE (Refer Table 1) has confirmed this fact and it has delivered very poor performance since 2008 when compare with the other sector indices of NSE. This scenario has urged us to have insight about the performance rendered by the stocks of the realty sector listed in the Indian equity market in light of its return and the associated volatility.

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## Effect of Global Economic Crisis on the Price Behavior of Realty Sector Index Stocks of NSE

The influence of the global economic crisis on the Indian economy, Indian equity market and the developing countries has been reviewed by many academicians and practitioners in the context of their own. Among those research works, few of them have been highlighted to give some insight about the issues raised and solutions proposed by them. **Sivakumar (2008)** has conducted study to understand the impact of global economic crisis on the exports and imports of India. He found that India's export was started decline after the global economic meltdown. It was continuously on the declining trend and the trend was intact till September 2009. But after September 2009 India has witnessed a turn around and shown a positive growth in exports. The same trend continued in imports of the nation also. There was a negative growth in the imports because of the global economic crisis. But this crisis has affected the India's imports only for a short period of time i.e it lasted for a year. He concluded in his study with the note that India was able to withstand in the global melt down due to its strong domestic demand. A study by **Rajiv and Pankaj (2009)** has revealed the sluggishness in the FDI inflows, external commercial borrowings and remittances combined with massive outflow of FII had resulted significant deterioration of India's capital account in the financial year 2008-09 and the transmission of the global downturn to the Indian economy has resulted the steep decline in demand for India's export in major markets. Moreover the timing of this external shock was unfortunate because the Indian economy was already in the middle of the policy induced slowdown and this crisis have aggravated further. They concluded that the Indian economy continued to face its downtrend further in the first half of financial year 2009-10 and they have estimated based on a model "Leading Economic Indicators" that the economy may likely to recover in the later period of the financial year 2010-11. A study was conducted by **Visvanathan (2010)** with an objective to understand impact of global financial crisis on India and found that India was insulated from the global melt economic down due to its strong domestic consumption. The India domestic sector was large enough to cushion any shocks in the real sector of the economy. He also noted that Indian banking system was well regulated and continuously monitored by RBI with number of tools to control the money supply and to infuse the liquidity as needed. This contradictory move with other emerging market economies, those who have implemented strategies to expand their trade sector at the expenses of the domestic markets, helped India to withstand from this shock. He concluded with the note that Government of India has been expanding investments in social safety nets to soften the impact on the groups most vulnerable to economic shocks and contagion in free market. **Bhatt (2011)** has conducted a study to analyze the linkage between global financial recession and Indian economy and found that the recession has adversely affected the India's exports of software and IT services. The withdrawal by the foreign institutional investors led to a steep depreciation of the rupee and the banking and non banking financial institutions have been suffering the losses. The author concluded that the recession brought the negative impact on the Indian economy. For fighting this crisis, the Indian government should respond through its monetary policy by pumping the liquidity into the system rather than using fiscal policy like increasing public expenditure and investment to address the recession. **Suraj (2012)** has conducted study to know the

impact of global economic crisis on Indian economy and found that the economic crisis has significantly affected the poverty scenario in India. The increased job losses in the manual contract category and the continued lay off in export sector have forced many people in India to live in penury. The researcher concluded his work by adding that India cannot escape from the unscathed current crisis because the Indian economy has become more and more integrated with rest of the world over a period of time. In order to overcome this global economic crisis Indian government should support the industry with more monetary and fiscal stimulus package and more transparency is required in the event of setting repo rate, cash reserve ratio, reverse repo rate, statutory liquidity ratio etc. The Reserve bank of India must bring down the rate further to make the cost of funds cheap and boost the growth momentum. **Kimiko et al (2013)** have conducted study to examine the spillover effect of the global economic crisis on stock markets of developing countries. They found that African markets were severely affected by the spillovers from the global markets and modestly from the commodity and currency markets. Conversely, the regional spillovers within the African countries were smaller than the global ones and are insulated from the global crisis. They also found that the aggregated spillover effects of European countries to the African markets exceeded that of the United States even at the wake of the United States financial crisis. **Ftiti et al (2017)** investigated the impact of sovereign rating announcement on stock market volatility and the spillover effects and the main focus was on the fragile European countries. The author distinguished the study period into two periods: the global crisis period and the pre crisis period. The findings of the study revealed that during the sovereign crisis period an asymmetric reaction of the stock market volatility to the domestic actions in favour of rating downgrades were found and during pre euro crisis period the stock market volatility reacts to both downgrades and upgrades. Furthermore, the result had shown a similarity between the two periods concerning the spillover effect occurring only in the case of foreign downgrades. **Nishi (2019)** conducted study to investigate the impact of global financial crisis on the behavior of stock markets of leading Asian countries including India. The study period has been divided into three sub-periods viz., pre-crisis period, crisis period and post crisis period. It was noted that during the crisis period, every selected stock market experienced massive downfall in returns and the result evidenced significant impact on the volatility of all markets except China.

An international linkage of the financial markets is one among the dominating factor that widens the fluctuation band of the share prices. Now a days the domestic market is not only influenced by the domestic shocks but also gets influenced the external shocks. The down swings of one country may deliver a massive downfall in the other markets too. The financial crisis developed in United States was no more an exception to this situation. India equity market has shown a splendid performance since 2003 and bull trend was intact till 2007. But a sudden external shock (financial crisis originated in United States) in month of January 2008 has arrested this bull trend and triggered the bear phase.

The bench mark of the Indian equity market NIFTY index has travelled from its peak 6287 on 9<sup>th</sup> January 2008 and reached to 2573 on 9<sup>th</sup> March 2009. Due to the economic stimulus and various efforts by the central bank of India and authorities across the global, the recovery was started and the NIFTY has again touched its previous high (6303 mark-closer to its previous high 6287) on 5<sup>th</sup> November 2010. The price behavior of the various sectoral indices of NSE during this period were collected and the performance of these indices were measured and compared with each other and found that Realty index has delivered the worst performance among the selected indices during the selected time period. (Refer Table 1). In addition to this, to check whether the culprit of the global economy meltdown, the sub-prime crisis in United States which has happened due to the burst of the bubble in the asset price of housing sector in United States has influenced the Indian economy too in same way (burst of asset bubble and down fall in the asset prices in India) and which is reflected in the price behavior of the realty segment stocks, we have chosen the Realty index of NSE and the price behavior of the constituent stocks of this index were taken into account for the study. Our study will deal with these following two questions.

1. Whether the global economic crisis triggered by sub - prime crisis which was happened due to the burst in asset price of housing sector in United States have made any significant negative impact on the price behavior of the housing sector stocks of Indian equity market ?

2. If yes, whether this negative impact has brought volatility, more specifically asymmetric volatility (Leverage effect) to the Indian equity market?

As for as the scope of the study is concerned, we have confined our study with this stipulated time period and focuses solely on the price behavior of the constituent stocks of the Realty sector stocks of NSE in the cash segment and did not include the price behavior pattern in the derivative segment of the respective stocks. The constituent stocks of the Realty sector index includes Brigade Enterprises Ltd, DLF Ltd, Godrej Properties Ltd, Prestige Estate Projects Ltd, Sobha Ltd and Sunteck Realty Ltd. India Bulls Real Estate, Oberai Realty, Phoenix Ltd and Mahindra Life Space Developers Ltd and the stocks which are having the track record during the selected time period alone were taken for the analysis to achieve the objectives of the study and this paper has constructed as follows. The second section summarizes the data used for the analysis and the statistical tools applied to analyse the same. The third section deal with the results and discussion of the study. The fourth section deals with summary of findings and the concluding remarks were inked in the last section.

## II. METHODOLOGY PART OF THE STUDY

The primary objective of this study is to find out the returns delivered by the constituents stocks of the Realty index and the volatility pattern of the stocks selected during the study period. We have also devoted our attention to check whether leverage effect exists or not in the price behavior of the stocks selected for the study. In order to achieve this objective, the daily closing prices of the selected stocks were taken into account and this secondary data were collected from the official website of NSE. The data pertaining to the period from 9<sup>th</sup> January 2008 to 5<sup>th</sup>

November 2010 was collected for the analytical purpose. The rationale behind the time period selection is that only during this period the NIFTY index has dived from its peak 6287 mark on 9<sup>th</sup> January 2008 to 2573 mark on 9<sup>th</sup> March 2009 and bounced smartly from this low to reach the previous high on (6303 mark- closer to its previous high 6287) 5<sup>th</sup> November 2010. Hence, we felt that selection this time period would be an ideal to give a good amount of clarity in the volatility pattern (both symmetric and asymmetric) of the stocks selected for the study. The data collected were analyzed by using the statistical tools like Descriptive Statistics, Jarque Bera Test, Ljung Box Test, Augumented Dickey Fuller Test, Unit Root Test, ARCH – LM Test, and GARCH family models like GARCH (1,1), EGARCH (1,1) Test. The returns of the selected series were found by using the  $R_t = (\log P_t - \log P_{t-1}) \times 100$  formula, where  $R_t$  is the return of the selected series for time t.  $P_t$  is the closing value of the selected series at time t and  $P_{t-1}$  is the closing price of the corresponding series on t-1 day. To understand the distributional properties of the selected series, the descriptive statistics like Average, Standard deviation, Skewness and Kurtosis were used. To test the normality of the series selected for the study Jarque Bera Test, Ljung Box Test were applied. It is important that the financial time series should be always stationary in nature. If it found non stationary, it has to be converted into stationary by finding the first order or second order of the series. In order to verify the stationary status of the series the Augmented Dickey Fuller Test was employed. Before applying the GARCH family models to check the presence of volatility, it is important to check presence of ARCH effect in the series selected for the study. In the process of checking the same ARCH – LM test was applied and found the presence of ARCH effect in the series selected for the study. As it was founded in earlier studies by Banumathy and Ramachandran (2015), Liu C (2016), Amudha and Muthukamu (2018) Anwar et al., (2019), Jincy k John and Amudha (2019) and Jincy et al., (2019) the best fit model GARCH (1,1) was applied to check the presence of symmetric volatility. In order to understand the asymmetric volatility, termed as 'Leverage Effect' in the financial literature EGARCH (1,1) model was applied. In order to check whether the applied models – GARCH (1,1) and EGARCH (1,1) have well specified the volatility, Lag Range Multiplier Test and the Serial Correlation Test were applied.

## III. RESULTS AND DISCUSSION

We have applied the descriptive statistical tool to know the distributional properties of the stocks selected for the study and the results obtained have been shown in Table 2. The average daily return of the stocks selected for the study was negative during the study period. All the selected stocks have delivered negative return and among these six stocks, India Bull Real Estates (IB Real) has delivered worst performance (- 0.197776) followed by DLF (-0.170661). The standard deviation values of the stocks revealed that the returns of the stocks were volatile and deviated more from the measure of central tendency.

The standard deviation value was high in the case of India Bull Real Estates (**5.189890**) followed by DLF (**4.457976**) and Brigade (**4.372487**) indicated that the returns of these three stocks were possessing greater variability. The skewness values of the stocks selected for the study shown that three of them were positively skewed indicating that the share prices of these stocks were increasing frequently during the study period and as opposed to this situation, the remaining three were negatively skewed, their prices were mostly in the decreasing trend during the study period. The kurtosis values for all the selected stocks were higher than 3 which indicated that they were leptokurtic in nature and implies that the return series were fat tailed and did not follow the normal distribution. In order to confirm this, Ljung Box test was conducted and the results were depicted in Table 3 along with the calculated Jarque Bera values. The Jarque Bera values of the selected stocks with the corresponding probability values confirm that the return distributions were not normally distributed. For the further confirmation, the outcomes of the Ljung Box test were used. The lag selection was done meticulously and the Q statistics values of lag10, lag20 and lag 30 with its corresponding probability values were calculated, scrutinized and found that the selected return series were not distributed. This conformation has urged us to proceed for further. It is important that the selected financial time series should be stationary in nature for the further applications of the statistical tools in the process of finding its associated volatility. Hence, we have applied the Augmented Dickey Fuller Test (ADF Test) to check the unit root problem of the series selected for the study and the results obtained were shown in Table 4. The calculated values (At Level) for all the three methods viz. Intercept, Trend and Intercept and None with its probability values have confirmed that the selected series were stationary in nature. The calculated values were compared with the Test critical values (McKinnon critical values) and found that the calculated values (ignoring sign) were higher than the corresponding Test Critical values (ignoring signs) and the probability values were less than 0.05. This has confirmed that the selected return series were stationary in nature as it was required.

In the process of finding the symmetric and asymmetric volatility of the selected series, we have verified whether the selected series were possessing the heteroskedasticity effect or not. It is necessary that the series used to find the level of volatility should have an inheriting ARCH effect. To confirm this effect, we have applied ARCH LM test and the results found were depicted in Table 5. In order to confirm that the series are having ARCH effect, the calculated *F-statistic* Values should be higher than its corresponding *Observed R Squared values* and the corresponding probability values should be less than 0.05. The calculated values for all the selected series have fulfilled these conditions and found that ARCH effect exists in these selected series. Hence, as proved earlier by many researchers, the most suited GARCH family model tool, GARCH (1,1) was applied to find out the symmetric volatility of the selected series and the results obtained were exposed in the Table 6. The necessary parameters to confirm that the selected GARCH (1,1) model was the best fit model to specify the symmetric volatility of these selected financial time series, the calculated values of ARCH coefficient, GARCH coefficient and the Constant

values must be positive and found that the calculated values of these selected stocks have fulfilled this necessary condition. The sum of ARCH co-efficient and GARCH co-efficient, used as measure of persistence of variance to specify the level volatility, were closer to unity (1) except SOBHA Developers (**0.937280**) indicated that the selected series were more volatile during the study period. Among the selected stocks, the return series of the DLF (**0.998546**) was more volatile followed by India Bulls real estates (**0.996837**) and Pheonix Mills (**0.996613**) revealed that they have experienced high level of volatility lasting for many days during the post global economic crisis (sub - prime crisis) period. In order to check the adequacy of the GARCH (1,1) model, we have applied the Lag Range Multiplier Test - ARCH - LM and Serial Correlation Test by using the residuals estimated from the GARCH (1,1) model. The results arrived from ARCH -LM test was mentioned in Table 7. The decision rule to accept that the residuals are free from ARCH effect, the calculated *F statistics* values must be less than the *Observed R Squared values* and the corresponding Probability values must be greater than 0.05. It was found that the calculated *F statistics values* of all the selected return series were lesser than the *Observed R Squared values* and the corresponding probability values were greater than 0.05. Hence, it was confirmed that the GARCH (1,1) model has well addressed the symmetric volatility of the selected series and same has been further confirmed by the outcome of Serial correlation test conducted by using the residuals estimated from the GARCH (1,1) model. The outcome of the Serial correlation was shown in the Table 8. The Q statistics values for the lag 10, lag 20, Lag 30 and lag 36 with corresponding Probability values were found perfect to confirm that the GARCH (1,1) model has well specified the volatility of the selected series. The probability values were greater than 0.05 as it was required.

Leverage effect is the tendency for volatility to rise more following a large price fall than following a price rise of the same magnitude. The presence this asymmetric volatility, termed as Leverage effect, in the Indian equity market was checked by using EGARCH (1,1) model on the return series of the stocks selected for the study. The results obtained from the EGARCH (1,1) model was exhibited in Table 9. The calculated values of ' $\gamma$ '- which is used to notify the leverage effect, must be negative in value and the corresponding Probability values should be less than 0.05. The calculated ' $\gamma$ ' values and the corresponding probability values were found in line with the requirements. All the calculated ' $\gamma$ ' values of selected return series were negative (less than Zero) and they were significant at 5 percent level. The corresponding probability values were less than 0.05 and this confirmed that the selected series were prone to the leverage effect. Any negative shocks deliver more volatility than the same magnitude of the positive shocks. The selected realty sector stocks were more volatile during the study period - the period where global negative shock, sub - prime crisis has rattled the Indian equity market. In the process of checking the adequacy of EGARCH (1,1) model used to specify the asymmetric volatility, Lag Range Multiplier Test and Serial Correlation Test were engaged by using the residuals obtained after applying the EGARCH (1,1) model. The results obtained from ARCH LM test was shown in Table 10.

The calculated values of F statistics values and observed R square values were in line with requirements and the corresponding probability values were greater than 0.05 which confirmed that the EGARCH(1,1) model has well specified the asymmetric volatility of the selected financial time series. To have a further confirmation, we have applied the Serial correlation test and the outcomes were displayed in Table 11. The Q statistic values of Lag 10, Lag 20, Lag 30 and Lag 36 with its corresponding Probability values were calculated and found that they were in accordance with the requirements to confirm that the EGARCH (1,1) has well addressed the asymmetric volatility. The calculated probability values were greater than 0.05, which is mandatory to explain that the EGARCH (1,1) model has addressed the Leverage effect of the realty sector stocks of NSE.

#### IV. SUMMARY OF FINDINGS

The average daily return of the stocks selected for the study was negative during the study period. Among the stocks selected, the India Bulls Real Estates has delivered poor performance followed by DLF. The standard deviation values of all the stocks have revealed the greater variability in their price behavior post global economic crisis period. The skewness values of the constituent stocks of the realty index of NSE have shown that three of them were positively skewed and the remaining stocks were negatively skewed. The kurtosis values for all the stocks were greater than 3 indicated that they were leptokurtic in nature. The calculated Jargue Bera values with its corresponding probability values and the Ljung Box Q statistics values of Lag 10Lag 20 and Lag 30 with its probability values have confirmed that the selected financial time series were not normally distributed. The application of Augmented Dickey Fuller Test has revealed that the selected return series of the stocks of realty sector index of NSE were stationary in nature (At Level). The employed hetoskedasticity test on the return series of the selected stocks have found the existence of ARCH effect in the price behaviour of the realty index stocks and as it was demanded, the GARCH (1,1) test has revealed that the selected return series were volatile during the study period. Among the selected stocks, it was found that the DLF was more volatile followed by India Bulls Real Estates and Phenix Mills. The application of econometric tools viz. ARCH –LM Test and Serial Correlation Test to check the adequacy of the tool applied to specify the symmetric volatility (GARCH (1,1) model) revealed that the selected model – GARCH (1,1) has well specified the symmetric volatility of the selected constituent stocks of realty sector index stocks of NSE. In the way to find out the answer to the question whether the negative impact by the global economic crisis due to the burst of housing sector asset price bubble has brought the leverage effect in the Indian equity market, EGARCH (1,1) was employed and found that the Indian equity market was vulnerable to the leverage effect. The applied adequacy checking models like ARCH –LM and Serial correlation Test were confirmed that the applied EGARCH (1,1) has well addressed the Leverage effect of the Indian equity market.

#### V. CONCLUSION

From the findings of our study we have concluded that the burst of housing asset price bubble in the United States have

made a significant negative impact on the Realty sector stocks of NSE as it was happened in the United States and Global equity market. We also conclude that this negative shock has delivered more volatility on the price behavior of the selected realty sector stocks and these stocks were also shown the asymmetric volatility during the study period i.e they were shown the tendency for volatility to rise more following a large price fall than following a price rise of the same magnitude. The outcomes of the study of this kind would help the researcher and the practitioners to have deep insight about issues raised and may be useful to them to find the solutions for the problems of their choice. A similar research of this kind with the selection of stocks from other sectors will pave the way to understand the specific issues related to the selected sectors. As for as the other side of this study is concerned, we have taken only a few stocks i.e the constituent stocks of the selected index for our study and did not cover the all stocks pertaining to this sector listed in Indian equity market. If chosen, the findings might have given some more clarity in this respect.

#### CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this research work.

#### ETHICAL APPROVAL

This paper does not contain any studies with human participants or animals performed by any of the authors in anywhere in the universe.

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**Appendix  
Table 1**

**Average Returns of the Selected Sector**

S.No	Name of the Sector	Bear Trend - (09/01/2008 to 09/03/2009)	Bull Trend - (10/03/2009 to 05/11/2010)	Total Sample Period (09/01/2008 to 05/11/2010)
1	Auto	(-) 0.248704	0.318123	0.0868832
2	Banking Sector	(-) 0.396792	0.334837	0.0362990
3	Financial Service	(-) 0.417434	0.324961	0.0220300
4	FMGC	(-) 0.136370	0.179449	0.0505800
5	IT	(-) 0.283817	0.295746	0.0592580
6	Media	(-) 0.528580	0.277703	<b>(-) 0.0512980</b>
7	Pharma	(-) 0.156359	0.227867	0.0710850
8	Pvt. Bank	(-) 0.466464	0.372481	0.0301530
9	PSU Bank	(-) 0.338604	0.345353	0.0662670
10	Realty	<b>(-) 0.861351</b>	<b>0.171682</b>	<b>(-) 0.1906470</b>
11	Nifty Index	(-) 0.313720	0.217814	0.0009240

\*Data was not available for Metal sector index during the study period. \* Source: nseindia.com

**Table 2**

**Descriptive Statistics for the Selected Stocks**

S NO	Name of the Stock	Average	Standard Deviation	Skewness	Kurtosis
1	<b>BRIGADE</b>	-0.136225	4.372487	0.717027	9.538820
2	<b>DLF</b>	-0.170661	4.457976	-0.019644	6.926538
3	<b>SOBHA</b>	-0.134836	3.683004	-0.099230	6.726016
4	<b>IB REAL</b>	-0.197776	5.189809	0.182738	6.172540
5	<b>PHEONIX</b>	-0.089019	3.858827	-0.240582	6.308962
6	<b>MAHLIFE</b>	-0.082264	4.033468	0.183511	8.125099

**Table 3**

**Test for Normality in the Return Series of the Selected Stocks**

Name of the Stocks	Jarque Bera		Ljung Box lag10		Ljung Box lag 20		Ljung Box lag 30	
	JB value	Prob	Q Stat	Prob	Q Stat	Prob	Q Stat	Prob
<b>BRIGADE</b>	1299.587	0.00000	30.899	0.001	42.984	0.002	50.460	0.011
<b>DLF</b>	447.1581	0.00000	10.398	0.004	30.108	0.006	42.814	0.007
<b>SOBHA</b>	403.7549	0.00000	38.311	0.000	46.193	0.001	54.792	0.004
<b>IB REAL</b>	295.758	0.00000	17.080	0.007	28.651	0.016	37.997	0.019
<b>PHEONIX</b>	324.2418	0.00000	66.243	0.000	75.776	0.000	84.576	0.000
<b>MAHLIFE</b>	765.6390	0.00000	10.753	0.001	29.507	0.063	31.382	0.084

**Table 4**  
**Tests for Unit Root Problem using Augmented Dickey Fuller Test**

Name of the Stock	Intercept	P value	Trend and Intercept	P value	None	P value
BRIGADE	-23.23484	0.00000	-23.36397	0.00000	-23.23177	0.00000
DLF	-24.81746	0.00000	-24.89844	0.00000	-24.80245	0.00000
SOBHA	-22.58899	0.00000	-22.85191	0.00000	-22.57800	0.00000
IB REAL	-25.75655	0.00000	-25.81721	0.00000	-25.74221	0.00000
PHEONIX	-14.48163	0.00000	-14.61474	0.00000	-14.48178	0.00000
MAHLIFE	-25.27760	0.00000	-25.39064	0.00000	-25.28600	0.00000

**Table 5**  
**Testing of the Heteroskedasticity Effect**

S.NO	Name of Stocks	F-statistic	Prob - F	Observed R-squared	Prob.Chi-Square
1	BRIGADE	24.47789	0.0000	23.71102	0.0000
2	DLF	34.60399	0.0000	33.05338	0.0000
3	SOBHA	27.04445	0.0000	26.10380	0.0000
4	IB REAL	40.288867	0.0000	38.18500	0.0000
5	PHEONIX	56.11003	0.0000	52.05707	0.0000
6	MAHLIFE	117.1724	0.0000	100.5154	0.0000

**Table 6**  
**Symmetric Volatility Estimation by Using GARCH (1,1) Model**

S.No	Name of the Stocks	C Value	ARCH Value ( $\alpha$ )	GARCH Value ( $\beta$ )	$\alpha + \beta$
1	BRIGADE	0.241124	0.132215	0.861425	0.993640
2	DLF	0.119681	0.100182	0.898364	0.998546
3	SOBHA	0.852598	0.105444	0.831836	0.937280
4	IB REAL	0.238219	0.112075	0.884762	0.996837
5	PHEONIX	0.045467	0.051294	0.945319	0.996613
6	MAHLIFE	0.187523	0.102848	0.889239	0.992087

**Table 7**  
**Checking Adequacy of GARCH (1,1) Model Using ARCH – LM Test for**

S.NO	Name of Stocks	F-statistic	Probability F	Observed R-squared	Probability.chi-square
1	BRIGADE	1.099149	0.2948	1.100576	0.2941
2	DLF	0.721978	0.3958	0.723308	0.3951
3	SOBHA	0.439053	0.5078	0.440041	0.5071
4	IB REAL	0.605029	0.4368	0.606507	0.4361
5	PHEONIX	9.979902	0.1700	9.9866615	0.1691
6	MAHLIFE	2.944647	0.0866	2.946650	0.0864

**Table 8**  
**Checking Adequacy of GARCH (1,1) Model using Serial Correlation Test**

Name of the Stocks	Lag 10		Lag 20		Lag 30		Lag 36	
	Q Stat	Prob						
BRIGADE	17.771	0.059	29.026	0.087	34.890	0.247	43.805	0.174
DLF	8.7895	0.552	25.600	0.179	35.690	0.218	47.353	0.098
SOBHA	32.901	0.051	41.471	0.053	49.541	0.051	55.461	0.058
IB REAL	11.261	0.338	21.693	0.357	29.848	0.473	31.912	0.663
PHEONIX	33.191	0.059	47.257	0.079	52.803	0.094	66.934	0.164
MAHLIFE	15.437	0.117	28.665	0.095	32.570	0.342	35.238	0.505

**Table 9**  
Asymmetric Volatility Estimation by Using EGARCH (1,1) Model

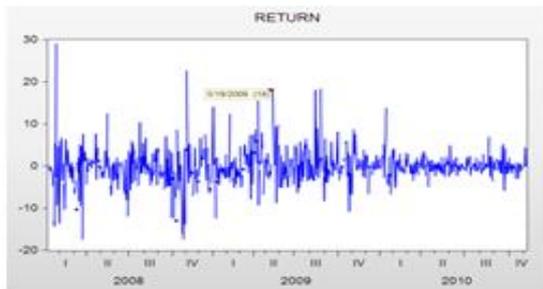
Name of the Stocks	$\alpha$	$\beta$	$\alpha + \beta$	$\gamma$	P value
BRIGADE	0.110440	0.842093	0.952533	-0.050760	0.0078
DLF	0.115049	0.874970	0.990019	-0.051613	0.0002
SOBHA	0.020755	0.962973	0.983728	-0.048943	0.0011
IB REAL	0.107589	0.884492	0.992081	-0.047499	0.0081
PHEONIX	0.061690	0.910416	0.972106	-0.031969	0.0002
MAHLIFE	0.088482	0.904302	0.992784	-0.016976	0.0016

**Table 10**  
Checking Adequacy of EGARCH (1,1) Model Using ARCH – LM Test

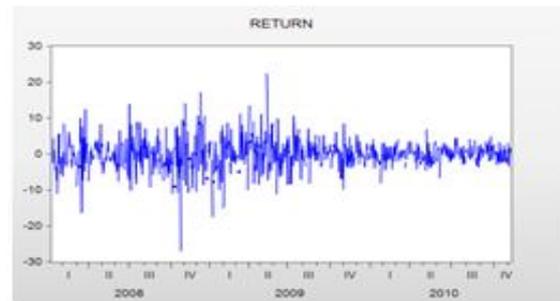
Name of Stocks	F-statistic	Probability F	Observed R-squared	Probability.chi-square
BRIGADE	1.455152	0.228	1.456294	0.227
DLF	3.697470	0.054	3.688461	0.054
SOBHA	1.678026	0.195	1.678803	0.195
IB REAL	0.948518	0.330	0.949955	0.329
PHEONIX	9.937567	0.773	9.825352	0.774
MAHLIFE	5.411682	0.200	5.385247	0.203

**Table 11**  
Checking Adequacy of EGARCH (1,1) Model using Serial Correlation Test

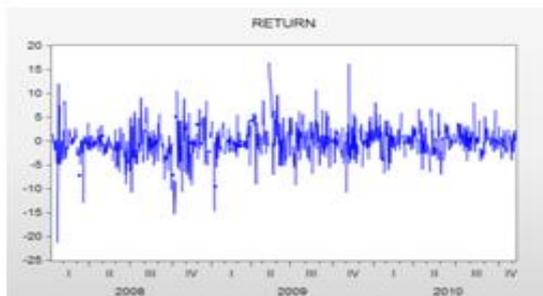
Name of the Stocks	Lag 10		Lag 20		Lag 30		Lag 36	
	Q Stat	Prob						
BRIGADE	19.418	0.053	30.516	0.062	37.396	0.166	46.468	0.114
DLF	8.9449	0.537	24.353	0.227	33.834	0.287	43.84	0.172
SOBHA	33.813	0.293	37.805	0.325	47.035	0.339	52.810	0.533
IB REAL	12.742	0.238	24.080	0.239	33.213	0.313	35.303	0.502
PHEONIX	28.646	0.109	42.497	0.209	47.832	0.498	59.982	0.539
MAHLIFE	15.706	0.108	28.527	0.097	31.801	0.379	34.677	0.531



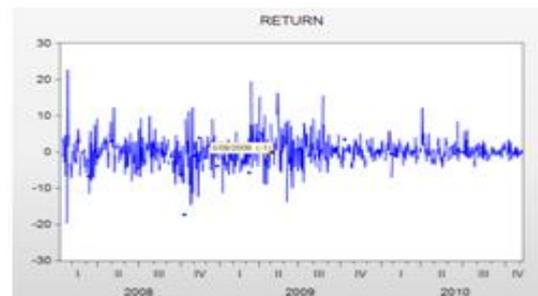
Return series - Brigade



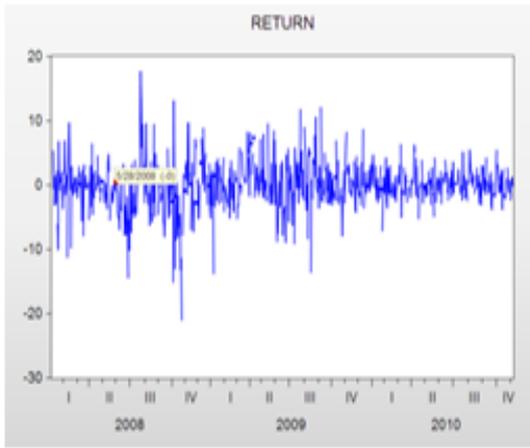
Return Series - DLF



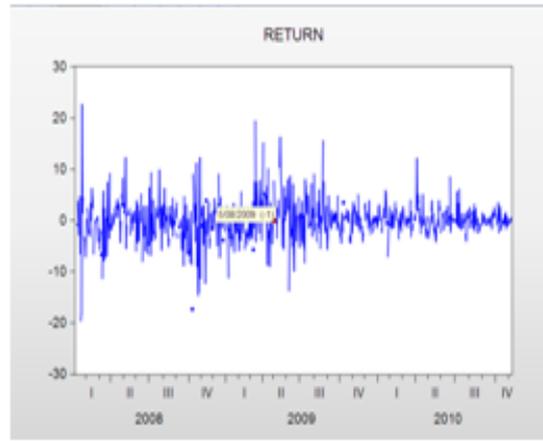
Return series - SOBHA



Return series – IB real



Return series - Pheonix



Return series – Mahindra life