VOLATILITY IN INDIAN STOCK MARKET : A STUDY WITH REFERENCE TO SELECTED NIFTY COMPANIES

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Abstract :

Volatility has been one of the most active and successful areas of research in time series econometrics and economic forecasting in recent decades. Volatility is a statistical measure of the dispersion of returns for a given security or market index. The aim of this paper is to estimate conditional volatility models in an effort to capture the salient features of stock market volatility in India and evaluate the models in terms of out-of sample forecast accuracy. The sample of this study is five companies taken from Nifty companies. The sample companies are Reliance Industries, State Bank of India, Jindal Steel, BHEL and Asian Paints. The study period has taken from January 2007 to December 2012. Tools used for the study is descriptive model, unit root test and GARCH model (1,1). This finding has implications for more volatile during the study period for all sample companies.

Keywords: *Stock market, Volatility, GARCH model, Unit root test.*

1. Introduction

Volatility is a statistical measure of the dispersion of returns for a given security or market index. Volatility is generally measured either by using the standard deviation or variance between returns from that same security or market index. Commonly, the higher the volatility, the riskier is the security. In terms of options pricing, volatility is a variable in option-pricing formula showing the extent to which the return of the underlying asset will fluctuate between now and the options expiration. Volatility, expressed as a percentage coefficient within option-pricing formula, arises from daily trading activities. How volatility is measured will affect the value of the coefficient used.

Volatility is the variability of the asset price changes over a particular period of time and it is very hard to predict it correctly and consistently. In financial markets volatility presents a strange paradox to the market participants, academicians and policy makers – without volatility superior returns cannot be earned, since a risk free security offers meager returns, on the other hand if it is 'high' it will lead to losses for the market participants and represent costs to the overall economy. Therefore there is no gainsaying with the statement that volatility estimation is an essential part in most finance decisions be it asset allocation, derivative pricing or risk management.

Volatility is an important phenomenon in markets in general and security markets in particular. Modeling stock market volatility has been the subject of empirical and theoretical investigation by both academicians and practitioners. As a concept, volatility is simple and intuitive. It measures the variability or dispersion about a central tendency. In other words, it measures the current price of an asset deviates from its average past values. The study of volatility becomes more important due to the growing linkages of national market in currency; commodity and stock with rest of the world markets and existence of common players have given volatility a new property – that of its speedy transmissibility across markets. To many among the general public, the term volatility is simply synonymous with

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risk: in their view high volatility is to be deplored, because it means that security values are not dependable and the capital markets are not functioning as well as they should.

2. Review of Literature

There are few studies which examined emerging equity market volatility. Bekaert and Harvey (1995) examined the emerging equity market characteristics in relation to developed markets. Emerging markets found to have four distinguishing features: average returns were higher, correlations with developed markets returns were low, returns were more predictable and volatility is higher. They argued that modeling volatility is difficult in emerging markets, especially in segmented markets. In fully integrated markets volatility is strongly influenced by world factors whereas in segmented markets it is strongly influenced by local factors. More open economies had lower volatility and political risk to a large extent explained the cross sectional in volatility. Finally, they found significant decline in volatility in emerging markets following capital market liberalization. Bekaert et al. (1998) argued that emerging markets returns are highly non-normally distributed and exhibit positive skewness in it.

Poshakwale Sunil (2002) examined the random walk hypothesis in the emerging Indian stock market by testing for the nonlinear dependence using a large disaggregated daily data from the Indian stock market. The sample used was 38 actively traded stocks in the BSE National index. He found that the daily returns from the Indian stock market do not conform to a random walk. Daily returns from most individual stocks and the equally weighted portfolio exhibit significant non-linear dependence. This is largely consistent with previous research that has shown evidence of non-linear dependence in returns from the stock market indices and individual stocks in the US and UK.

Yakob, Beal and Delpachitra (2005) examined seasonal effects of ten Asian Pacific stock markets, including the Indian stock market, for the period January 2000 to March 2005. They stated that this is a period of stability and therefore ideal for examining seasonality as it was not influenced by the Asian financial crisis of the late nineties. Yakob, et al., concluded that the Indian stock market exhibited a month-of-the-year effect in that statistically significant negative returns were found in March and April whereas statistically significant positive returns were found in May, November and December. Of these five statistically significant monthly returns, November generated the highest positive returns whereas April generated the lowest negative returns. In a similar study by Bodla and Jindal (2006) several seasonal anomalies in the Indian stock market utilizing the S&P CNX Nifty index for the period January 1998 to August 2005. For the monthly effect, they did find some significant differences utilizing ANOVA for their sub-period, January 2002 to August 2005. However, they were unable to find any significant differences among individual months.

Rakesh Kumar and Raj S Dhankar (2011) in their article titled, "Distribution of Risk and Return: A test of normality in Indian stock market", examined the normality of return and risk of daily, weekly, monthly and annual returns in Indian stock market. They used parametric and non-parametric test to prove these objectives. They have selected Sensex, BSE 100 and BSE 500 indices from Bombay Stock Exchange (BSE) for the period 1996 to 2006. The results show that, the returns are negatively skewed for all the indices over the period. Asymmetry is found in risk and return in case of daily and weekly returns i.e., risk and return relationship seems inconsistent in case of daily and weekly returns. Monthly and annual return, however are found normally distributed for all three indices over the period of time. The study shows the importance of time horizon in investment strategy for the Indian stock market.

Raja sethu Durai and Saumitra N Bhaduri (2011) in their article titled, "Correlation dynamics in Equity markets", aimed to analyze the correlation structure of the Indian equity markets with that of world markets. The indices considered for the study are NASDAQ composite (USA), S & P 500 (USA), FTSE 100 (UK) and DAX 30 (Germany) classified as developed markets. KLSE composite (Malaysia), Jakarta composite (Indonesia), Straits times (Singapore), Seoul composite (South Korea), Nikkei (Japan), Taiwan weighted index (Taiwan) and the S & P CNX Nifty (India) are classified as Asian market, for the period 1997 to 2006. The logistic smooth transition regression (LSTR) model results for the conditional time varying correlation of S & P CNX Nifty with six Asian market and S & P CNX Nifty with four developed markets show that there is a significant regime shift in the year 2000 and there is a considerable increase in integration in the second regime. This indicates that the S & P CNX Nifty index is moving towards a better integration with other world markets but not at a very noteworthy phase.

3. Statement of the Problem

Most of the stock market investors are not able to pick rights stocks at right time and they met with loss. This paper provides guidance to the investors on how to invest in stocks at right time.

3.1. Objectives of the Study

- To study the volatility behavior of selected companies listed in NSE.
- To analyse the volatility using GARCH model.

3.2. Sample Design and Tools used for Analysis

Sample Area: Indian Stock Market

Population: Nifty

Sample: The sample of this study is 5 companies taken from Nifty

Study Period: January 2007 to December 2012

Sampling Techniques: The research has adopted non-probability convenience sampling

Sources of Data: Secondary data was collected from NSE website. The other required data were collected from various books, journals and magazines.

Sample companies for the study: Reliance Industries, State Bank of India, Jindal Steel, BHEL, Asian Paints.

Tools used for the study: Descriptive model, Unit Root Test and GARCH (1,1) Model.

4. Methodology

4.1 Descriptive Model

Descriptive statistics are typically distinguished from inferential statistics. In the business world, descriptive statistics provide a useful summary of security returns when researchers perform empirical and analytical analysis, as they give a historical account of return behavior.

4.2 Unit Root Test

A unit root test is a statistical test for the proposition that in an autoregressive statistical model of a time series, the autoregressive parameter is one. It is a test for detecting the presence of stationarity in the series. For randomness purpose, there are two unit root tests. One is Augmented Dickey Fuller (ADF) which is parametric test another most powerful test to check the randomness is the Phillips Perron (PP) unit root test which is non-parametric test. If the test statistic value is greater than critical value at 1% or probability value is less than the value then we reject our null hypotheses.

4.3 GARCH Model

In this model, the conditional variance is represented as a linear function of its own lags.

The simplest model specification is the GARCH (1,1) model

The general specification of GARCH is, GARCH (p, q) is as

$$\sigma_t^2 = \omega + \sum_{j=1}^{q} \alpha_j \varepsilon_{t-1}^2 + \sum_{i=1}^{p} \beta_i \sigma_{t-1}^2$$

where, p is the number of lagged σ^2 terms and q is the number of lagged ε^2 terms.

5. Results and Analysis

5.1 Descriptive Statistics

Table 1: Descriptive Statistics of Sample Companies from 2007 to 2012

Company Name	Mean	S.D	Skewness	Kurtosis
Reliance	0.0040	0.2009	0.8743	15.7882
SBIN	0.0147	0.1808	-2.5049	16.1630
Jindal Steel	1.0947	5.2686	3.9668	25.8009
BHEL	0.0726	2.9698	-0.2144	4.8774
Asian Paints	1.3257	1.6573	-0.321	2.5642

Table 1 reports the results of negative values for the skewness indicate data that are skewed left and positive values for the skewness indicate data that are skewed right. By skewed left, we mean that the left tail is long relative to the right tail. Similarly, skewed right indicates that the right tail is long relative to the left tail. Some measurements have a lower bound and are skewed right. A kurtosis value near zero indicates a shape close to normal. A negative value indicates a distribution which is more peaked than normal. A negative value indicates a distribution which is more peaked than normal, and a positive kurtosis indicates a shape flatter than normal. An extreme positive kurtosis indicates a distribution where more of the values are located in the tails of the distribution rather than around the mean.

5.2 Augmented Dickey Fuller Test (ADF)

Table 2: ADF Test of Reliance Industries

		t-Statistic	Prob
Augmented Dickey-Fuller test statistic		-6.6194	0.0000
Test Critical values	1% level	-3.5461	
	5% level	-2.9117	
	10% level	-2.5936	

Table 2 reports the results of Augmented Dickey Fuller Test of Stationarity of Reliance Industries returns for the study period. It is to be noted that the Reliance Industries are stationarity in the level difference itself with the value of -6.6194 and with the probability value of 0.0000. The test statistic value was smaller than the Test Critical values were -3.5461, -2.9117 and -2.5936 at 1% level, 5% level and 10% level respectively. It is concluded that during the study period, the returns of Reliance Industries were stationarity in the level difference itself. Hence, the return values were considered to be stationary.

Table 3: ADF Test of State Bank of India

		t-Statistic	Prob
Augmented Dickey-Fuller test statistic		-10.9609	0.0000
Test Critical values	1% level	-3.5461	
	5% level	-2.9117	
	10% level	-2.5936	

Table 3 reports the results of Augmented Dickey Fuller Test of Stationarity of State Bank of India returns for the study period. It is to be noted that the State Bank of India are stationarity in the level difference itself with the value of -10.9609 and with the probability value of 0.0000. The test statistic value was smaller than the Test Critical values were -3.5461, -2.9117 and -2.5936 at 1% level, 5% level and 10% level respectively. It is concluded that during the study period, the returns of State Bank of India were stationarity in the level difference itself. Hence, the return values were considered to be stationary.

Table 4: ADF Test of Jindal Steel

		t-Statistic	Prob
Augmented Dickey-Fuller test statistic		0.4561	0.0000
Test Critical values	1% level	-3.5482	
	5% level	-2.9126	
	10% level	-2.5940	

Table 4 reports the results of Augmented Dickey Fuller Test of Stationarity of Jindal Steel returns for the study period. It is to be noted that the Jindal Steel are stationarity in the level difference itself with the value of 0.4561 and with the probability value of 0.0000. The test statistic value was smaller than the Test Critical values were -3.5482, -2.9126 and -2.5940 at 1% level, 5% level and 10% level respectively. It is concluded that during the study period, the returns of Jindal Steel were stationarity in the level difference itself. Hence, the return values were considered to be stationary.

Table 5: ADF Test of BHEL

		t-Statistic	Prob
Augmented Dickey-Fuller test statistic		-0.9862	0.0000
Test Critical values	1% level	-3.5461	
	5% level	-2.9117	
	10% level	-2.5936	

Table 5 reports the results of Augmented Dickey Fuller Test of Stationarity of BHEL returns for the study period. It is to be noted that the BHEL are stationarity in the level difference itself with the value of -0.9862 and with the probability value of 0.0000. The test statistic value was smaller than the Test Critical values were -3.5461, -2.9117 and -2.5936 at 1% level, 5% level and 10% level respectively. It is concluded that during the study period, the returns of BHEL were stationarity in the level difference itself. Hence, the return values were considered to be stationary.

Table 6: ADF Test of Asian Paints

		t-Statistic	Prob
Augmented Dickey-Fuller test statistic		-6.8144	0.0000
Test Critical values	1% level	-3.5461	
	5% level	-2.9173	
	10% level	-2.5936	

Table 6 reports the results of Augmented Dickey Fuller Test of Stationarity of Asian Paints returns for the study period. It is to be noted that the Asian Paints are stationarity in the level difference itself with the value of -6.8144 and with the probability value of 0.0000. The test statistic value was smaller than the Test Critical values were -3.5461, -2.9173 and -2.5936 at 1% level, 5% level and 10% level respectively. It is concluded that during the study period, the returns of Asian Paints were stationarity in the level difference itself. Hence, the return values were considered to be stationary.

5.3 GARCH Model

Table 7: Volatility Behaviour in Reliance Industries – Variance Equation

Variable	Coefficient	Std.Error	z-Statistic	Prob
C	0.0188	0.0264	0.7121	0.4764
ARCH	0.2068	0.3433	-0.6026	0.5468
GARCH	0.5918	0.5918	1.0453	0.2959

The results of GARCH (1,1) effect for Reliance Industries returns are given in table 7. According to the table, the effect of variance equation coefficient of Reliance Industries was 0.0188. The coefficient of parameters 'c' at 0.0188, ARCH at 0.2068 and GARCH 0.5918. The sum of ARCH and GARCH Reliance Industries was close to one (0.7986). This reveals the Reliance Industries experienced the lower volatility. It's not at the very risky to the investors during the study period from 2007 to 2012.

Table 8: Volatility Behaviour in State Bank of India – Variance Equation

Variable	Coefficient	Std.Error	z-Statistic	Prob
C	0.0103	0.0026	0.0026	0.0001
ARCH	-0.0613	0.0514	0.0514	0.2331
GARCH	0.4615	0.1465	0.1465	0.0016

The results of GARCH (1,1) effect for State Bank of India returns are given in table 8. According to the table, the effect of variance equation coefficient of State Bank of India was 0.0103. The coefficient of parameters 'c' at 0.0103, ARCH at -0.0613 and GARCH 0.4615. The sum of ARCH and GARCH State Bank of India was close to one. This reveals the Reliance Industries experienced the lower volatility. It's not at the very risky to the investors during the study period from 2007 to 2012.

Table 9: Volatility Behaviour in Jindal Steel – Variance Equation

Variable	Coefficient	Std.Error	z-Statistic	Prob
C	3.50E+11	1.11E+15	0.4080	0.6832
ARCH	-0.1157	1784.93	-0.5191	0.6037
GARCH	0.4327	583.38	0.4876	0.6259

The results of GARCH (1,1) effect for Jindal Steel returns are given in table 9. According to the table, the effect of variance equation coefficient of Jindal Steel was 3.50E+11. The coefficient of parameters 'c' at 3.50E+11, ARCH at -0.1157 and GARCH 0.4327. The sum of ARCH and GARCH Jindal Steel was close to one. This reveals the Jindal Steel experienced the lower volatility. It's not at the very risky to the investors during the study period from 2007 to 2012.

Table 10: Volatility Behaviour in BHEL – Variance Equation

Variable	Coefficient	Std.Error	z-Statistic	Prob
C	2.6773	5.4191	0.4941	0.6213
ARCH	0.9506	1.4686	0.6473	0.5174
GARCH	-0.5778	1.7126	-0.3374	0.7358

The results of GARCH (1,1) effect for BHEL returns are given in table 10. According to the table, the effect of variance equation coefficient of BHEL was 2.6773. The coefficient of parameters, 'c' at 2.6773, ARCH at 0.9506 and GARCH -0.5778. The sum of ARCH and GARCH BHEL was close to one. This reveals the BHEL experienced the lower volatility. It's not at the very risky to the investors during the study period from 2007 to 2012.

Table 11: Volatility Behaviour in Asian Paints – Variance Equation

Variable	Coefficient	Std.Error	z-Statistic	Prob
C	6.3594	2.0017	3.1771	0.0015
ARCH	0.2419	0.2097	1.1538	0.2486
GARCH	-0.2307	0.4146	0.5563	0.578

The results of GARCH (1,1) effect for BHEL returns are given in table 11. According to the table, the effect of variance equation coefficient of Asian Paints was 6.3594. The coefficient of parameters, 'c' at 6.3594, ARCH at 0.2419 and GARCH -0.2307. The sum of ARCH and GARCH Asian Paints was close to one. This reveals the Asian Paints experienced the lower volatility. It's not at the very risky to the investors during the study period from 2007 to 2012.

6. Summary and Conclusion

Reliance Industries

- The results of Augmented Dickey Fuller Test are noted that the Reliance Industries are stationarity in the level difference itself with the value of -6.6194.
- The results of GARCH (1,1) effect for Reliance Industries. The coefficient of parameters Reliance Industries 'c' are 0.0183, ARCH 0.2069 and GARCH 0.5918.

State Bank of India

- The results of Augmented Dickey Fuller

Test are noted that the State Bank of India are stationarity in the level difference itself with the value of -10.9609.

- The results of GARCH (1,1) effect for State Bank of India. The coefficient of parameters State Bank of India 'c' are 0.0103, ARCH 0.0103 and GARCH -0.0103.

Jindal Steel

- The results of Augmented Dickey Fuller Test are noted that the Jindal Steel are stationarity in the level difference itself with the value of 0.4561.

- The results of GARCH (1,1) effect for Jindal Steel. The coefficient of parameters Jindal Steel 'c' at 3.50E+11, ARCH at -0.1157 and GARCH 0.4327.

BHEL

- The results of Augmented Dickey Fuller Test are noted that the BHEL are stationarity in the level difference itself with the value of 0.4561.

- The results of GARCH (1,1) effect for BHEL. The coefficient of parameters BHEL 'c' at 3.50E+11, ARCH at -0.1157 and GARCH 0.4327.

Asian Paints

- The results of Augmented Dickey Fuller Test are noted that the Asian Paints are stationarity in the level difference itself with the value of -6.8144.

- The results of GARCH (1,1) effect for Asian Paints. The coefficient of parameters Asian Paints 'c' at 6.3594, ARCH at 0.2419 and GARCH -0.2307.

India has been witness to years of up and down cycle in the stock markets. Since 1992, the Indian markets have peaked every fourth year and then dropped 35-45% during the next three years. Some of the major conclusions derived in the study are as under. News related to any political and economical affair has direct effect on stock market. Any unusual news about a particular company will affect the value of the scrip. It is suggested that the investors who want to measure the accurate volatility of the stock market, the GARCH model which is the best one to measure the volatility of the stock market. It's in the final hands of the investor to invest in stock market at the right time.

References

- Geert Bekaert and Campbell R. Harvey (1995), "Time varying world market integration", Journal of Finance, Vol.1, No.2, pp. 403-425.

- Bollerslev, T (1986), "Generalised Autoregressive Conditional Heteroscedasticity", Journal of Econometrics, Vol.31, pp.307-327.

- Kumar Rakesh and Dhankar Raj S (2009), "Asymmetric Volatility and Cross correlations in Stock returns under Risk and Uncertainty", Vikalpa, Vol. 34, No.4, pp. 25-36.

- Poshakwalae S (2002) "The random walk hypothesis in the emerging Indian stock market" Journal of Business Finance and Accounting, 29 (9 & 10), 1275-1299.

- Raja sethu Durai and Saumitra N Bhadurai (2011), "Correlation dynamics in Equity markets", Research in International Business and Finance, Volume no:25, Issue no: 1, 2011, pp: 64-74.

- Yakob, N. A., Beal, D. and Delpachitra, S. (2005) Seasonality in the Asia Pacific stock markets, Journal of Asset Management 6 (4): 298-318.