FINANCIAL MODELLING AND EFFICIENCY DIAGNOSIS OF INDIAN SHARIAH MARKET

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Abstract

This work seeks to analyze the behavior, informational and market efficiency of Indian Shariah market with regard to Weak form efficiency of Efficient Market Hypothesis. The study period covers from 01/January/2008 to 31/May/2013 on CNX 500, CNX NIFTY Shariah and S&P BSE Tasis 50 Shariah index. The paper employs traditional tools of identifying the efficiency of the returns with auto correlation and run test and advanced financial modelling tools like ARCH Mean model and GARCH(1,1) model. The results indicated that the Shariah market is inefficient in weak form and it is possible that investors may be able to earn abnormal profit by reviewing the movements of the market. As the market lacks informational efficiency it need to be corrected at the earliest because it is violating the principles laid down by Islamic guidelines. The existing informational inefficiency will help the rational investors to adopt the technical analysis in predicting the behavior of Shariah market at least in short run. But policy makers need to take cognizance action so that Indian Shariah index doesn't violate the principles of Islamic finance.

Key words: Shariah market, Weak form efficiency, Informational efficiency, financial modelling

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We would like to acknowledge Mr. Shaheen V.P, Sales Engineer, Corodex Group of Companies, Abu-Dhabi, UAE.

Prelude

The global financial crisis has directed the attention of various financial markets world over towards Islamic finance on two important premises i.e. prohibition of derivatives and speculation. Unmindful usage of derivatives causing global financial tornado encircled most of the financial markets which were more open and liberal in aspects of financial innovations transferring the risk. Being the instrument of risk transfer the derivatives also pave the way for speculation. That is the reason derivatives are termed as double edged blade. As Islamic finance doesn't open itself to use of derivatives and speculation it has potential to ward of the onslaught of the hazardous effect of derivatives usage there by unnecessary speculation. The basic principles of Islamic finance are the prohibition of Riba (usury), Gharar (speculation). Islamic finance is among the alternatives to conventional finance. In fact modern Islamic finance began to develop in the early 1970s. It differs from conventional finance in terms of capital and labor. It runs on the principle of equal sharing of profit and investment risk which made it a universal concept for acceptance. These profits must be generated by investments in real assets and through a fair and legitimate trade. The basic principle of Islamic finance proved to be capable of withstanding the severe blow of financial crisis. Hence global attention was grabbed on appreciating the idea of adhering to the rules of Islamic finance which paved the way for promotion of Shariah index. Shariah index is nothing but index comprising of representative Shariah compliant shares to indicate the trends of stock abiding to the rules of Islamic finance. During the financial meltdown the Shariah compliant stocks and the Shariah indices were the out performers beating the market in terms of risk and return Islamic finance and the Shariah indices were the out performers beating the market in terms of risk and return. Even though, it attained the preference of an **"Out performer"**Akhtar et al (2010) in the market, during the disintegration, studies and researches were scarce and scanty on the in-depth analysis of Shariah stock market. Hence it is an attempt to study the market efficiency of Shariah market in Indian perspective. Efficiency of market is always of considerable interest to researchers and market participants. Hence this study has been intended to investigate the efficiency of Shariah index with several sophisticated econometric and statistical tools.

Efficient Capital Market theory and the random walk model have been at the center stage of debate in financial literature for several decades. The literature on capital market studies overflows with studies on Efficiency of Stock market. Many studies have favored the market efficiency in some form or another whereas equal number of studies have contradicted the existence of the same in any form. But with regard to Islamic index and stock market studies can be counted in finger tips. Majority of the studies on Islamic finance were focused on the volatility of the stock prices so that it can be established as universal index to protect the economy from meltdowns and attack of derivatives. Some of the main studies in Shariah index conducted across the globe were:

Rahim (2009) evaluated the information transmission and correlation between Islamic stock indices in South East Asia with regard to return and volatility level of daily returns. The study found out that the day of the weekend effect was present only in KLSI and not for FBM Emas Shariah and FBM Hijarah Shariah. Another research was done by Akhtar et al (2010) who analyzed the intensity of volatility linkage between Islamic and conventional markets. Since the crisis had affected the diversification benefits, the investor couldn't get a better payoff during peak times.It was concluded that the intensity of volatility linkages was found weaker in Islamic markets relative to non-Islamic markets, as there exist a smaller set of common information and lower cross-market hedging activity in Islamic markets. Chiadmi&Fouzia (2012)argued the volatility presence of SP 500 index over SP Shariah during the period December 2006 to March 2011 by considering SP 500 index over SP Shariah indices. The main objective of the study was to compare the two stock market indices in terms of volatility behaviors. The statistical properties of both the indices showed that SP Shariah was less volatile in terms of standard deviation during the study period and also showed that the returns were deviating from normality for both the indices. The results of auto correlation test showed that the returns of SP Shariah were not independent and identically distributed, and rejected the hypothesis of white noise.Hence it was concluded that the returns of SP Shariah was less volatile when compared to SP 500 index during the subprime crisis. The reason attributed may be because of the restrictive covenant like prohibition of interest and speculation imposed on Shariah stocks.

Eventhough many studies have addressed volatility of Shariah index, Romliet al (2012)studied the volatility during the financial crisis i.e. during the period 2007 to 2010. The index considered for the study was FTSE Bursa Malaysia Hijarah index.It was concluded that the

Malaysian Bursa index was less volatile during the crisis period when compared to conventional indices of Malaysia.

Efficient market theory and the random walk model have been at the center stage of debate in financial literature for several decades. Abraham et al (2002) argued the random walk behavior of Gulf stock market mainly Kuwait, Bahrain and Saudi Arabia. The Auto regressive Moving Average (ARMA 1, 1) process was adopted in order to find out the auto regression with in the returns of the market. The Saudi Arabia and Kuwait showed a spike in auto correlation at one week lag and Bahrain index showed a slow decay in auto correlation of a mixed ARMA process. A pattern of 2, 4,8,16 were considered for Variance Ratio test. The results proved that the thin markets of Gulf countries are inefficient in weak form of efficiency to the prices and information. Hence there was a random walk in these markets during the research period.

Another study done by Barnes (1986) examined the market efficiency of Kuala Lumpur stock exchange with respect to volume of trade and monthly indices of the market and found that the returns of KLSE were not predictable and speculators or arbitragers did not have any scope to earn any extra or abnormal return form the market. Antoniou et al (1997) presented the nonlinear behavior of thin markets of Istanbul stock market employing Generalized Autoregressive Conditional Heteroscedasticity model. The results showed that the random walk model was accepted. Augmented logistic map model was considered to test for efficiency and concluded Istanbul market was inefficient till 1990; with a nonlinear behavior and later on i.e. from 1991 the market showed efficiency in information.

Though many studies focused on general efficiency of market none of the studies were conducted on weak form efficiency of Islamic capital market. But researches on this line are blitzed on the conventional market all over the world. Hence it is an attempt to identify the efficiency of Indian Shariah market with regard to weak form efficiency propagated under Efficient Market Hypothesis by Fama (1965) who contradicted the theories of fundamental and technical analysis. Poshakwale (1996) illuminated the presence of weak form efficiency and day of the week effect in BSE of Indian stock market. The period of the study covered was from January 1987 to October 1994.The study implied that investors cannot earn abnormal return from their shares in Indian market. Gupta and Basu (2007) compared Bombay stock exchange and National stock exchange regarding the efficiency of the market and concluded that both the

markets were weakly efficient i.e. past price does not influence the current price and the markets were informationally efficient.

Venkatesan (2010) employed Augmented Dickey & Fuller test and Phillips- Perron test in order to determine the efficiency of daily returns of National Stock Exchange of Indian market during the period January 2008 to December 2009 using Ordinary Least squares method and concluded that Indian stock market was efficient in weak form model of Efficient Market Hypothesis. The studies which rejected the random walk hypothesis for Indian stock market were;

Srinivasan (2010) validated the random walk hypothesis of S&P CNX Nifty and Sensex of Indian stock market. The study indicated that the returns of the major indices were predictable and investors and earn abnormal profit by scrutinizing the movements of the market.

Abdullah et al (2011) assessed the week effect of Malaysian stock market with two major indices; they were FBM Emas Shariah and FBM Hijarah Shariah during the period 1990 to 2008.Since the sample size was very low; it showed that there was no week effect on both the indices of Malaysia.

Several studies proved that Shariah index outperformed in every country during meltdown hence it is an attempt through this paper to trace out the informational efficacy along with volatility persistence in the returns of Shariah index. Since the performance of Shariah index during crisis was better than conventional index, the studies on informational efficiency or market efficiency is still in question, where researches on efficiency have ample on conventional index.

From the reviews it was clearly evident that studies on weak form efficiency of were not explored on Shariah market, hence the study focuses on the weak form efficiency of Indian Shariah index. Hence the study purely focuses on the weak form efficiency of the EMH theory which explains that future and current prices completely include the past price information and no one can earn abnormal profit by predicting the patterns of the same.

Materials and Methods

The study mainly focuses on the weak form efficiency of Indian Shariah market i.e. CNX NIFTY, CNX500 and S&P BSE TASIS 50 for the period 01/January/2008 to 31/May/2013. For the purpose of estimating the weak form efficiency, the returns of closing prices of the market were considered i.e. $\mathbf{R_t = Log(P_t/P_{t-1})*100}$ **.** The indices studied were;

- CNX Nifty Shariah
- CNX 500 Shariah
- S&P BSE Tasis 50

In order to detect the weak form efficiency the study employed parametric test, Non parametric test and econometric tool. The data were collected from Bloomberg and analyzed through SPSS, Gretl and E views. In parametric test auto correlation, in non-parametric test run test and as econometric tool Unit root test were used. On the event of finding financial time series and stock returns exhibiting significant auto correlation at recent and at higher levels it was felt that there was scope for further financial modelling hence ARCH and GARCH models were employed. The model suggest that if the coefficients are statistically positive and significant it will be concluded that there is predictability in returns and it follows a trend in the market which allows investors to earn abnormal profit which is prohibited in the principles of Islamic finance.

B. Traditional Test of Serial correlation:

B.1 Autocorrelation

In statistics, autocorrelation is a random process which describes the correlation between values of the process at different times, as a function of the two or of the time difference. Autocorrelation function will be used for the purpose of detect the non-randomness in our data and also identify, if the data are not random in the time series data. The autocorrelation function is defined as

$$r_k = \frac{\sum_{i=1}^{N-k} (Y_i - Y)(Y_{i+k})}{\sum_{i=1}^{N} (Y_i - \overline{Y})^2}$$

C. Traditional test for Randomness:

C.1. Runs Test

In the random data set, the probability that the larger values i.e. $(I+1)^{th}$ value is smaller than I^{th} value following a binomial distribution, is the basis of the run test. Run test count the number of observed runs and number of expected runs. The test statistic of run test is

$$z = \frac{R - \bar{R}}{s_R}$$

Where R is the observed number of runs, $\bar{R}$ is the expected number of runs and s_R is the standard deviation of the number of runs. The value of R and s_R are computed as follows:

$$\bar{R} = \frac{2n_1n_2}{n_1 + n_2} + 1$$

$$S^2{}_R = \frac{2n_1n_2(2n_1n_2 - n_1 - n_2)}{(n_1 + n_2)^2(n_1 + n_2 - 1)}$$

Where n_1 and n_2 are the number of positive and negative values in the series.

D. Test of stationarity

D.1. Unit root tests

A time series is stationary if its mean and variance are constant over time and the value of co variance between two time periods depends only on the distance or gap between the two periods and not the actual time at which the co-variance is computed. For checking stationarity commonlylog of the variables are taken. Because a change in log variables represents a relative change (rate of return), whereas a change in variable itself represents an absolute change, Damodhar Gujarati (2011).

D.1.1. Augmented Dickey – Fuller test

The Augmented Dickey- Fuller follows a regression line i.e.

$$\Delta Y_t = \beta_1 + \beta_2 + \sigma Y_{t-1} + \sum_{t-1}^{m} \alpha_i \Delta_{t-i} + \varepsilon_t$$

Where ε_t is a pure white noise error term and where $\Delta Y_{t-1} = (Y_{t-1} - Y_{t-2})$, $\Delta Y_{t-2} = (Y_{t-2} - Y_{t-3})$, etc. the number of lagged difference terms to include is often determined empirically, the idea being

to include enough terms so that the error term in the equation (iv) gets serially uncorrelated. In ADF we will test whether σ = 0 is tested and the ADF test follows the same asymptotic distribution as the DF statistic, so the same critical values can be used.

D.1.2. Philips - Perron test

Philips Perron (1988) developed a generalization of the ADF test procedure that allows for fairly mild assumptions concerning the distribution of errors. The test regression of the Phillips-Perron (pp) test is the AR (1) process.

$$\Delta Y_t = \alpha_0 + \beta Y_{t-1} + \varepsilon_t$$

While the ADF test corrects higher order serial co relation by adding lagged difference terms on the right hand side, the PP test makes a correction to the t statistics of the co efficient *Y* from the AR (1) regression to account for the serial correlation in $\mathcal{E}_t$. So the PP statistics are just modification of the ADF t statistics that takes in to account the less restrictive nature of the error process. It is good to perform two tests (ADF and PP) for the researchers. As with the ADF test the PP test can be performed with the inclusion of a constant and linear trend, or neither in the test regression (Asteriou, 2006).

If the series is found to be to have unit root then the market is efficient in weak form and if the not then the past price of stock influences the current price of stock.

D.1.3. KPSS test

The alternative unit root test introduced by Kwiatkowski – Phillips – Schmit – Shin (KPSS) in the year 1992 and called henceforth KPSS test, has the null hypothesis stationarity of a series around either mean or a linear trend. The KPSS test is the sum of three components i.e. deterministic trend, a random walk and a stationary error term.

The model takes the following form;

$$y_t = \xi t + r_t + \varepsilon_t$$
$$r_t = r_{t-1} + \mu_t$$

Where y_t, t = 1, 2, …, T denotes series of observation of interest, t – deterministic trend, r - random walk process, ε_t - error term of the first equation, by assumption is stationary, μ_t denotes an error term of second equation, the assumption of the series is identically distributed random variables of expected value equal to zero and constant.

D. Advanced Financial Modelling techniques:

Measurement of volatility is an important issue in financial econometrics. It is associated with the concept of risk and returns and key elements involved in all the financial decisions. The volatility refers to the degree or fluctuations or the variability of a variable around its mean; where mean may be constant or varying with time or other variables. Statistically, volatility is equivalent to dispersion and it is time invariant which is measured as the standard deviation or the variance. Since the unconditional variance doesn't take into account the time varying volatility in asset returns, a measure that takes into account the past is known as Autoregressive Conditional Heteroscedasticity.

D. 1. Autoregressive Conditional Heteroscedasticity Mean model;

The assumption that the variance is constant over time and this also follows an AR (1) process, this means the squared error of today is a function of squared error of yesterday.

$$\varepsilon^2_t = \omega + a\,\varepsilon^2_t + v_t$$

This representation of error term is called Autoregressive conditional Heteroscedasticity (ARCH) model of order 1 proposed by Engle (1992).

Since Arch (1) doesn't capture adequately the volatility persistence found in asset returns, it is extended into **Arch (m)** or **Arch Mean** model by including GARCH(r,m) model , where the conditional volatility (h_t) is the function of past volatility (h_{t-r}) and past squared innovations in mean equation ε^2_{t-m}

D. 2. Generalized Autoregressive Conditional Heteroscedasticity (1, 1);

TheGARCH (r,m) model was proposed by Bollerslev (1986). In GARCH (r,m) model the conditional volatility (h_t) is the function of past conditional volatility (h_{t-r}) and past squared innovations in mean equation ε^2_{t-m}. The GARCH (1,1) model is more popular and represented as ;

$$R_t = c + \rho R_{t-1} + \varepsilon_t$$

$$\varepsilon_t = Z_t * \sqrt{h_t} \; where \; Zt \sim N(0,1)$$

$$H_t = \omega + \alpha\,\varepsilon^2_{t-1} + \beta h_{t-1}$$

$\alpha+\beta$ measures the volatility persistence and it is observed very close to 1, which signifies that the volatility of asset returns is highly persistent. The arch effect is identified through F statistics and observed $R^{2.}$ The fitness of the model is identified through serial correlation test and Arch effect and normality of residuals. But the normality of residuals are not a serious issues even if

the null hypothesis is not accepted the model created for identifying the volatility will be precise and reliable.

Discussions

The descriptive statistics of return series of CNX Nifty, CNX 500 and S&P BSE Tasis 50 is reported in table (1); the series in total depicts that the returns are not normal. The series are positively skewed with negative mean and median. The kurtosis clearly shows that the returns have fatter tails than the normal distribution since it is more than the value of kurtosis which is 3, and the series is Leptokurtic. The hypothesis of normality of returns is not accepted since that value of JarqueBera statistics for all the indices are significant. Hence it was concluded that the returns of Indian Shariah market were not normal during the study period.

The result of auto correlation test shows that the series are serially correlated and follows a pattern in the market. The hypothesis of the series that there is no autocorrelation is not accepted till lag 3 but the series were not serially correlated from 4^{th} lag till 6^{th} lag and it follows autocorrelation from 7^{th} lag onwards up to 36^{th} lag which shows that the returns are serially correlated except 4^{th} lag to 6^{th} lag.

The run test was carried out with runs form Mean and median. The run test identifies the non-randomness of the series which is reported in table (2):

The result show that expected runs and actual runs were not equal and the Z statistics shows that the series doesn't follow a random pattern for all the indices and actual runs observed. Since the market shows no – randomness it can be said that the Indian Shariah market is inefficient with regard to weak form efficiency of EMH.

The stationarity tests of the series were investigated through ADF test PP test and KPSS test. In order to avoid the limitations with ADF stationarity test the returns were cross checked with PP test which follows the same null hypothesis of ADF i.e. there is unit root in the series and the KPSS follows the null hypothesis of there is stationarity in the series.

It can be observed from table (4) that the indices CNX nifty, CNX 500 and S&P BSE Tasis 50 follows stationarity in the returns at 1% significance level with Hannan Quinn Criterion lag selection which is more moderate when compared to liberal lag selection of AIC and strict

lag selection of SIC. PP test results are more negative than the critical value than ADF which again rejects the theory of weak form efficiency under EMH.

In order to trace out the persistence in return, volatility clustering is employed at the introduction stage. Volatility clustering implies a strong correlation in squared returns. In order to test volatility clustering Ljung Box was employed where n as sample size and k as lag length.

The persistence of auto- regressiveness is tested through GARCH (1, 1) model where volatility clustering was identified and depicted in graph (1), (2) and (3) which clearly indicate that these three indices CNX nifty, CNX500 and S&P BSE Tasis 50 follows a volatility clustering during periods of turbulence in where in their prices showed wide swings and periods of tranquility in the wide swing were absent. Since Arch (1) doesn't capture adequately the volatility persistence found in asset returns, it is extended into Arch (m) or Arch Mean model by including GARCH(r,m) model , where the conditional volatility (h_t) is the function of past volatility (h_{t-r}) and past squared innovations in mean equation ε^2_{t-m} .The attempt to find out the patterns in modelling and Heteroscedasticity in the returns the ARCH LM test was employed and it was found that there was no homoscedasticity in the returns which even gives further scope for volatility clustering.

For the results shown in the table (5) it is clearly found that the ARCH effect and null hypothesis of CNX 500, CNX nifty and S&P BSE Tasis 50 cannot be accepted since the F statistics and observed R^2 are significant at 1% thus it suggest that there is a further scope for modelling volatility. The volatility clustering of all the indices also shows that high returns are followed by high returns and low returns are followed by low returns.

The result of GARCH(1,1) presented in table (4) which depicts that the α is small for CNX 500 when compared to CNX NIFTY and S&P BSE Tasis 50 which indicates that the shock to conditional variance will not take much time to die out. The coefficients of variance equation i.e. GARCH term are positive and significant at 1% level provides clue that successful modelling is possible to capture volatility. ThusGARCH (1, 1) model was successfully employed in order to capture the existenceof excess volatility and fat tail feature of the return of Shariah indices. From the results it can be concluded that the excess volatility is captured through GARCH (1, 1) model and it also has an influential power in predicting the return with one days lag.

The ARCH Mean model as presented in table (5) clearly depicts that the SQRT of GARCH table no (5) i.e. the standard deviation of the return or the risk of the returns i.e. CNX 500, CNX nifty and S&P BSE Tasis 50 is positive and significant which says that when the standard deviation comes down then the volatility will come down and the assets are treated as less riskier ones.

Since the coefficient of residuals shows a significant and positive value it can be concluded that there is an influential power in predicting the return with one days lag and the coefficient of GARCH term also shows a significance which means that the explains the volatility of the CNX 500, CNX nifty and S&P BSE Tasis indices.

The coefficients of variance equation i.e. GARCH term are positive and are significant at 1% level which indicates that successful modelling is possible to capture volatility. Hence GARCH (1,1) model was successfully developed in order to capture the explanation for excess volatility and fat tail feature of the return of Shariah indices.so it can be concluded that the excess volatility is captured through GARCH (1,1) model and it also has an influential power in predicting the return with one days lag. The serial correlation results were analyzed and the null hypothesis is accepted which explains that the series are not serially correlated after the formulation of the GARCH (1, 1) model.

Concluding Remarks

The attempt was made to detect the efficiency of Shariah index under Efficient Market Hypothesis in its weak form by employing the traditional methods of autocorrelation test and run test and advanced tools of stationarity test and financial modelling was done through Arch and GARCH. The indices considered for the study were CNX 500 and CNX NIFTY Shariah and S&P BSE Tasis 50 during the period 01/01/2008 to 31/05/2013. From the results of the study it can be concluded that the Shariah market is inefficient in its Weak form model of EMH. The past price of the shares can be used to predict the future prices. Apart from that the results of GARCH modelling suggest that not even the conditional mean, even conditional variance of the return series can also be modelled effectively. In addition the GARCH model explains the excess volatility and its clustering associated with the series. Hence there is high scope for investors and speculators for earning abnormal profit by scrutinizing the movements of the market. The policy makers and regulators should take necessary steps to control the market since the Shariah

principle forbids abnormal profits and speculation. Even though Shariah market is in its developing form it is not wrong to conclude that the informational efficiency is still at its dubious and cynical stage in India. This conclusion adds value to existing literatures on Shariah market and its efficiency.

Annexures***:***

Table no (1): ***Descriptive statistics of returns***

Indices	Mean	Median	Maximum	Minimum	Std.Dev	**Skewness**	**Kurtosis**	**JarqueBera Statistics**
CNX NIFTY	-0.000124	-0.000188	0.166192	-0.119192	0.016932	**0.275636**	**13.81610**	**6553.681****
CNX500	-0.000113	0.000210	-0.153070	-0.108757	0.016068	**0.075224**	**13.80027**	**6533.439****
S&P BSE Tasis 50	0.017590	0.022630	12.60158	-10.47058	1.425045	**0.050599**	**11.84208**	**4352.719****

Table no (2): ***Autocorrelation test of return***

INDEX	1		2		3		4		5		6		7		8		9		10		11		12	
	Q. Stat	**P. Value**	**Q. Stat**	**P. Value**	**Q. Stat**	**P. Value**	**Q. Stat**	**P. Value**	**Q. Stat**	**P. Value**	**Q. Stat**	**P. Value**	**Q. Stat**	**P. Value**	**Q. Stat**	**P. Value**	**Q. Stat**	**P. Value**	**Q. Stat**	**P. Value**	**Q. Stat**	**P. Value**	**Q. Stat**	**P. Value**
CNX Nifty	1.49	0.22	2.04	0.36	2.85	0.42	4.33	0.36	4.86	0.43	5.82	0.44	8.14	0.32	22.34	0.00	22.35	0.01	22.35	0.01	22.40	0.02	22.50	0.03
CNX 500	5.56	0.02	5.57	0.06	5.58	0.13	7.71	0.10	8.39	0.14	8.92	0.18	13.30	0.07	24.95	0.00	25.41	0.00	25.41	0.01	25.50	0.01	25.52	0.01
S&P BSE TASIS 50	6.13	0.01	6.59	0.04	6.61	0.09	7.59	0.11	8.21	0.15	9.78	0.13	14.93	0.04	24.40	0.00	24.41	0.00	24.68	0.01	25.00	0.01	26.02	0.01
INDEX	**13**		**14**		**15**		**16**		**17**		**18**		**19**		**20**		**21**		**22**		**23**		**24**	
	Q. Stat	**P. Value**	**Q. Stat**	**P. Value**	**Q. Stat**	**P. Value**	**Q. Stat**	**P. Value**	**Q. Stat**	**P. Value**	**Q. Stat**	**P. Value**	**Q. Stat**	**P. Value**	**Q. Stat**	**P. Value**	**Q. Stat**	**P. Value**	**Q. Stat**	**P. Value**	**Q. Stat**	**P. Value**	**Q. Stat**	**P. Value**
CNX Nifty	0.015	0.04	27.50	0.02	27.59	0.02	27.90	0.03	39.15	0.00	40.13	0.00	40.75	0.00	46.67	0.00	47.07	0.00	48.08	0.00	52.47	0.00	53.86	0.00
CNX 500	25.90	0.02	31.80	0.00	31.98	0.01	33.29	0.01	42.17	0.00	42.61	0.00	42.64	0.00	45.84	0.00	45.85	0.00	46.54	0.00	48.52	0.00	49.73	0.00
S&P BSE TASIS 50	26.47	0.02	30.83	0.01	31.20	0.01	31.57	0.01	40.60	0.00	41.00	0.00	41.40	0.00	42.10	0.00	42.15	0.00	42.51	0.01	43.50	0.01	44.21	0.01
INDEX	**25**		**26**		**27**		**28**		**29**		**30**		**31**		**32**		**33**		**34**		**35**		**36**	
	Q. Stat	**P. Value**	**Q. Stat**	**P. Value**	**Q. Stat**	**P. Value**	**Q. Stat**	**P. Value**	**Q. Stat**	**P. Value**	**Q. Stat**	**P. Value**	**Q. Stat**	**P. Value**	**Q. Stat**	**P. Value**	**Q. Stat**	**P. Value**	**Q. Stat**	**P. Value**	**Q. Stat**	**P. Value**	**Q. Stat**	**P. Value**
CNX Nifty	60.95	0.00	61.44	0.00	64.96	0.00	65.26	0.00	68.26	0.00	68.97	0.00	70.38	0.00	70.41	0.00	70.88	0.00	74.53	0.00	77.79	0.00	77.89	0.00
CNX 500	53.09	0.00	55.45	0.00	56.08	0.00	56.10	0.00	57.45	0.00	57.60	0.00	58.28	0.00	58.34	0.00	59.02	0.00	67.63	0.00	74.51	0.00	76.11	0.00
S&P BSE TASIS 50	48.41	0.00	49.94	0.00	50.78	0.00	50.78	0.01	53.06	0.00	53.18	0.01	53.18	0.01	53.18	0.01	53.19	0.01	58.69	0.01	62.88	0.00	64.16	0.00

Table no (3) ***Runs Test for Randomness***

	MEAN				MEDIAN			
	Cases < Test Value	Cases >= Test Value	Number of Runs	Z	Cases < Test Value	Cases >= Test Value	Number of Runs	Z
CNX Nifty	461	880	39	-34.335***	670	671	57	-33.574***
CNX 500	449	895	49	-33.734***	672	672	47	-34.164***
S&P BSE TASIS	481	855	19	-35.498***	666	670	32	-34.886***

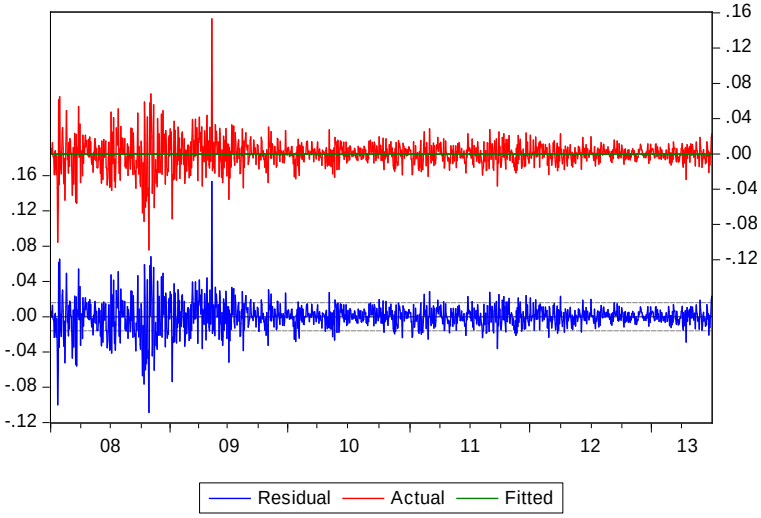
*** Significant at 1% level.

Table no (4) ***Unit Root Results of Stationarity***

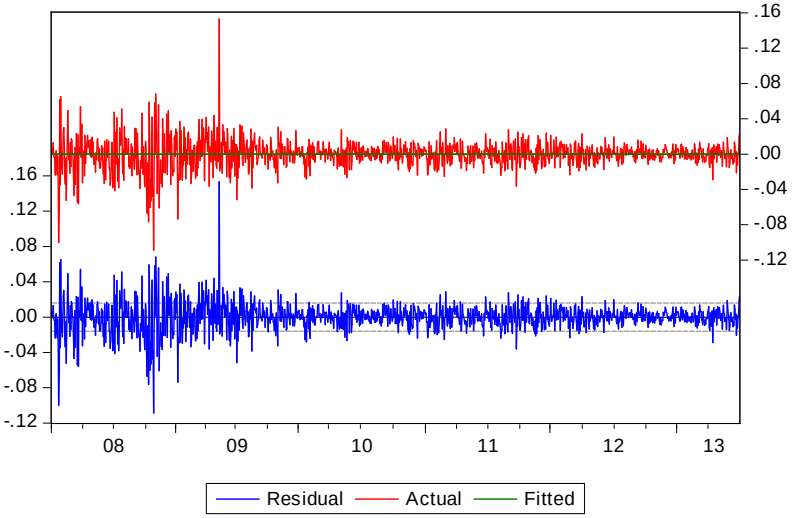
Variable	ADF	PP	KPSS
CNX 500 Shariah	-34.33 ***	-34.33 ***	0.279
CNX Nifty Shariah	-35.36***	-35.35 ***	0.219
S&P BSE Tasis 50	-34.12 ***	-34.12 ***	0.227

*** Significant at 1% level.

GRAPH (1)***SHOWING VOLATILITY CLUSTERING OF CNX NIFTY SHARIAH***



GRAPH (2)***SHOWING VOLATILITY CLUSTERING OF CNX 500 SHARIAH***



GRAPH (3)***SHOWING VOLATILITY CLUSTERING OF S&P BSE TASIS 50***

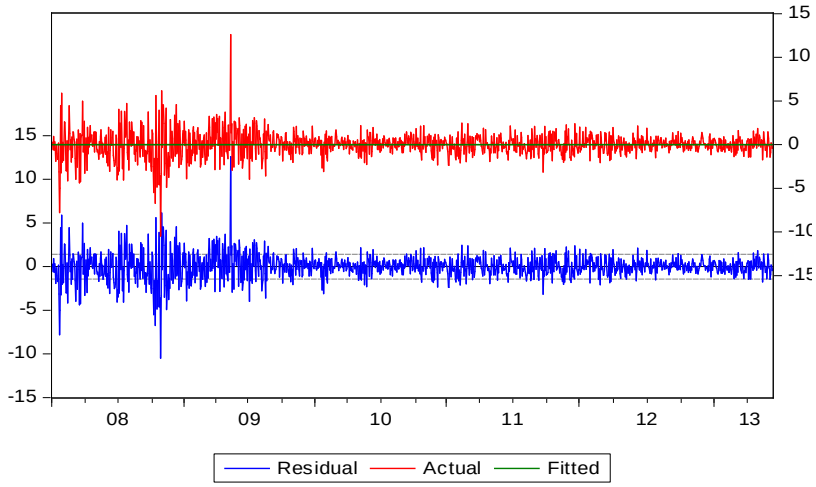


Table no (5**)** ***results of ARCH effect from ARCH LM test:***

	CNX500	CNX NIFTY	S&P BSE TASIS 50
F statistics	31.02548***	19.99845***	42.60739***
Observed R^2	30.37856***	19.73725***	41.35419***

*** Significant at 1% level

Table no (6**)** ***results of GARCH (1, 1):***

Indices	Mean	Variance		
	β	α	RESID(-1)^2	β
CNX Nifty	**0.051396**	**1.98E-06**	**0.109370****	**0.889605****
CNX500	**0.029918**	**1.27E-06**	**0.116180****	**0.887290****
S&P BSE TASIS 50	**0.073953**	**0.016103**	**0.121310****	**0.876938****

**Significant at 5% level

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