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Rescaled Range Analysis – A Comparative Study on Bombay Stock Exchange and National Stock Exchange

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Abstract

The present study is an attempt to find out the long range persistence of selected sample listed in BSE and NSE Sectoral Indices. To analyze the comparative study on Bombay Stock Exchange and National Stock Exchange (Special Reference with BSE Auto, Bankex & NSE Auto, Bankex), Augmented Dickey Fuller Test, Phillips Perron Test for Stationarity, Autocorrelation, Normality test using Kolmogorov- Smirnov and Shapiro –Wilk Test, ARCH and GARCH model and Rescaled Range Analysis during the study period 01st April 2005 to 31st March 2017 of selected Sectoral Indices listed in Bombay Stock Exchange and National Stock Exchanges.. The findings of the study indicated that there is a persistence of long range memory in selected sample return of BSE and NSE during the study period.

Keywords: BSE Bankex & Auto and NSE Bankex & Auto, Persistence, Augmented Dickey Fuller Test, Rescaled Range Analysis.

I. INTRODUCTION

Rescaled Range Analysis is a statistical technique used to analyze trends in the scopes, developed by British hydrologist Harold Edwin Harst. Rescaled Range Analysis can be used to detect and evaluate the amount of persistence randomness or mean reversion in financial market time series data.

Exchange rates and stock prices do not follow a random walk or unpredictable path, like they would if price changes were independent of each other. If a strong trend exists in the data, it will be captured by the Hurst exponent which is known as the index of long range depends, i.e., it range between 0 and 1 and measure persistence, randomness or mean reversion. Rescaled Analysis of random event is known as to reveal the persistent (or) ant persistent nature of the process, which the Hurst exponents is the key parameter to determine the level of anti persistent

II. Review of literature

"**Rescaled Range Analysis and De-trended Fluctuation Analysis: Finite sample properties and Confidence Intervals "** by Ladislav Kristoufek (2010), analyzed the presence of R/S were significantly higher than an asymptotic limit of 0.5 of random time series, using Hurst exponent H Estimation – Rescaled range analysis and de-trended fluctuation analysis on different types of financial assets. The findings indicated the R/S was useful and robust method when compared to newer method of DFA.

In the paper **"Long Memory in Eastern European Financial Markets Returns",** by Cipriannecula and Alina Nicoleta Radu (2012), analyzed the long memory property of stock returns of Eight CEE emerging markets, namely Czech Republic, Hungary, Poland, Slovenia, Bulgaria, Slovakia, Croatia and Romania, using ARFIMA and FIGARCH model. It was found that there existed persistence of long memory in the returns of selected CEE emerging markets.

Ladislav Kristoufek (2012), in the paper entitled **"How are Re-scaled Range Analyses affected by different memory and distributional properties? A Monte Carlo Study"** analyzed the effect of different distributional properties and the ability of the methods to efficiently distinguish between short term and long term memory, using classical and modified R/S analysis, ARFIMA and Monte Carlo simulation Techniques. It was concluded that the R/S exhibited biased results upwards for short range dependent process and M-R/S exhibited strong biased results downwards for long range dependency.

Using Rescaled analysis, Shekar Shetty, Dhari Alabdulhadi et al (2014) in the paper entitled **"Stock Market Behaviour: A Fractal Analysis of Saudi Stock Exchange"** estimated the fractal dimension of price returns in order to determine the predictability of a time series. The findings indicated that Saudi Stock market returns comply with neither the weak form of the efficient market nor the random walk assumption.

Arun Joe Bebulo .S, Janaki. B and Jeeva. C (2014), in the paper entitled **"Stock Market Indices prediction with Various Neural Networks Models "** analyzed the various Neural Networks models for stock prediction, using Modular Neural Network, ARIMA- based Neural Networks, Genetic Algorithm, Recurrent Network, Back Propagation, Radial Basic Function, Branch Network, Functional Link Artificial Neural Network, Feed Forward Neural Network and Fuzzy Neural Networks. The findings indicated that the efficient stock market prediction remains difficult task mainly due to complex and varying in time dependencies between factors affecting the price.

Using ARFIMA and FIGARACH model, Serpil Turkyilmaz and Mesut Balibey (2014), in the paper entitled **"Long Memory Behavior in the Returns of Pakistan Stock Market: AFRIMA – FIGARACH Models"** measured the predictable structure of volatility of Pakistan stock market for the period 2010-2013. The findings indicated that the FIGARCH model indicated that volatility of market returns has long memory.

Using Mono Fractal Analysis, Multi Fractal Analysis and Empirical Analysis, Yi Wang, Xin Su and Xueil Zhen (2015), in the paper entitled **"Fractal Analysis of the Agricultural Products Price Time Series"** measured the predictability of wholesale price of agricultural product for the period of February 2003 to May 2014 which comprised of 594 weeks. The findings indicated that the price exhibited mono fractal and multi fractal method of prediction and risk assessment for agricultural products.

"Stock market Prediction using Social Media Analysis" by Oscar Alsing and Oktay Bahceci (2015), to analyzed social media with Machine learning and Sentiment Analysis for stock market forecasting. It was found that using artificial neural network a company-specific model capable of predicting stock price movement with 80% accuracy.

Nikola Milosevic (2015), in the paper entitled **"Equity forecast: Predicting long-term stock price movement using machine Learning"** analyzed the equity's future price over a long time using machine learning aided approach. It was found that the machine learning method was able to correctly predict company's value which will be 10% higher than other cases.

Hakob Grigoryan (2015), in the paper **"Stock prediction using Artificial Neural Networks Case Study of TAL1T, Nasdaq OMX Baltic Stock"** analyzed the combined prediction model, based on artificial neural networks with Principal Components Analysis (PCA) for financial series forecasting, using Technical analysis, Principal Components Analysis and Artificial Neural Networks. The findings indicated that the model can be successfully used as an alternative method to standard technical techniques for financial times series forecasting. It was concluded that the PCA NARX prediction model provides promising alternative tools to other artificial neural networks based methods in financial times series forecasting.

In the paper "**Stock Market Prediction using Artificial Neural Networks",** by Gaurav Kshirsagar, Rukshed Amaria, Mohit Chandel, Shantan Kakade (2016), analyzed the effects of Artificial Neural Networks to map any non linear function without a prior assumption using prediction algorithm and Back Propagation algorithm, it was found that artificial neural networks are best suited for predicting nearest stock prices.

Using R/S Statistic, LO Statistic, Robinson's Estimate, Soumya Guha et al (2016), in the paper entitled **"Investigating the Efficiency of the Indian Currency market: A Persistence Perspective"** measured long-range persistence and its impact on policy decisions in the Indian Forex market during the period 2000 to 2015. The findings indicated that the long memory in volatility and absolute return series of each currency pair were evidence but the logarithmic return series of each currency pairs indicated proclivity towards random walk.

In the paper "**Stock Market Index prediction using Artificial Neural Networks"** by Amin hedayati Moghaddam, Moein Hedayati Mohaddam and Morteza Esfandyri (2016), determined the ability of artificial neural networks in forecasting the daily NASDAQ stocks during the study period 28th January 2015 to 18th June 2015, using a Robust Model. The findings indicated that there was no distinct difference between the prediction ability of the daily NASDAQ stock.

Jaydip Sen and Tamal Datta Chaudhuri (2016), in the article, **"Decomposition of Time Series Data of Stock Markets and its Implications for Prediction – An Application for Indian Auto Sector"** analyzed the structural analysis to forecasting and computed their accuracy in prediction of India Auto sector, during the study period 2010 to 2015, using Neural network, Back Propagation network, ARIMA and Bayesian Autoregressive model. It was found that the accuracy of our decomposition results and efficiency of forecasting techniques even in presence of a dominant Random component in the time series.

Bhagyashree Nigade , Aishwarya Pawar et al (2017), in the paper entitled "**Stock Trend Prediction Using Regression Analysis – A Data Mining Approach"** analyzed the development and implementation of stock price prediction application using machine learning algorithm and object-oriented approach of software system development, for the period of 1203 days, using regression analysis. The findings indicated that the proposed model uses regression analysis as a data mining techniques and develops a system for exploiting time series data in the financial institution.

"**ARIMA / GARCH (1,1) Modeling and Forecasting for a GE Stock Price Using R",** by Varun Milk (2017), developed an understanding of the time series analysis, modeling and forecasting performance using ARIMA, GARCH (1,1) and R during the study period 2001 to 2014. It is found that ARIMA and GARCH (1,1) model is applied to observe the forecasting values of low and high stock price in (USD) for GE company.

III. Research Methodology

The present study considered selected sectoral Indices listed in Bombay Stock Exchange of India ltd and National Stock Exchange of India to analyze the behavior of Share prices using Descriptive Statistics, Augmented Dickey Fuller Test Phillips Perron Test for Stationarity, Normality test using Kolmogorov- Smirnov and Shapiro –Wilk Test, Volatility Test using ARCH and GARCH model and Rescaled Range analysis during the study period 01st April 2005 to 31st March 2017 to assess the Long range persistence of selected sectoral sample return listed in Bombay Stock Exchange of India Ltd and National Stock Exchange of India Ltd.

Research Gap

The study is different from earlier studies in the way that Sectoral Indices listed in two major Stock Exchanges in India namely the Bombay Stock Exchange of India Ltd and National Stock Exchange of India were taken into consideration for the present study during the period 01st April 2005 to 31st March 2017. The Long range Persistence of selected sample is an art of trying to determine the future value of the stock market or other financial instrument traded on the stock exchange. The successful stock market prediction will reveal the increase and extra earnings of the share. Generally, a change occurs in the price of the stock only because of certain changes in the economy, industry or company. Information about these changes alters the stock prices immediately and stock moves to a new level, upwards or downwards, depending on the types of information.

Statement of the problem

The basic premise in random walk theory is that the information on changes in the economy, industry and company performance is immediately and fully spread so that all investors have full knowledge of the information. The price of each day is independent. It may be unchanged, higher or lower from the previous price, but that depends on new pieces of information being received in each day.

Fundamentalists believe that it may take several days or weeks before investors can fully assess the impact of new information. As a consequence, the price may be volatile for a number of days before it's adjusted to a new level. This provides an opportunity to the analyst who is superior analytical to earn excess returns.

The efficient market theory holds the view that in an efficient market, new information is processed and evaluated as it arrives and prices instantaneously adjust to the new and correct level. An investor cannot consistently earn excess returns by undertaking the fundamental and technical analysis.

It is to be noted that the different forms of stock price prediction using Artificial Neural Network have been tested through several methods. While analyzing the previous work related to the present study, the following points were noted. Stock Market prediction using Artificial Neural Network was worked out in different study periods by Gaurav Kshirsagar, Rukshed Amaria, Mohit Chandel, Shantan Kakade (2016), using prediction algorithm and Back Propagation algorithm, it was found that artificial neural networks are best suited for predicting nearest stock prices, Amin hedayati Moghaddam, Moein Hedayati Mohaddam and Morteza Esfandyri (2016), during the study period 28th January 2015 to 18th June 2015, using a Robust Model, there was no distinct difference between the prediction ability of the daily NASDAQ stock. Rao A, Hule .S et al (2015), using Statistical Computational Methodologies and Artificial Neural Networks. Navale G. S, Nishant Dukhwala and Kunal Jadhav (2016), using Autoregressive Moving Average (ARMA), found that data mining and artificial Intelligence when put together will result in near accuracy. Ali Sorayaei, Zahra Atf and Masood Gholami (2016), the period of 2010-2014, using feed forward Neural Networks with back propagation algorithm. The results found that artificial neural networks and regression results are consistent with, but the results demonstrate the advantages and effectiveness of the neural network method than regression in predicting stock prices.

The studies found that the stock price prediction using Rescaled range analysis from different Stock exchanges. Taking into account, the above analysis, the present study considered the Stock Market Prediction using Rescaled Range Analysis with special reference to selected Sectoral Indices listed in Bombay Stock Exchange (BSE) and National Stock Exchange in India (NSE) for analyzing the Share

price prediction using Descriptive statistics, Augmented Dickey Fuller Test, Phillips Perron Test for Stationarity, Autocorrelation, Normality test using Kolmogorov- Smirnov and Shapiro –Wilk Test, ARCH and GARCH model and Rescaled Range Analysis during the study period 01st April 2005 to 31st March 2017 selected Sectoral Indices listed in Bombay Stock Exchange and National Stock Exchanges.. Generally, a change occurs in the price of the stock only because of certain changes in the economy, industry or company. Information about these changes alters the stock prices immediately and stock moves to a new level, either upwards or downwards, depending on the type of information. Therefore, it becomes necessary to evaluate the share price returns from time - to - time.

Need for the Study

The present study is based on the stock market prediction of selected sample sectoral indices listed in Bombay Stock Exchange of India Ltd and National Stock Exchange of India. This study will help the investors to assess how the current prices of stock already fully reflect all the information that is contained in the historical sequence of prices. Generally, the Efficient Market Hypothesis, Fundamental Analysis, Technical Analysis and Internet-based data sources are used for analyzing the share price movements and prediction of share return.

The stock brokers and stock market mediators who deal in stock market trading can use the fundamental analysis (Intrinsic Value), Technical analysis (Study of Charts), Traditional Times series Forecasting (Linear Prediction Model and Regression model) and Machine Learning method (Linear and Non linear model) to predict the share price and advice their clients and shareholders to get good returns.

Prediction of the stock market index is an important issue in the financial sector, generally artificial neural networks can effectively be used to predict the stock prices in the stock market and this gives profitability opportunities to the investors and financial analysts.

Investors in stock exchange need to maximize their profit by buying and selling of securities at an appropriate time. Stock market index nonlinear pattern, so predicting the future prices of the shares is highly difficult.

Forecasting of stock market index gains more attention as the Key factors of investors in the stock market mainly is profitability, if the direction of the stock price is successfully predicted the investors can yield enough profit out of stock market using various stock prediction model.

IV. Objectives of the study

1. To analyze the long range dependence of the selected sectoral Indices listed in Bombay Stock Exchange of India and National Stock Exchange of India.
2. To summarize the findings and suggestions of the study.

Null Hypothesis of the study

- ✓ The daily index returns of selected Sectoral Indices listed in Bombay Stock Exchange of India Ltd (BSE) and National Stock Exchange of India (NSE) exhibited no long range dependence during the study period.

Methodology of the Study

a) Sample Selection

As on 27th Oct 2017, totally 5 major indices listed in Bombay Stock Exchange of India Ltd & National Stock Exchange of India namely, BSE Sector & Industry – Real time, BSE Thematics – Real-time, BSE Strategy – Real-time, BSE Sustainability- Real-Time , BSE Strategy- End of Day and NSE Broad Market Indices, NSE Sectoral Indices, NSE Strategy Indices, NSE Thematic Indices, NSE Fixed Income Indices. Out of the 5 Major Indices, the Sector & Industry (BSE) and Sectoral Indices (NSE) was taken as a sample for the study based on the following conditions:

- ➢ The data availability of the selected sample from 1st April 2005 to 31st March 2017.
- ➢ The data availability of the selected sample with the Open, High, Low and Close price of the daily share returns of the study period.

- The selected sample returns only from sectoral Indices listed in Bombay Stock Exchange in India and National Stock Exchange in India special reference with BSE Auto & Bankex and NSE Auto & Bankex. (for the entire study- specify that is applicable for the selected sectors alone)

Based on the above conditions, out of 19 Indices, listed in Bombay Stock Exchange of India Ltd, Sector & Industry, only 2 Indices were selected, the National Stock Exchange of India out of 11 sectoral indices, only 2 were selected for the sample which met the above criteria. Finally, 4 Indices (2 from BSE and 2 From NSE especially BSE Auto & Bankex and NSE Auto & Bankex) were selected for the study as follows:

Sources of Data

The data for the present study was collected through secondary data. The daily Index price of selected sectoral Indices listed in Bombay Stock Exchange of India Ltd was taken from the official website BSE (www.bseindia.com) and selected sectoral Indices listed in National Stock Exchange of India data were taken from official website NSE (www.nseindia.com). Other relevant data were collected from various Books, Journals, and online sources.

Period of Study

The present study is an attempt to find the stock market prediction using Rescaled Range Analysis of selected Sectoral Indices listed in Bombay Stock Exchange of India Ltd and National Stock Exchange of India during the study period of 12 years from 1st April 2005 to 31st March 2017.

Tools used for Analysis

The following statistical tools were used for the analysis of the returns and stock prediction for the selected sample during the study period from 1st April 2005 to 31st March 2017.

S.No	Statistical Tools	Meaning
1	Return	To convert the daily closing price of the selected Indices into logarithmic returns
2	Mean	It used to measure for representing the entire data by one value called an average.
3	Standard Deviation	It is a measure of how much ”Spread” or “variability” is present in the sample.
4	Skewness	When a distribution is not symmetrical it is called a skewed distribution. It is said to be positive (Mean < Mode) or negative Distribution (mode < mean).
5	Kurtosis	It refers to the degree of flatness or peakedness in the region about the mode of frequency curve.
6	Normality Test (Kolmogorov-Smirnov and Shapiro –Wilk)	A normality test is used to determine whether sample data has been drawn from a normally distributed population (within some tolerance).
7	Stationarity test (using ADF and PP)	If trend persists, prediction is not possible, data convert trend data to stationarity data. In simple trend data convert into times series data.
8	Volatility Test	Volatility refers to the amount of uncertainty or risk about the size of changes in a security's value. A higher volatility means that a security's value can potentially be spread out over a larger range of values. A lower volatility means that a security's value does not fluctuate dramatically, but changes in value at a steady pace over a period of time.
9	Rescaled range Analysis	It is a statistical techniques designed to assess the nature and magnitude of variability in data over a times. It has been used to detect and evaluate the amount of persistence, randomness or mean revision in financial market time’s series data.

Limitations of the Study

1. The data for the present study was based only on Secondary source and as such, all the limitations of a secondary source of data applies to the study also.
2. The duration of the study period is restricted to twelve years from 1st April 2005 to 31st March 2017.
3. While Calculating Descriptive, Normality, Stationarity, Volatility and Rescaled Range Analysis, only Closing Stock Returns of a selected sample are considered.

4. Results and Interpretations

Table 4.1 Results of Summary Statistics of Sample Indices during the Study period

Measures	BSE		NSE	
	Auto	Bankex	Auto	Bankex
Mean	-0.998959	-0.999051	-0.998927	-0.999066
Maximum	0.00000	0.000000	0.00000	0.00000
Minimum	-1.110126	-1.134848	-1.103149	-1.134876
Standard Deviation	0.023652	0.026703	0.023559	0.026706
Skewness	25.19535	17.59847	25.54556	17.59633
Kurtosis	1069.987	660.5438	1087.353	660.3491

Source: Data collected from www.nseindia.com & www.bseindia.com **and computed using E-views.**

Table 4.1 shows the results of Descriptive statistics of BSE Auto & Bankex and NSE Auto & bankex during the study period 1st April 2005 to 31st March 2017. The Minimum and Maximum values of selected sample ranged between – 1.134876 to 0.0000. The average returns of selected sample were -0.998959 which indicates that the investors of NSE and BSE (Auto and Bankex) earned negative returns during the study period. It is to be noted that the standard deviation value of S&P BSE and S&P NSE was found to be 0.023, 0.026 auto and bankex respectively, which indicates a low volatility. With respect to the data distribution, a positive skewness with a value of 25.19535 and 17.59 was recorded. The Kurtosis which measures, the peakedness of the data distribution was found to be greater than three i.e 1087.353 (NSE Auto) which indicated Leptokurtic distribution.

Table 4.2 Summary Results of Normality Test using Kolmogorov- Smirnov and Shapiro – Wilk Statistic of Sample Indices during the study period 1st April 2005 to 31st March 2017.

Tests of Normality						
	Kolmogorov-Smirnov			Shapiro-Wilk		
Particulars	Statistic	df	Sig.	Statistic	Df	Sig.
S&P BSE AUTO	0.145504	2979	<0.001	0.452194	2979	<0.001
S&P BSE BANKEX	0.125091	2979	<0.001	0.56948	2979	<0.001
S&P NSE Auto	0.145861704	2978	<0.001	0.445729	2978	<0.001
S&P NSE BANKEX	0.12434007	2978	<0.001	0.572127	2978	<0.001

Source: Data Collected from www.bseindia.com **and Computed Using SPSS.**

The results of normality analysis using Kolmogorov-Smirnov and Shapiro-Wilk Test Statistic for S&P BSE Auto, Bankex and S&P NSE Auto, Bankex during the study period 01st April 2005 to 31st March 2017 are presented in **Table 4.2.** It is to be noted that the Kolmogorov-Smirnov Statistic was found to be 0.145 and 0.125 and Shapiro-Wilk Statistic was 0.4521 and 0.57 for BSE& NSE auto and BSE & NSE Bankex during the study period. With respect to the 'p' value, both statistic recorded statistically significant 'p' value at 5% level. Hence the H01.1: **"There is no normality in the daily index returns of selected sample"** is rejected. Therefore it becomes evident that S&P BSE& NSE Auto and BSE & NSE Bankex witnessed normality of data distribution during the study period.

Table 4.3 Summary Results of Stationarity test using Augmented Dickey Fuller Statistic and Phillips-Perron Statistic of Sample Indices during the study period 1st April 2005 to 31st March 2017.

Stationarity test						
Particulars	**ADF**	**PP**	**1% Level**	**5% Level**	**10% Level**	**Sig.**
S&P BSE AUTO	-29.9421	-29.788	-3.4323	-2.8623	-2.5672	<0.001
S&P BSE BANKEX	-34.9271	-33.913	-3.4323	-2.8623	-2.5672	<0.001
S&P NSE Auto	-29.9132	-29.606	-3.4323	-2.8623	-2.5672	<0.001
S&P NSE BANKEX	-35.1781	-34.209	-3.4323	-2.8623	-2.5672	<0.001
*MacKinnon (1996) one-sided p-values.						

Source: Data collected from www.bseindia.com **and Computed using E-views**

Table 4.3 shows the results of Stationarity test using Augmented Dickey Fuller (ADF) and Phillips – Perron (PP) statistics for S&P BSE& NSE Auto and BSE& NSE Bankex during the study period 1st April 2005 to 31st March 2017. The Augmented Dickey Filler (-29.9421) (-34.92) and Phillips Perron (-29.7886)(-33.913) (Ignoring the Sign) was greater than Test critical values at 1% level (-3.43236), 5% level (-2.86231) and 10% level (-2.56723) for selected returns of S&P BSE & NSE Auto and BSE & NSE Bankex at level range. Further, the Prob Value was less than 0.05 for the selected sample return of S&P BSE & NSE Auto and BSE & NSE Bankex (0.000). Hence the **H02: "There is no stationarity in the daily shares price return of Selected Indices"** is rejected. Therefore the S&P BSE & NSE Auto and BSE & NSE Bankex confirmed stationarity at level difference. As S&P BSE & NSE Auto and BSE & NSE Bankex attained stationarity at level difference, it is not necessary to go for first level and second level difference.

Table 4.3 Volatility Analysis using GARCH (1,1) Model for Sample Indices 1st April 2005 to 31st March 2017.

Tests of Volatility									
	Mean Equation				**Variance Equation**				
Particulars	**Var**	**Coefficient**	**Std. Error**	**z-Statis**	**Variable**	**Coefficient**	**Std. Error**	**z-Stati**	**Prob.**
S&P BSE Auto	C	-0.998	0.00028	-3542.0	C	2.50E-07	3.74E-08	6.69174	<0.001
					ARCH(1)	-0.00115	9.42E-05	-12.2374	
					GARCH(1)	1.000754	6.03E-05	16583.7	
S&P BSE Bankex	C	-0.9990	0.00042	-2375.39	C	1.00E-06	7.37E-08	13.5599	<0.001
					ARCH(1)	-0.000753	7.85E-05	-9.596	
					GARCH(1)	0.999399	6.64E-05	15050.3	
S&P NSE Auto	C	-0.99865	0.00027	-3640.88	C	1.23E-07	3.05E-08	4.04421	<0.001
					ARCH(1)	-0.00067	9.24E-05	-7.25923	
					GARCH(1)	1.000823	3.83E-05	26154.9	

S&P NSE BANKEX	C	-0.99912	0.00043	-2279.41	C	1.11E-06	9.01E-08	12.3532	<0.001
					ARCH(1)	-0.00076	8.94E-05	-8.49953	
					GARCH(1)	0.999149	8.67E-05	11527.5	

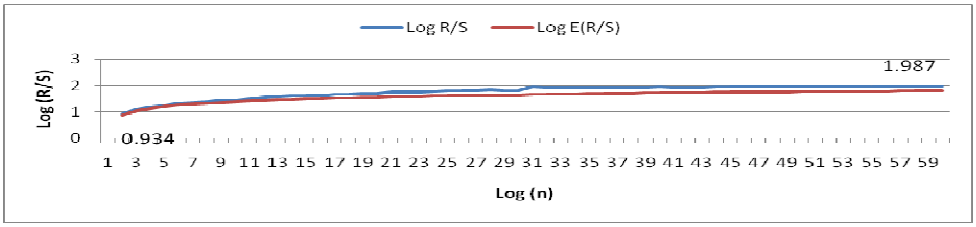
Source: Data Collected from www.bseindia.com & www.nseindia,com , computed using Eviews.

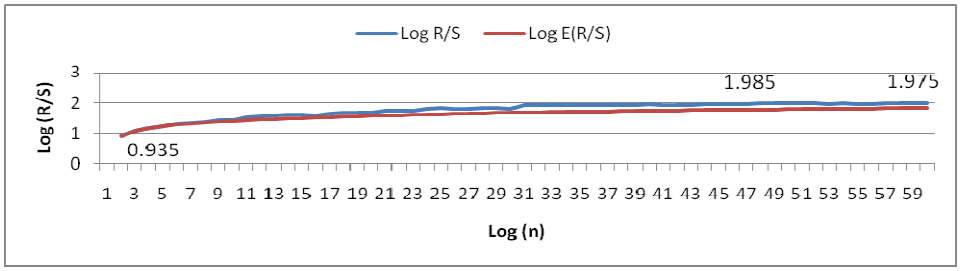
Table 4.5 presents the results of the mean and variance Equation of GARCH model for S&P BSE & NSE Auto and BSE & NSE Bankex daily returns from 1st April 2005 to 31st March 2017. It is to be noted that 'C' represent constant. The findings indicates that the mean equation co efficient was negative (-0.999) and significant at 5% level for S&P BSE & NSE Auto and BSE & NSE Bankex. The variance equation coefficient of ARCH (1) and GARCH (1) of S&P BSE & NSE Auto and BSE & NSE Bankex returns were close to one (0.999). The coefficient of GARCH is closer to one and ARCH (1) parameter was less than Zero. It is found from the above analysis that the volatility was highly persistent. Hence the **H03: "There is no significant Volatility in the selected sample return",** is rejected.

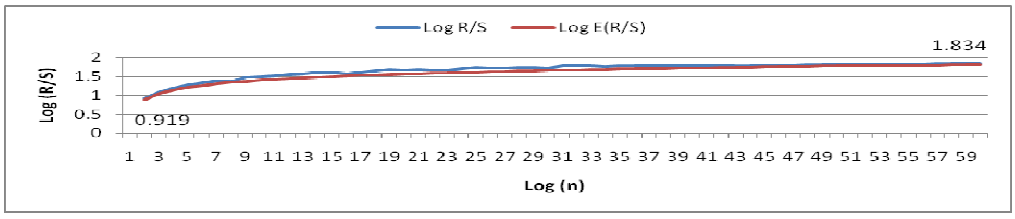
Rescaled Range Analysis

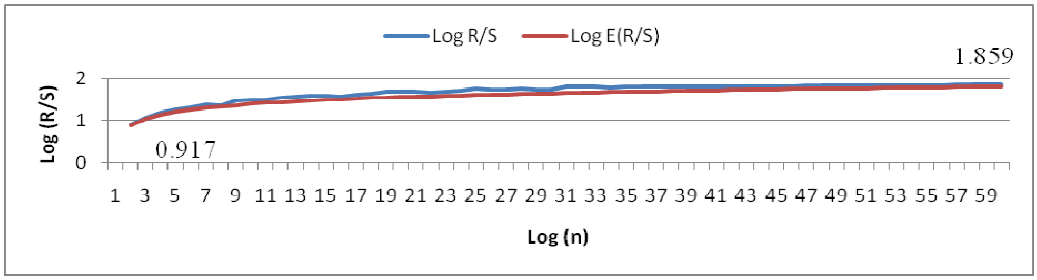
Chart-5.1

R/S Chart for Selected Indices during the study period 1st April 2005 to 31st March 2017.





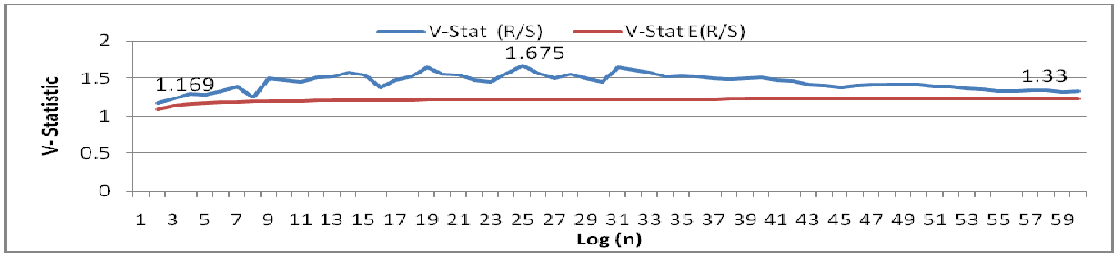


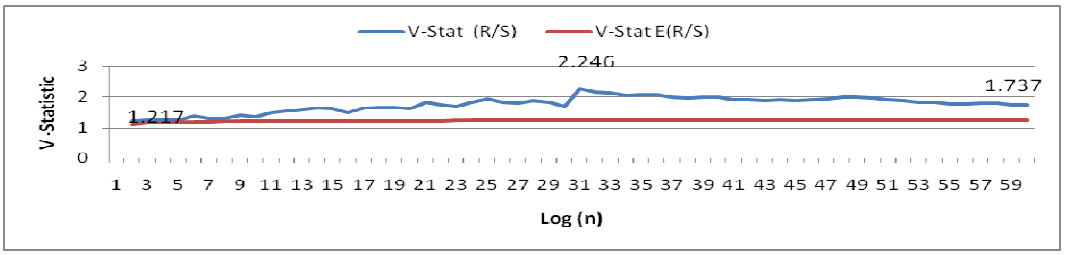


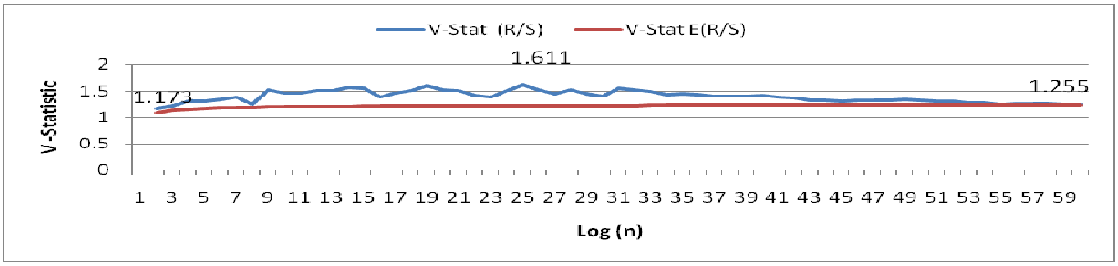
Source: Computed from Matlab 2013a using Microsoft Excel (Version 97-2003)

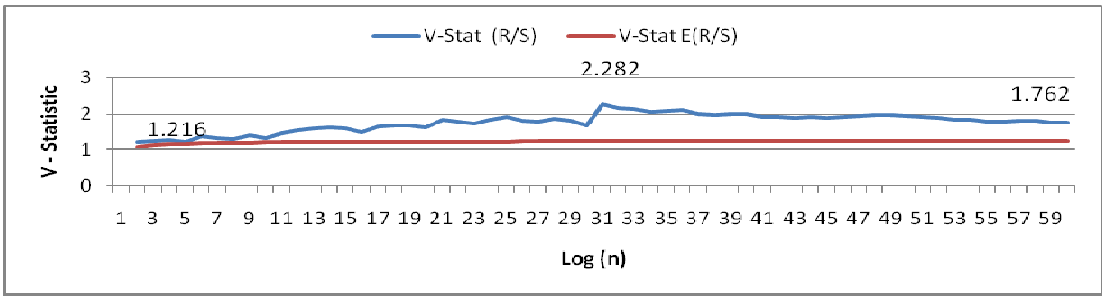
Chart-5.2

V-Statistic Charts for Selected Indices during the study period 1st April 2005 to 31st March 2017.









Source: Computed from Matlab 2013a using Microsoft Excel (Version 97-2003)

Chart 5.1. represents a plot of Log (R/S) and Log E(R/S) against (n) for selected indices of BSE and NSE Bankex and Auto for the study period from 1st April 2005 to 31st March 2017. It is understood from the above Chart 5.1 Log R/S plot scale was above to that of Log E(R/S) plot until 2600th day (1.789). After that the Log R/S was close of that of Log E (R/S) until the period of 2950th starting from 2650th day. In other words after the point 49, the deviation of Log (R/S) slope down was close to the Log E(R/S) until the period n = 2950th day. It is clearly noted that there was presence of long memory in the case selected indices.. Thus, the outcome evidenced from this study is that the selected indices returns registered long range dependence. Hence the null hypothesis (H04.2), namely, **There is no long range dependence in the returns of selected indices,** is accepted for the Selected study period. Hence the investor is advised to buy share in the market at the right time because in the next five years period, the stock price may be expected to rise.

Chart- 5.2 show that the plot of the V – Statistic for selected indices during the study period 1st April 2005 to 31st March 2017, to evaluate the movement of the Log (R/S) and Log E(R/S). The V – Statistic of Log R/S slope moved up to 1.391 on the 300th day. After that there was a decrease in V-Statistic for Log (R/S) plot 1.249 on the 350th day. It is to be noted that the growth movement of V –

Statistic for Log (R/S) 1.646 on 1500th day. After that the V- Statistic for Log (R/S) and Log E(R/S) decreased throughout the study period. It is significant that the plot of V –Statistic for Log (R/S) and Log E(R/S) was close during the whole study period and this implies that the long range dependence exists in selected indices. As a result the returns of selected indices would tend to increase in the future too.

Findings, Suggestions and Conclusion.

Major Findings of the Study

From the above study it is to be noted that all the selected sectoral indices of both Bombay Stock Exchange (BSE) and National Stock Exchange (NSE) provided same negative average returns for the Investors i.e (-0.99). The Standard deviation which measures the variation in the dataset was found to be higher for both S & P BSE and NSE Bankex which recorded a value of 0.026 and least value was found for S&P BSE and NSE Auto i.e 0.023. Skewness was found to be positive for all the selected sample returns of sectoral indices, it was found that S&P BSE& NSE Auto recorded highest skewness of 25. and least value was found that for S&P BSE & NSE bankex 17.59 the deviation from the selected sample were EIGHT. The Kurtosis which measures the degree of flatness or peakedness of the data distribution was found to be greater than three for S&P NSE auto with a value of 1087.353. Similarly, lowest Kurtosis value was noticed in both BSE and NSE Bankex i.e., 660.54 and 660.34.

From the results of Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) test of stationarity, it was found that 'P' valued less than 0.05 for all the indices of BSE and NSE which resulted in stationarity at the level difference. It was also found that ADF and PP statistics (Ignoring Sign) was greater than critical values at 1%, 5% and 10% level for all the selected BSE and NSE Sectoral indices at the level range. Therefore all the selected BSE and NSE indices confirmed stationarity at the level difference. The result of Kolmogorov – Smirnov, and Shapiro –Wilk test witnessed 'P' value of less than 0.05 for all the indices of BSE and NSE which indicated normality of data distribtion. It is noted that all the selected BSE and NSE confirmed normality.

The results of GARCH (1,1) which measures the Volatility ($\alpha + \beta$) was found greater than one of the sample indices revealing the persistence of high volatility during the study period. The volatility of selected BSE Sectoral indices reveals that the daily returns were significant at 5% risk level, both in mean and variance Equation for all the selected BSE sectoral indices was found to be Beta and Alpha value were close to one, For S&P BSE Auto 0.999604, S&P BSE Bankex 0.998646. The volatility of selected NSE Sectoral indices revealed that the daily returns were significant at 5% risk level, both in mean and variance Equation for all the selected NSE sectoral indices as the Beta and Alpha value were close to one, for NSE Auto 1.000153, NSE Bankex 0.99838.

The plot of V –Statistic for R/S and E(R/S) did not coverage for the whole study period and this implies that the S&P NSE Bankex returns showed long range dependence. The series of log R/S and log E(R/S) were identical with the random walk. This clearly shows the fact that there was no long memory in the case of S&P BSE Auto during the study period from 1st April 2005 to 31st March 2017.

V. CONCLUSION

The present study made an attempt to find the stock market prediction of selected sectoral indices listed in Bombay Stock Exchange of India Ltd and National Stock Exchange of India during the study period of twelve years from 1st April 2005 to 31st March 2017. The present study used different statistical tools, namely desriptive statistics (Mean, Standard Deviation, Skewness, and Kurtosis), Normality Test (Kolmogorov – Smirnov and Shapiro Wilk test), Stationarity Test (Augmented Dickey-Fuller and Phillip-Perron) and Volatility test (Autoregressive Conditional Heteroskedasticity Model and Generalized Autoregressive Conditionally Heteroskedasticity Model).

From the above analysis and Findings, it is concluded that Information flow determines the intensity of returns for Investors. Hence careful evaluation of Market information and its sensitivity can help investors retains and earn higher returns in stock markets.

Scope for further Study

1) Many different algorithms can be used with the neural networks.
2) Feed Forward, Bach Propagation, Multilayer Perception, Generalized feed forward could be used predict the stock market price Index.
3) Artificial Intelligent systems such as Fuzzy Inference system and adaptive neuro fuzzy inference system can be applied to predict stock market Indices.

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