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Weak Form Efficiency Of Indian Stock Market – An Empirical Analysis With Sub – Periods

Mr. Suresh T.S, M.Com, Mba M.Phil Scholar, Mr. Suresh T.S, M.Phil Scholar,
Dept. of Commerce, Sacred Heart College Thevara, Ernakulam (Dist), Kerala
Dept. of Commerce, Sacred Heart College Thevara, Ernakulam (Dist), Kerala
[1]Corresponding Author: Mr. Suresh T.S

***ABSTRACT*:** *Market efficiency of Indian stock market based on the daily return of NSE Nifty and BSE Sensex form 1 January 1994 to 31 December 2015 is tested by applying Unit root, Autocorrelation, Run test and Variance ratio methodologies for seven sub-periods based on the trends and patterns in the movements of Indian market. The unit root tests like ADF and PP proved that the Indian stock market is non-stationary and contains a unit root. The auto correlation results are also revealed high degree of dependence on previous prices, which means that previous prices are related with current prices. The strong autocorrelation behaviour of the variable leads to non stationarity situation in data series, which means that the stock market movements are not in predictable manner. The run test results also proved that there is no randomness in Indian stock market. The results from the sub periods for each test are also giving the results which support the whole study period results. It clearly proved real behaviour of Indian stock market. From the results, it is clear that the Indian stock market does not follow random walk and it is in inefficient in its weak form.*

KEY WORDS :- *Market efficiency, Weak form, Dependency behaviour of Market, Independent Movements, Random Movements*.

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I INTRODUCTION

Capital market is an institutional arrangement, which facilitates long term borrowing and lending of funds, where the investors are always interested for capital appreciation and dividend returns. An efficient capital market is one where the security prices reflect all the, relevant information. Capital Market efficiency or Stock Market efficiency is very important for the investors from the investment point of view.

In financial literature the term 'Stock Market Efficiency' is used to explain the relationship between information and share prices movement in the Capital Market of any economy. Fama (1970) provided the formal definition of 'Market Efficiency' into three categories namely weak form, semi- strong form and strong form.

Market efficiency has an influence on the investment strategy of an investor because since in an efficient market, the prices of securities will reflect the markets best estimate of their expected return and risk, taking into account all that is known about them. Therefore, there will not be any undervalued securities. If, however markets are not efficient and excess returns can be made by correctly picking winners, then it will pay investors to spend time finding these undervalued securities.

II NEED OF THE STUDY

India is one of the fastest growing economies of the world. It has a vibrant stock market that has attracted a lot of foreign institutional investments. The institutional changes such as online trading, availability of real time data and instant execution of transactions have led to increase volume of trading in Indian stock markets. Still the level of sophistication in terms of market participation and techniques is nowhere near to the developed markets (Sapate, 2013). A study to measure the market efficiency will be very relevant, if a market is efficient, stock price movements should follow a random walk and the price movements in the past should be not related to future price movements. But if the market is not efficient and price movements are not random, some investors can exploit the inefficiency by gaining abnormal returns (Alan 2012). They may be able to correctly predict the future price movements by examining the historical price movements. Especially the speculators will take such advantages.

Since there are three forms of market efficiency, but working on all the three forms is not possible in this paper because of unavailability of the data and usefulness of the results for attaining the objectives of the study. Testing the strong form of market efficiency is not possible on account of data unavailability because it

considers private or insider information which is not easily accessible, and the results of testing semi-strong form does not measures the randomness in the market returns, which is only possible through testing the weak form of market efficiency (Sharma 2011). There are many studies testing the market efficiency of Indian stock market. Majority of the study are either based on and single index, i.e Nifty or Sensex and the basic one or two tools. This study is a comprehensive study of market efficiency of Indian stock market based on NSE Nifty and BSE Sensex using Various tools.

III REVIEW OF LITERATURE

Eugene F Fama (1969) developed the theory of random walk and efficient market is defined as a market where there are large numbers of rational profit-maximizers actively competing, with each trying to predict future market values of individual securities and where important current information is almost freely available to all participants. A random walk market is defined as a market where successive price changes in individual securities are independent. **R Vaidyanathan & Kanti Kumar Gali (1994)** has conducted a research to test the weak form of efficiency of the Indian Capital Market. The randomness is tested using run test, serial correlation and filters rule and the results provide supportive evidence for the weak form of efficiency of the Bombay Stock Exchange. **Sunil Poshakwale (1996)** conducted a study on weak form efficiency of Indian Stock market over a period of 1987-1994 and the results provide evidence of day of the weak effect and that the stock market is not weak form efficient. **Eugene F Fama (1997)** made another theoretical analysis which gave explanations to the challenges of the literature on long-term return anomalies. **Elory Dimson and Massoud Mussavian (2000)** made a descriptive research on the concept of market efficiency by using event studies which is related with testing of semi strong form of markets. **Asma Mobarek & Professor Keavin Keasey (2000)** conducted a study titled, weak form efficiency of an emerging market like the Dhaka stock exchange of Bangladesh. The study seeks evidence supporting the existence of atleast weak-form efficiency of the market. The results of both non-parametric test and parametric test provide evidence that the share return series do not follow random walk model and the significant auto-correlation co-efficient at different lags reject the null hypothesis of weak form efficiency. **Gagan Deep Sharma & Mandeep Mahendru (2007)** This paper attempts to investigate the validity of efficient market hypothesis on the Securities Market by taking a sample of eleven securities listed on the BSE, and they applied the runs test and the autocorrelation tests in order to judge the efficiency of Stock Markets. **Samuel Dupernex (2007)** defined a random walk and discussed how the random walk model is associated with the idea of market efficiency, then random walk of stock price does not imply that stock market is efficient. The study gave a rough idea as to whether the stock follows a random walk when the EMH can be considered as a benchmark for measuring the efficiency of markets. **Rakesh Gupta & Parikshit K Basu (2007)** conducted a study to test the weak form of efficiency in the framework of random walk hypothesis for the equity markets in India by applying unit root test and suggested that these markets are not weak form efficient. **P K Mishra (2009)** has conducted a study to examine the weak form efficiency of efficient market hypothesis in Indian capital market in the random walk framework by using (GARCH) modelsand it provided the evidence of weak form inefficiency of the Indian Market. **P Srinivasan (2010)** examined the random walk hypothesis to determine the validity of weak-form efficiency for two major stock markets in India by using unit root tests and revealed that the null hypothesis of unit root is convincingly rejected in the case of stock market returns of two major indices and suggested that the Indian Stock Markets does not show characteristics of random walk. The empirical results did not support the validity of weak form efficiency for stock market returns of Indian Stock Exchanges. **Prof A Q Khan & Sana Ikram (2010)** conducted a study to test the market efficiency of Indian Capital Market in its semi-strong form of EMH in the context of impact of FII'S investment on Indian Capital Market. So the study revealed that there is a relationship between stock market efficiency and flow of FII'S. **Victor K Gimba (2010)** conducted a study to test the weak form efficiency from Nigerian stock market. The paper tests the weak form efficient market hypothesis of Nigerian Stock Exchange by applying Autocorrelation, run test and variance test to analyse the data. The empirical findings derived from the tests concluded that the Neigerian stock market is inefficient in the weak form. **Ambuj Gupta (2011)** conducted a critical analysis of weak form efficiency in Indian stock market based on the four Indian indexes namely, BSE 100, BSE 500, CNX 100, S&P CNX 50 for a period of five years by employing Kolmogrov Smirnov test, Unit root test, Durbin Watson Statistics and run test. The result indicated that the Indian Stock Markets are 'weak form efficient' and follow 'random-walk'. **A Q Khan, Sana Ikram & Mariyam Mehtab (2011)** conducted a study to test the efficiency of Indian Capital Market in its weak form by employing run test on BSE and NSE for the period of ten years and found that both NSE and BSE does not follow random walk model. **Anil K Sharma & Neha Seath (2011)** conducted a study to study the impact of recent financial crisis on stock market efficiency in the emerging stock market such as India. On the basis of empirical results the study concluded that Indian Stock Market does not exhibit weak form of market efficiency and thus does not follow random walk in both period 1 and period 2. **Rakesh Guptha & Junhao yang (2011)** conducted a study during the period 1997 to 2011 to test the weak form of efficiency for the two major equity

markets (BSE & NSE) in India. The results of the study were mixed. In 2007-2011 are more favourable in terms of weak form of efficiency. Especially with lower time frequency base like quarterly, whereas for earlier period 1997-2007 markets are inefficient. **M Bharath & Dr. H Shankar (2012)** was conducted a study intended to test the informational efficiency of the Indian Stock Market in the semi-strong form of efficient market hypothesis with respect to the event bonus issues announced by listed on BSE 500 companies. The study results revealed that the level of efficiency of the stock market in high so that the investors had not been able to earn abnormal returns in the sample companies. **Zabiulla (2012)** conducted a study to test market efficiency of Indian Capital Market in its weak form by using the data base of BSE Sensitivity index. The return series have a asymmetric and leptokurtic distribution and are characterised by a heavier tail than the standard normal distribution. The test results suggested that the market didnot not follow random walk and as such are not efficient in weak form. **Mr. Divyanag J Joshi (2012)** was conducted a study to test the efficiency level in Indian Stock Market and the random walk nature of the stock market. To check the randomness among them Run test is used then the results of the study showed the evidence of inefficient form of the Indian Stock Market in long run but efficient form in short run. That is the findings support the random walk hypothesis in short duration but in long run it doesn't. **Dr. Kapil Jain & Paryul Jain (2013)** conducted a study to test the randomness of Indian Stock Market using BSE SENSEX as a base index representing the Indian Stock Market and comment on its weak form of efficiency. Considering Dickey Fuller test as a better tool to assess the randomness in values, the results of the study are in support of random walk Indian Stock Market suggesting the existence of weak form of efficiency in the market. **Mr Mohad & Prof Mouhi (2013)** conducted a study to investigate whether prices of stock in BSE follows a Random walk process as required by the market efficiency theory. Result from test conducted revealed that there is no normal distribution in any of the time series for the given period under study. No time series follow random walk and technical analysis of stocks and indices can be put to use. **Haritika Arora (2013)** conducted a study to verify weak form of efficient market hypothesis and random walk hypothesis using daily data for the index of Indian Stock Market .To test the data ADF test, Auto- correlation test, ljung-Box Q test, Auto-regression, ARIMA Model, portmanteau BDS test and GARCH (1.1) model were used. Ljung-Box Q statistics, serial correlation LM test and autoregressive model confirmed the presence of linear dependences. BDS test applied on the residuals series generated by ARMA model revealed the presence of non-linear dependence. Overall results provide evidence for the absence of the weak form of efficiency and random walk hypothesis. **Sachin K & Kanlesha Sanningammanarara (2014)** conducted a descriptive research to determine whether the Indian stock market follows a random walk model. This paper takes into consideration, 23 stocks in different sectors of National Stock Exchange(NSE) and tries to investigate the efficiency of Indian Stock Market. The data for the study consist of daily closing price of 23 nifty companies of India form 1.4.2004 to 31.3.2014 in different sectors such as automobile, energy, finance, FMCG, and pharma. The random walk hypothesis is examined using a serial autocorrelation test and a non-parametric run test. The empirical results of the study show that Indian Stock Markets are weak, form inefficient. The hypothesises were rejected and the results proved that the behaviour of share price displays considerably more violations of the random walk hypothesis. **Daniel Stefan & Sorin lulian (2014)** conducted a study to test the informational efficiency of Romanian Capital Market. The study was conducted using the closing values of BET index to test the EMH unit root test, Jarque Bera test, Multiple variance ratio test and GARCH Model is used. At the Initial Dickey Fuller test for stationary showed that the logarithm series of the BET closing values is not a random walk. **Dr Ravi Kumar Gupta (2014)** conducted a study to analyse the volatility of Indian Stock Market .The results did not show evidence of random walk which means that the information regarding yesterday's indices are not effectively absorbed by today's indices. **Ghada (2014)** conducted a study to test the random walk behaviour in Damascus Securities Exchange. It was found that the daily returns do not confirm to a random walk during the period under examination. **Achal Aswathi & Dr O Leg Malafeyev (2015)** conducted a study to test the efficiency and random walk nature of Indian Stock Market. The auto-correlation results significantly differ which shows that the stock indices are biased random lime series and stock market is not weakly efficient in pricing securities. The study also suggested that correction in the stock market could be a reason for the runs.

Research Gap

The evidence from past research shows that the efficiency in stock market explains the extent to which the stock prices reflects all available information in the market and therefore by relaying upon this information one can take decisions about buying or selling stock. In an efficient market, the share price over a long period of time do not show any types of patterns and there is no systematic correlation between one movement and subsequent ones. They all follows random walk and nobody knows exactly what will happen tomorrow. Financial economists often classify efficiency into three categories based on the level of information efficiency. – The weak, Semi-strong, and Strong forms. Weak form suggest that one cannot beat the market by knowing past prices. Semi strong form efficiency suggests that one cannot consistently beat the market using publically available information, that is, cannot win knowing what everyone else knows- annual report. Strong form

efficiency states that no information of any kind can be used to beat the market. But working on all the three forms is not possible because of unavailability of data.

Many research studies have been done on weak form market efficiency. From reviewing the past studies, we identify that unit root, Serial correlation, Run test, Variance test ratio are the various tools used to test weak form efficiency The studies conducted by the researchers are also contradicting to one another. Some studies prove that Indian stock market is weak form efficient where Some other studies proves that Indian market is not weak form efficient. From the reviews, According to Fama (1997), Elory(2000), Mishra(2009), Gupta(2011),

Rakesh Gupta(2011), Bharath(2012), Divyangi(2012), Kapil(2013), Mohad(2013), Sachin(2014) et.al are in support of weak form efficiency in Indian market. But According to

Srinivasan(2010), Khan(2011), Sharma(2011), Zabiulla(2012), Haritika(2013), Ravi Gupta(2014), Ghada(2014), et.al Indian market is not weak form efficient. Studies provide different results because of the peculiarities of data and peculiarities of tool used. These variations and differences in results provide researchers opportunity to test the weak form efficiency of Indian Market for a long period and get the consistency of the result by dividing the study period in different sub- periods by applying the same statistical tools.

IV OBJECTIVES OF THE STUDY

The objectives of the study are listed below;

1. To understand the various forms of stock market efficiency.
2. To test whether the Indian Stock Market is weak form efficient or not
3. To test whether there is any difference in weak form efficiency during various sub period s in Indian stock market.

Hypothesis

In order to determine whether the Indian stock market is weak form efficient or not, it can be verified by checking some characteristics of stock market. The stock market data falls in the category of time series. Time Series data generally follows some characteristics such as, stationarity, Independency and random movement of Prices, and specifically the stock prices will follow a random walk movement. The characteristics of the Indian Stock market are verified by testing the following hypothesis.

H01: The Indian Stock market is not in Stationary form.

H02: Daily returns of Indian stock market do not exhibit significant serial correlation.

HO3: The Indian stock market follows a random sequence

H04: The Indian stock market returns follow a random walk process

Data and Data Period

Indian capital market is always represented by the major two indices viz, NSE Nifty, the index of National Stock Exchange(NSE) and BSE Sensex the index of Bombay Stock exchange (BSE). The data for the study has been collected from the official web sites of NSE and BSE. The data includes the daily closing vale of the stock indices from 1 January 1994 to 31 December 2015.

Tools for the Analysis

This study is using parametric tests namely autocorrelation and variance test ratio, and one non parametric test called run test. In the work we are also applying the unit root test to analyse the week form efficiency of Indian Capital Market.

Variables of the Study

The two variables used in the study to test the efficiency of Indian stock market, are the daily closing value of major two indices in India i.e., NSE Nifty and BSE Sensex. These indices are selected because these are enough to represent the whole Indian market.

The period of study consists daily closing value of BSE Sensex and NSE Nifty observations from 1 January 1994 to 31 December 2015. The data series of NSE nifty and BSE Sensex for the whole period (i.e. from 1-1-1994 to 31-12-2015) has been divided in to small sub-groups based on the observation of trend and patterns in the whole series line graph.

Analysis & Interpretation

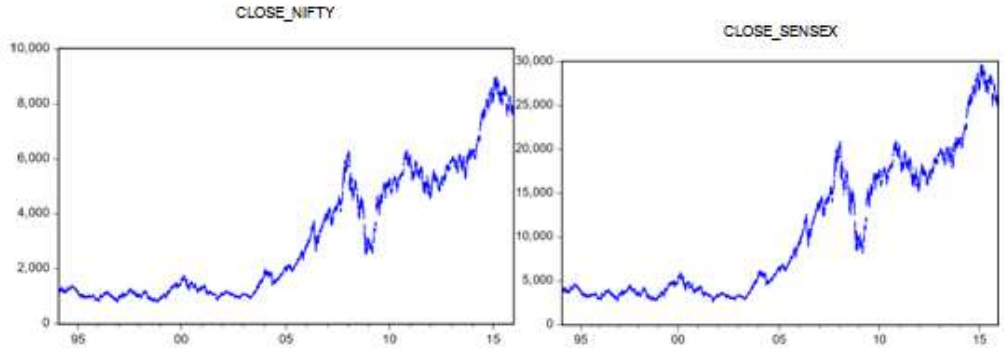
The chapter deals with the analysis and interpretation of data. The collected data were analyzed in order to have a deep understanding of the subject matter of study. In order to analyze the data both statistical and mathematical tools are used. The behaviour of stock returns has been extensively debated over the years. Researchers have examined the efficient market hypothesis (EMH) and random walk characterization of returns.

In an informationally efficient market, current prices quickly absorb information and hence such a mechanism does not provide scope for an investor to make abnormal returns (Fama 1970). In respect of empirical evidence, earlier studies have found evidence in favour and against of random walk hypothesis. In this context, an attempt is made to empirically check whether the Indian stock market follow random walk or not.
The daily closing value of NSE Nifty and BSE Sensex are the two variables used in the study to test the efficiency of Indian stock market. The whole data period of our study includes the daily closing value of both the indices form 1 January 1994 to 31 December 2015.

The basic trends and patterns of stock market movements

Line graphs are extensively used for the analysis of time series data (Robert, 1999). The basic trends and patterns of stock market movements can be explained in detail with the help of line graph. The trends of variables (NSE Nifty and BSE Sensex) of our study can be identified from their below figure 1
The data for the study consist of BSE Sensex and NSE Nifty from 1 January 1994 to 31 December 2015. Before the establishment of NSE Nifty in 1994, BSE Sensex was the single stock index to represent the Indian market. After the implementation, Nifty has gained as an important stock market index. Now a day both the NSE Nifty and BSE Sensex is considered as appropriate indicators of Indian market. The daily closing index value of Nifty and Sensex ranging from January 1994 to December 2015 were used in the study.

Figure 1 Line graph of NSE Nifty and BSE Sensex for Whole Period of study



The Figure 1 shows the line graph of NSE Nifty and BSE Sensex for the whole period of study. The line graph of NSE Nifty and BSE Sensex almost moves in a similar pattern except certain trends and variations. The graph helps us to know the market reaction, the various crisis faced by the market and the level of ups and downs. From the line graph it can also identify shapes and patterns such as V shape, W shape, Double top, Cup and holder etc.

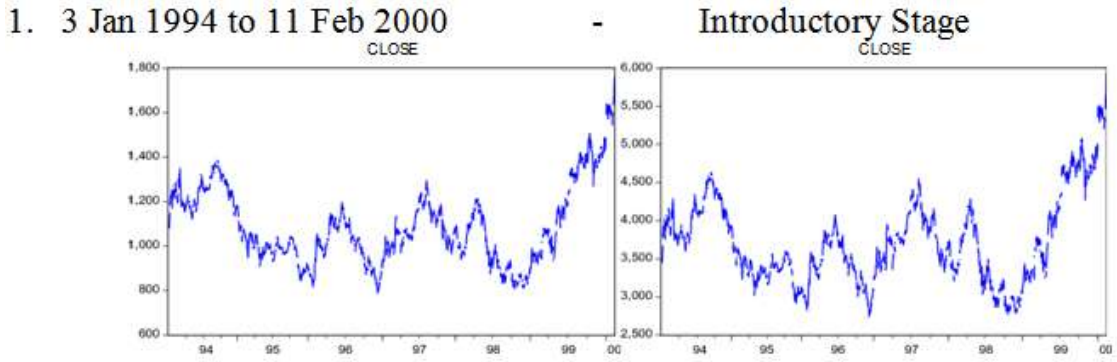
The data series of NSE nifty and BSE Sensex for the whole period (i.e. from 1-1-1994 to 3112-2015) has been divided in to small sub-groups based on the observation of trend in the whole series line graph. The classification of whole data into sub groups, makes it possible to clarifystudy the week form efficiency of India eqity market deeply.

The sub periods were named as follows

1. 3 Jan 1994 to 11 Feb 2000 - Introductory Stage
2. 14 Feb 2000 to 25 Apr 2003 - Bubble Period
3. 28 Apr 2003 to 8 Jan 2008 - Pre Crisis Period
4. 9 Jan 2008 to 21 Dec 2009 - Crisis Period
5. 22 Dec 2009 to 9 Nov 2010 - Recovery Period
6. 10 Nov 2010 to 28 Aug 2013 - Period of Shapes
7. 29 Aug 2013 to 31 Dec 2015 - Period of hope

The names were assigned to these various periods based on the trends in the period, market conditions and related factors. The line graphs are displayed as the first one is NSE Nifty and second one is BSE Sensex.

Figure No: 2 Line graph of introduction period

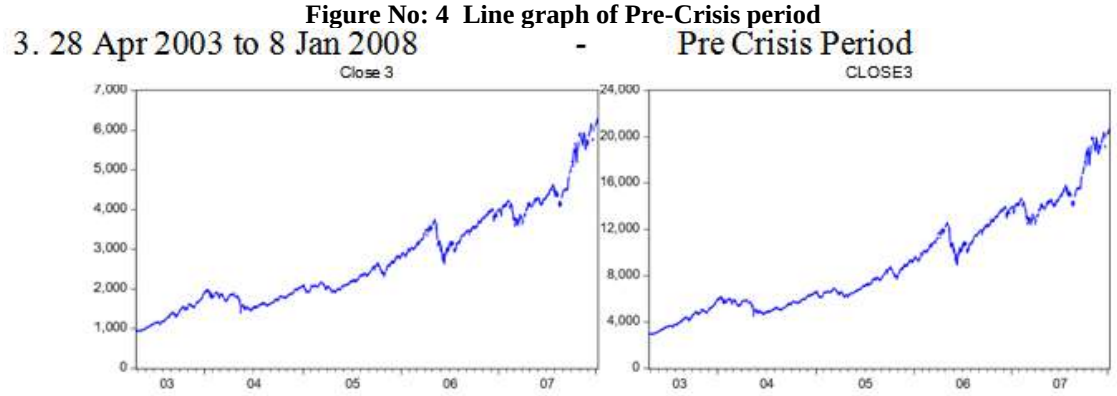


The above period is named as introductory stage because the classification is done on the basis of NSE Nifty. It is taken as the base because Nifty has more market capitalisation than Sensex. From the above graphs it is identified that the market is not stable and showing many ups and downs and different trends and shapes. The information technology boom was the major reason for the rises as stock market during the period 1997 to 2000.

Figure No: 3 Line Graph of Bubble period

The period ranging from February 2000 to April 2003 is named as bubble period. It is the period in which the stock market crashes as an aftermath of the dot-com bubble. Even if the market ups in the previous years due to the technological advancement and resulted industrialized Nation's equity value rise rapidly from growth in the Internet sector and related fields. While the latter part was a boom and bust cycle, the Internet boom is sometimes meant to refer to the steady commercial growth of the Internet with the advent of the World Wide Web. The speculative bubble bursted out in 2000, lead to a stock market crash, which affected whole stock markets in the world.

Figure No: 4 Line graph of Pre-Crisis period

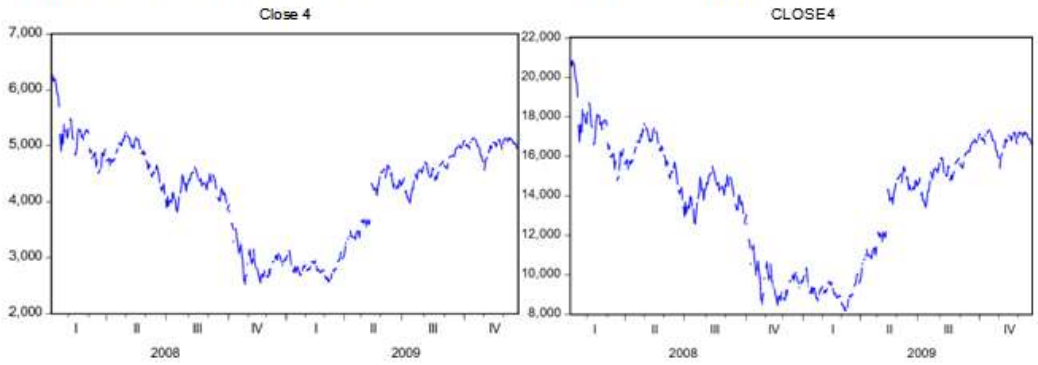


The financial crisis of 2007–09, also known as the Global financial crisis, is considered by many economists to have been the worst financial crisis since the Great Depression of the 1930s.The financial crisis is characterized by contracted liquidity in the global credit and housing market, triggered by the failure of mortgage companies, investment banks, and government institutions which had heavily invested in subprime loans (Sutradhar, 2009). Though the crisis started in 2005-06, but has become more visible during 2007-08,

when many of the renowned Wall Street firms collapsed. Then the period describes the pre-crisis period impact on Indian stock market.

Figure No: 5 Line graph of Crisis period

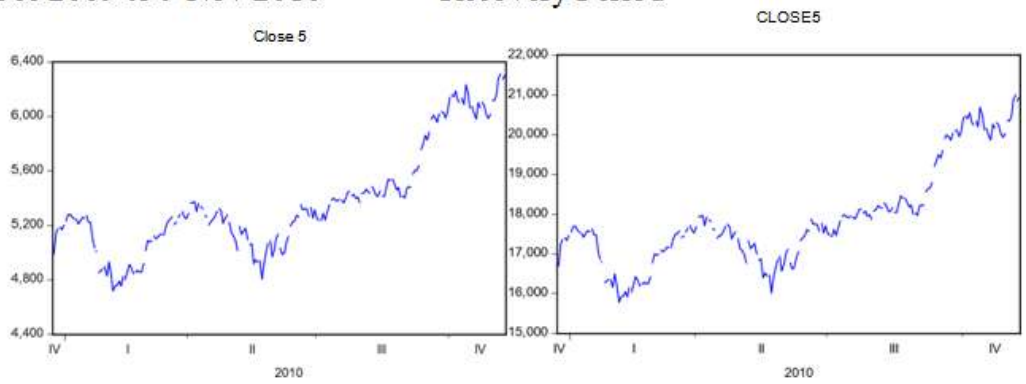
4. 9 Jan 2008 to 21 Dec 2009 - Crisis Period



The period from 9 January 2008 to 21 December 2009 shows the recession period. The US meltdown which shook the world had little impact on India market, because of India's strong fundamental and less exposure of Indian financial sector with the global financial market (RBI). Perhaps this has saved Indian economy from being swayed over instantly. When we look at the long term graph we can see this period as a v-shaped crisis period. The actual impact of global financial crisis can be measured in Indian stock market during this period

Figure No: 6 Line graph of Recovery period

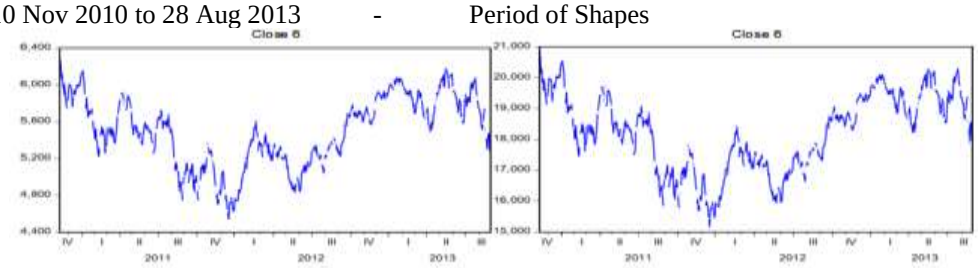
5. 22 Dec 2009 to 9 Nov 2010 - Recovery Period



The above period is named as recovery period because during this period the market was on the recovery path from the financial crisis aftermaths. It is observed that the market shows an increasing trend during the study period.

Figure No: 7 Line graph of Period of shapes

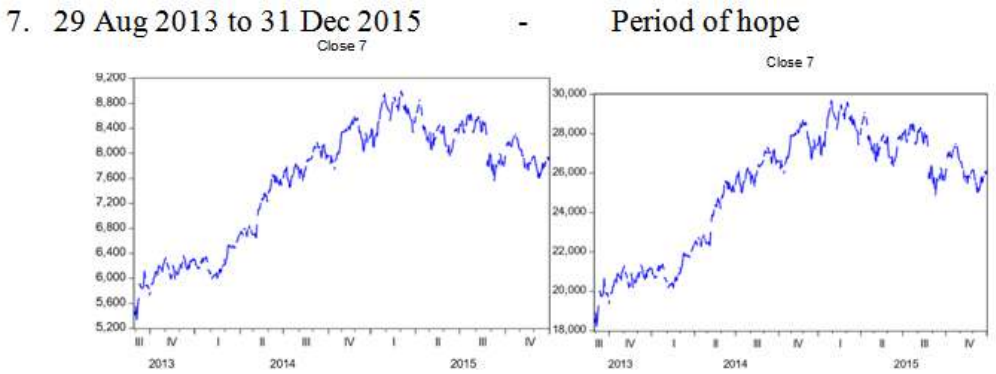
4. 10 Nov 2010 to 28 Aug 2013 - Period of Shapes



The period starting from Nov 2010 to Aug 2013 has been named as the period of shapes because when we go through the graph we can see that the market was highly volatile and we can identify many shapes and patterns

such as V shape, W shape, Double top, Double bottom, M shape and the presence of strong bullish and bearish trends.

Figure No: 8 Line graph of Period of hope



The period from Aug 2013 to Dec 2015 is named as period of hope because the new changes occurred in India especially the victory of NDA Govt. in 2014 general elections, The NDA government is more business oriented and the new political polices of them will benefits to business sector. This boosts up the growth of Indian industrial sector. New hopes of industrialist for development, feelings, and emotions of the investors are reflected in the stock market as hopes in the market during this period.

Randomness of Indian Stock Market

The random walk hypothesis is a financial theory stating that stock market prices evolve according to a random walk and thus cannot be predicted. It is consistent with the efficientmarket hypothesis. In short, this is the idea that stocks take a random and unpredictable path (Rawal,2014). The random walk can be measured with the help of various tests such as unit root, Run test, Autocorrelation, Variance test ratio.

Descriptive Statistics

In order to get more clarification about the basic characteristics of variable descriptive statistics can be used. Mean, Median, Standard Deviation, Skewness, Kurtosis and Jarque- Bera are measured and presented for various study periods.

Table No:1

Descriptive for the Whole Period		
Statistic	**NSE Nifty**	**BSE Sensex**
Mean	3157.93	10532.59
Median	1977.73	6384.940
SD	2318.27	7743.552
Skewness	0.725	0.7007
Kurtosis	2.261	2.2001
JB	601.203	588.6917
Probability	0.000	0.0000
No of Obs.	5452	5426

The basic characteristics of a normal distribution are symmetric around their mean, median, and mode of a distribution and it requires that skewness and kurtosis should be almost near to the standard values 0 and 3 respectively. The Jarque Bera test also measures the normality based on test.

Table No 1 contains the descriptive statistics of daily closing index value of NSE Nifty and BSE Sensex for the whole study period. It is clear from the figures listed in the table that the series is not normal for both the series during the whole study period. To check the consistency of normality of the variables along the different periods, the summary statistics of sub periods is also measured.

Table No: 2

Descriptive Statistics of Sub Periods of NSE Nifty							
	Introductory Stage	Bubble Period	Per Crisis Period	Crisis Period	Recovery Period	Period of Shapes	Period of Hope
Mean	1090.158	1166.766	2752.855	4190.573	5369.846	5492.642	7568.003
Median	1054.150	1104.550	2367.850	4430.700	5276.375	5522.350	7870.375

SD	171.9431	181.7044	1250.100	877.349	388.563	378.86	947.3416
Skewness	0.7919	1.012	0.764513	-0.421	0.8045	-0.254	-0.592
Kurtosis	3.432	3.5175	2.8475	2.077	2.848	2.153	1.954
JB	167.72	145.3015	116.5825	31.02	24.163	28.438	59.906
Probability	0.0000	0.0000	0.0000	0.0000	0.000006	0.000001	0.0000
No of Obs.	1493	799	1185	477	222	700	576

Table No: 3

Descriptive Statistics of Sub Periods of BSE Sensex							
	Introductory Stage	Bubble Period	Per Crisis Period	Crisis Period	Recovery Period	Period of Shapes	Period of Hope
Mean	3724.319	3668.181	9162.338	13978.03	17907.32	18209.54	25188.14
Median	3648.860	3411.920	7780.76.	14809.49	17627.98	18380.69	26113.04
SD	557.6640	653.6591	4393.231	3062.711	1262.589	1246.626	2996.919
Skewness	0.7934	1.1612	0.6923	-0.4109	0.800280	-0.23408	-0.58998
Kurtosis	3.5173	3.8623	2.5425	2.0209	2.8509	2.0799	1.947
JB	170.2691	204.3312	105.0136	32.47625	23.902	31.083	60.0271
Probability	0.0000	0.00000	0.0000	0.0000	0.0000	0.0000	0.00000
No of Obs.	1467	799	1185	477	222	700	576

The above table shows the summary statistics of the variables in different periods and it is clear that the series is not normally distributed in any of the periods of study. But the series is almost normally distributed in introductory period and Recovery period as the mean and median are almost near to each other and the skewness and kurtosis value is almost near to 0 and 3 respectively. To apply various statistical models and tools, it requires normally distributed data series, for that the series is to be smoothened by converting them in to log form. The further tools are applied on the log data except the run test as it is a non-parametric test to be applied on the raw data.

Dependency behaviour of Indian stock market

Stationarity of Data

A stationary time series is one whose statistical properties such as mean, variance and auto correlation are all constant over time (Babu, 2015). In other words, it is a quality in which the statistical parameters of the process do not change with time. In a stationarized series is relatively very easy to predict that is its statistical properties will be the same in the future as they have been in the past. Stationary is the important properties of time series data which shows the ability of the data series to explain the long and short term information. In time series econometrics, a time series that has a unit root is known as a random walk. A random walk is an example of a non-stationary time series (Shuba, 2010). As a preliminary test, it is necessary to test the stationarity of the variable by applying Augmented Dickey Fuller (ADF) and Philip Perron (PP) unit Root test. If the series is non-stationary in level form and stationary in first difference form, then it is expected that the series contains unit root.

In unit root tests we are making the decision on two bases where we will reject the null hypothesis, if the probability is less than .05 or if the test static value is more than critical values. The below table 4 and 5 shows the stationarity test results of NSE Nifty for the different periods of study

Table No: 4

ADF Test results of NSE Nifty						**PP Test results of NSE Nifty**				
Period	**Test statistic**	**Critical Values**			**Probability**	**Test statistic**	**Critical Values**			**Probability**
		1%	**5%**	**10%**			**1%**	**5%**	**10%**	
Whole Period	-2.765	-3.959	-3.410	-3.127	0.2105	-2.527	-3.959	-3.410	-3.127	0.3147
Introductory Stage	-1.069	-3.964	-3.412	-3.128	.9322	-1.141	-3.964	-3.412	-3.128	.9204
Bubble Period	-3.214	-3.969	-3.415	-3.129	.0824	-3.293	-3.969	-3.415	-3.129	.0680
Per Crisis Period	-2.982	-3.965	-3.413	-3.128	.1377	-2.902	-3.965	-3.413	-3.128	.1621
Crisis Period	-1.637	-3.3977	-3.419	-3.132	.7768	-1.617	-3.977	-3.419	-3.132	.7873
Recovery Period	-1.637	-4.00	-3.430	-3.138	.7754	-1.628	-4.00	-3.430	-3.138	.7791
Period of Shapes	-2.827	-3.971	-3.416	-3.130	.1877	-2.901	-3.971	-3.416	-3.130	.1629
Period of Hope	-1.490	-3.974	-3.417	-3.131	.8322	-1.693	-3.974	-3.417	-3.131	.7532

From the results , there is no possibility to reject the null hypothesis as the probability value is more than .05 and the test static values are less than the critical values, i.e. the daily closing values of NSE Nifty contains a unit root.
The below tables 5 shows the stationarity test results of BSE Sensex for the different study periods.

Table No: 5

Augmented Dickey Fuller (ADF) results of BSE Sensex						**Philip Perron (PP) result of BSE Sensex**				
Period	Test statistic	Critical Values			Probability	Test statistic	Critical Values			Probability
		1%	**5%**	**10%**			**1%**	**5%**	**10%**	
Whole Period	-2.483	-3.965	-3.410	-3.127	0.3363	-2.314	-3.959	-3.410	-3.127	0.4254
Introductory Stage	-1.261	-3.964	-3.413	-3.128	.08965	-1.417	-3.964	-3.412	-3.128	.8559
Bubble Period	-3.330	-3.969	-3.415	-3.129	.0621	-3.778	-3.969	-3.415	-3.129	.0551
Per Crisis Period	-3.003	-3.965	-3.413	-3.128	.1315	-2.956	-3.965	-3.413	-3.128	.1453
Crisis Period	-1.584	-3.977	-3.419	-3.132	.7980	-1.530	-3.977	-3.419	-3.132	.8180
Recovery Period	-1.593	-4.000	-3.430	-3.138	.7928	-1.625	-4.000	-3.430	-3.138	.7800
Period of Shapes	-2.710	-3.971	-3.416	-3.130	.2327	-2.917	-3.971	-3.416	-3.130	.1575
Period of Hope	-1.427	-3.974	-3.417	-3.131	.8521	-1.646	-3.974	-3.417	-3.131	.7731

The results state that BSE Sensex for the whole period and sub-periods are non-stationary.
i.e. The Indian stock market is non-stationary and contains a unit root. It's a general thing that the data which is nonstationary in level form will be stationary in first difference in this case it is essential to check the stationarity of data series in first difference and proved that the data is stationary in first difference.

Table No: 6

Unit root test in first difference of NSE					**Unit root test in first difference of NSE**			
Period	ADF		PP		ADF		PP	
	T Static	P value	T static	P value	T Static	P value	T static	P value
Whole Period	-16.753	.0000	-68.187	.0000	-16.949	.0000	-67.667	.0000
Introductory Stage	-16.278	.0000	-35.761	.0000	-16.372	.0000	-34.538	.0000
Bubble Period	-20.150	.0000	-25.116	.0000	-26.086	.0000	-26.033	.0000
Per Crisis Period	-16.472	.0000	-31.616	.0000	-25.973	.0000	-32.071	.0000
Crisis Period	-20.784	.0000	-20.782	.0000	-20.345	.0000	-20.309	.0000
Recovery Period	-15.646	.0000	-15.661	.0000	-15.450	.0000	-15.467	.0000
Period of Shapes	-15.631	.0000	-24.645	.0000	-24.723	.0000	-24.678	.0000
Period of Hope	-17.669	.0000	-21.757	.0000	-17.517	.0000	-21.828	.000

From the above results it is clear that NSE Nifty and BSE Sensex for the sub periods are nonstationary in level form and stationary in first difference, which implies that the series contains a unit root. Therefore, the market is inefficient at its weak form. The results are supported by the empirical evidence of Sharma (2011), Gupta (2013), Sachin (2014).

Test of independence of Indian stock market

Auto correlation test (serial correlation coefficient) is the most commonly used tool to test weak form efficiency.The autocorrelation function (ACF) test is examined to identify the degree of autocorrelation in a time series data. It measures the relationship between the stock return at current period and its value in the previous period. Auto correlation techniques are used if price change in one-time period is not correlated with the price change in some other time period, then the price changes are considered to be serially independent. It means that the market is efficient follows random walk.
One way to determine if there is autocorrelation in the time series is to plot the ACF with different number of lags and check if the correlation coefficient for each lag is significantly different from 0. If time series has unit root, then the autocorrelation function slowly decrease starting from the value of one and the partial correlation function has only first value which differs from zero.

Table No: 7

Autocorrelation results for the entire period of NSE Nifty and BSE Sensex

Lags	Whole Period	
	NSE	BSE
1	0.999	0.999
2	0.999	0.999
3	0.998	0.998
4	0.998	0.998
5	0.997	0.997
6	0.997	0.997
7	0.996	0.996
8	0.996	0.996
9	0.995	0.995
10	0.995	0.995
11	0.994	0.994
12	0.994	0.994
13	0.993	0.993
14	0.993	0.993
15	0.992	0.992
16	0.992	0.992
17	0.991	0.991
18	0.991	0.991
19	0.990	0.990
20	0.990	0.989
21	0.989	0.989
22	0.988	0.988
23	0.988	0.988
24	0.987	0.987
25	0.987	0.987
26	0.986	0.986
27	0.986	0.986
28	0.985	0.985
29	0.985	0.985
30	0.984	0.984
31	0.984	0.984
32	0.983	0.983
33	0.983	0.983
34	0.982	0.982
35	0.982	0.982
36	0.981	0.981

The table no.7 shows the auto correlation results of NSE Nifty and BSE Sensex for the whole study period. The test of autocorrelation is done using up to 36 lags depending upon akaike criterion. It's very interesting to note that the auto correlation results are same for both NSE and BSE. In the initial analysis it is found that both the NSE and BSE moves with similar trends and patterns, this finding is again supported by the auto correlation results. The results indicate a high degree of dependence on previous prices when the lag is low. For NSE Nifty and BSE Sensex the ACF value is ranging between 0.999 and 0.981. However, the market to be efficient in its weak form, the values of auto correlation should be around zero (Sachin,2014). That means the share prices do not follow the weak form efficiency or the market is inefficient in its weak form for the whole study period.

If the AC(1) is nonzero, it means that the series is first order serially correlated. If AC(k) dies off more or less geometrically with increasing lag k, it is a sign that the series obeys a loworder autoregressive (AR) process. If AC(k) drops to zero after a small number of lags, it is a sign that the series obeys a low-order moving-average (MA) process.

Even if the whole data period shows strong auto correlation, there may be changes in the degree of dependence in the various Sub periods. The market conditions, related factors will affect the level of dependency. The below tables No. 8 shows the auto correlation results of various sub periods of NSE Nifty and BSE Sensex.

Table No: 8

Auto correlation result of NSE Nifty								
Lags	Whole Period	Sub Periods						
		Introductory Stage	Bubble Period	Per Crisis Period	Crisis Period	Recovery Period	Period of Shapes	Period of Hope
1	0.999	0.991	0.988	0.996	0.989	0.975	0.984	0.992
2	0.999	0.981	0.976	0.991	0.978	0.954	0.967	0.983
3	0.998	0.972	0.964	0.987	0.967	0.931	0.950	0.976
4	0.998	0.962	0.952	0.983	0.956	0.909	0.934	0.967
5	0.997	0.953	0.941	0.978	0.946	0.889	0.919	0.959
6	0.997	0.944	0.928	0.974	0.937	0.869	0.906	0.951
7	0.996	0.935	0.916	0.970	0.929	0.849	0.892	0.944
8	0.996	0.927	0.905	0.966	0.920	0.833	0.878	0.939
9	0.995	0.919	0.893	0.962	0.912	0.818	0.863	0.933
10	0.995	0.911	0.881	0.957	0.905	0.800	0.848	0.927
11	0.994	0.902	0.869	0.953	0.897	0.779	0.833	0.922
12	0.994	0.893	0.859	0.949	0.889	0.757	0.821	0.916
13	0.993	0.884	0.848	0.945	0.880	0.734	0.809	0.911
14	0.993	0.876	0.838	0.941	0.872	0.708	0.798	0.906
15	0.992	0.867	0.827	0.937	0.862	0.687	0.783	0.902
16	0.992	0.859	0.816	0.933	0.853	0.666	0.768	0.898
17	0.991	0.851	0.804	0.929	0.843	0.644	0.753	0.893
18	0.991	0.843	0.793	0.924	0.832	0.623	0.738	0.888
19	0.990	0.835	0.781	0.920	0.820	0.599	0.724	0.883
20	0.990	0.828	0.772	0.916	0.809	0.575	0.710	0.877
21	0.989	0.820	0.764	0.912	0.799	0.553	0.698	0.871
22	0.988	0.812	0.756	0.907	0.790	0.530	0.686	0.865
23	0.988	0.805	0.747	0.903	0.781	0.507	0.675	0.859
24	0.987	0.797	0.738	0.899	0.774	0.484	0.664	0.853
25	0.987	0.790	0.729	0.895	0.766	0.459	0.656	0.848
26	0.986	0.783	0.719	0.891	0.757	0.436	0.647	0.843
27	0.986	0.776	0.709	0.887	0.746	0.411	0.639	0.837
28	0.985	0.769	0.700	0.884	0.735	0.392	0.631	0.833
29	0.985	0.763	0.692	0.880	0.724	0.375	0.623	0.829
30	0.984	0.757	0.684	0.876	0.713	0.357	0.616	0.825
31	0.984	0.752	0.677	0.872	0.703	0.337	0.609	0.821
32	0.983	0.747	0.669	0.868	0.693	0.317	0.600	0.817
33	0.983	0.741	0.662	0.865	0.684	0.299	0.592	0.812
34	0.982	0.736	0.656	0.861	0.674	0.283	0.583	0.808
35	0.982	0.731	0.652	0.857	0.663	0.268	0.572	0.804
36	0.981	0.724	0.648	0.853	0.654	0.250	0.563	0.800

The above table no.8 present test of autocorrelation test using up to 36 lags depending upon akaike criterion, the null hypothesis of there is no autocorrelation for stock returns of NSE Nifty.

The ACF results of various sub periods also indicate high degree of dependence on pervious prices when the lag is low. However, as the time lag increases the impact of past prices found to be reducing. Results of autocorrelation for the introductory period at time lag one is 0.991 when the lag increases the value decreases at lag 16 the ACF value is 0.859 and when it reaches to lag 36 the value is 0.724. during the bubble period the ACF values are ranging between 0.986 and 0.648 a similer value is obtained in the crisis period the value ranges between 0.989 and 0.654, during both the periods the market was in a bearish trend. during the pre-crisis period the value ranges between 0.996 and 0.853 and a similar rang is during the period of hope ie. 0.992 and 0.806 the market was on an increasing trend during both these periods. the ACF value lies around 0.984 and 0.536 during the period of shapes as the market was highly fluctuating. During the recovery period the ACF range seems to be the highest the values lies around 0.975 to 0.250. by examining the values, it is seen that the autocorrelation values start from very high values and their values decrease very slowly. If their value reaches zero as the k

increases, then the market is said to be efficient. The overall analysis of NSE Nifty for the whole period and sub periods help us to interpret that the ACF values are not laying around the zero that means the share prices do not follow a random walk and are inefficient at weak form.

Table no 9 shows the ACF results of BSE Sensex for the various sub periods of study

Table No: 9

Autocorrelation results of BSE Sensex								
Lags	Whole Period	Sub Periods						
		Introductory Stage	Bubble Period	Per Crisis Period	Crisis Period	Recovery Period	Period of Shapes	Period of Hope
1	0.999	0.990	0.986	0.996	0.990	0.975	0.984	0.992
2	0.999	0.979	0.973	0.992	0.979	0.953	0.967	0.983
3	0.998	0.968	0.960	0.988	0.969	0.930	0.950	0.976
4	0.998	0.958	0.947	0.984	0.959	0.908	0.935	0.967
5	0.997	0.947	0.935	0.981	0.949	0.887	0.921	0.959
6	0.997	0.938	0.922	0.977	0.941	0.867	0.908	0.951
7	0.996	0.929	0.909	0.973	0.933	0.847	0.895	0.944
8	0.996	0.920	0.898	0.969	0.926	0.829	0.881	0.938
9	0.995	0.911	0.885	0.965	0.918	0.814	0.867	0.933
10	0.995	0.901	0.873	0.961	0.910	0.795	0.853	0.927
11	0.994	0.891	0.861	0.958	0.903	0.773	0.839	0.921
12	0.994	0.881	0.850	0.954	0.895	0.750	0.827	0.916
13	0.993	0.872	0.839	0.950	0.886	0.727	0.816	0.910
14	0.993	0.862	0.828	0.947	0.877	0.700	0.805	0.905
15	0.992	0.853	0.819	0.943	0.868	0.679	0.791	0.901
16	0.992	0.844	0.808	0.939	0.858	0.657	0.777	0.897
17	0.991	0.835	0.796	0.935	0.849	0.635	0.763	0.892
18	0.991	0.826	0.783	0.931	0.838	0.613	0.748	0.887
19	0.990	0.817	0.773	0.927	0.827	0.589	0.734	0.882
20	0.989	0.809	0.763	0.923	0.816	0.564	0.721	0.876
21	0.989	0.801	0.756	0.920	0.806	0.542	0.709	0.870
22	0.988	0.793	0.748	0.916	0.797	0.520	0.697	0.863
23	0.988	0.786	0.740	0.912	0.788	0.496	0.686	0.857
24	0.987	0.779	0.731	0.908	0.780	0.474	0.676	0.851
25	0.987	0.772	0.722	0.905	0.772	0.449	0.668	0.846
26	0.986	0.765	0.712	0.901	0.763	0.426	0.659	0.840
27	0.986	0.758	0.704	0.897	0.752	0.402	0.651	0.835
28	0.985	0.750	0.696	0.894	0.741	0.382	0.643	0.830
29	0.985	0.743	0.689	0.890	0.729	0.365	0.636	0.826
30	0.984	0.737	0.682	0.887	0.719	0.346	0.629	0.822
31	0.984	0.731	0.676	0.883	0.708	0.326	0.623	0.818
32	0.983	0.725	0.670	0.880	0.698	0.306	0.615	0.814
33	0.983	0.719	0.664	0.877	0.689	0.288	0.607	0.810
34	0.982	0.713	0.657	0.873	0.679	0.272	0.599	0.806
35	0.982	0.707	0.655	0.870	0.668	0.257	0.589	0.802
36	0.981	0.701	0.651	0.866	0.658	0.239	0.580	0.798

The initial autocorrelation results of Nifty and Sensex for the whole period are also consistent with the results of sub-period, the ACF results is almost same for the sub-periods of Nifty and Sensex.

The ACF results of various sub periods of BSE Sensex indicate high degree of dependence on pervious prices when the lag is low. However, as the time lag increases the impact of past prices found to be reducing. Results of autocorrelation for the introductory period the value lies between 0.990 and 0.701. during the bubble period the ACF values are ranging between 0.986 and 0.651 as in the case of nifty series a similer value is obtained in the crisis period of Sensex, the value ranges between 0.990 and 0.658. During the pre-crisis period the value ranges between 0.996 and 0.866 and a similar rang is during the period of hope ranges between 0.992 and 0.798. the ACF value lies around 0.992 and 0.580 during the period of shapes as the market was highly fluctuating. During the recovery period the ACF values range the highest, the values lies around 0.975 to

0.239. The overall analysis of BSE Sensex for the whole period and sub periods help us to interpret that the ACF values are not lying around the zero that means the share prices do not follow a random walk and are inefficient at weak form. The test results are significant and it is supported by empirical evidences of sharma(2011), Jain(2013), Sachin(2014), Mohad(2013), Ghada(2014), Sunil(1996). The empirical results clearly explain that Indian share market movements may not follow a random walk and the market is inefficient at weak form.

Test the randomness of price changes in Indian stock market

Run test is a nonparametric test for serial dependence in the stock Returns, which designed to examine whether or not an observed sequence is random. A run is the frequent occurrence of the same value of a variable. The run test converts the total number of runs into a Z statistic. For large samples the Z statistics gives the probability of difference between the actual and expected number of runs. The Z value is greater than or equal to +/- 1.96, reject the null hypothesis at 5% level of significance (Sharma and Kennedy, 1977). As can be seen from the above tables, the Z statistics of daily market return is greater than +/- 1.96 then it means that the observed number of runs is fewer than the expected number of runs with observed significance level.

The null hypothesis for the run test is ***The Indian stock market follows a random sequence.*** The hypothesis is based on the belief that since the market is not normal we are expecting that the series may follow a random pattern.

The below table 10 shows the result of run tests of NSE Nifty and BSE Sensex.

Table No: 10

Run test result of NSE Nifty and BSE Sensex for the whole period

	NSE Nifty	**BSE Sensex**
Test Value[a]	1977.73	6384.94
Cases < Test Value	2726	2713
Cases >= Test Value	2726	2713
Total Cases	5452	5426
Number of Runs	10	12
Z	-73.601	-73.369
Asymp. Sig. (2-tailed)	.000	.000

Median

The above table shows the result of run test for the whole period of study of both NSE Nifty and BSE Sensex. For NSE Nifty, it is found that the Z value are more than +/- 1.96, therefore, null hypothesis for the run test is rejected at 5 percent level of significance for the whole period of NSE Nifty. When we take into consider the p value also it is 0.000 which is clearly too small than the alpha (.05) hence we can reject null hypothesis. In case of BSE Sensex also the same results is revealed. Hence it can be concluded that both the series do not follow random walk over the time period of study and for this reason both the NSE and BSE are considered to be weak form inefficient. Sharma(2011), Mohad (2013), Sachin (2014), Kapil (2013) supported the results in their empirical conclusion.

The below table 11 shows the Run test results of NSE nifty for the various periods of study.

Table No: 11

Run Test results of NSE nifty for various sub periods								
	Whole Period	Sub Periods						
		Introductory Stage	Bubble Period	Per Crisis Period	Crisis Period	Recovery Period	Period of Shapes	Period of Hope
Test Value[a]	1977.73	1054.15	1104.55	2367.85	4430.70	5276.38	5522.35	7870.38
Cases < Test Value	2726	746	399	592	238	111	350	288
Cases >= Test Value	2726	747	400	593	239	111	350	288
Total Cases	5452	1493	799	1185	477	222	700	576
Number of Runs	10	33	24	8	21	20	34	22
Z	-73.601	-36.995	-26.656	-34.032	-20.030	-12.377	-23.980	-22.269
Asymp. Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000

a. median

The table no: 11 shows the result of run test for the various sub periods of NSE Nifty. For NSE Nifty, from the first observation it can be found out that the Z value are more than +/- 1.96 in all cases therefore the null hypothesis for the run test is rejected at 5 percent level of significance for all the sub periods of NSE Nifty.

Table No: 12

Run Test results of BSE Sensex for various sub periods								
	Whole Period	**Sub Periods**						
		Introductory Stage	Bubble Period	Per Crisis Period	Crisis Period	Recovery Period	Period of Shapes	Period of Hope
Test Value[a]	6384.94	3648.86	3411.92	7780.76	14809.49	17627.98	18380.69	26113.04
Cases < Test Value	2713	733	399	592	238	111	350	288
Cases >= Test Value	2713	734	400	593	239	111	350	288
Total Cases	5426	1467	799	1185	477	222	700	576
Number of Runs	12	34	18	10	19	18	40	16
Z	-73.369	-36.591	-27.081	-33.915	-20.213	-12.646	-23.526	-22.770
Asymp. Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000

a. median

The above table no 12, shows the result of run test for the various sub periods of BSE Sensex. In case of various sub periods of Sensex, the null hypothesis for the run test is rejected at 5 percent level of significance for all the sub periods of BSE Sensex.

Therefore, in all the cases of both the NSE and BSE, the results states that the series of return is not following the assumption independent relationship of random walk model. Therefore, the study rejects the null hypothesis that the return series on the NSE Nifty and BSE Sensex follows random walk and by this evidence it is confirmed that Indian equity market is inefficient in its week form Market. The result is consistent with the literature of Sharma(2011), Mohad(2013), Sachin(2014), Kapil(2013).

Test of variance of Indian stock market returns

The hypothesis of random walk can be tested under the asymptotic distribution of both homoscedasticity. Variance ratio estimators developed by Lo and MacKinlay (1988) can be applied to test the variance of Indian Stock market with the null hypothesis of VR (q) = 1, which means that the returns follow a random-walk process. If the value does not equal to one, then it means that the series is auto correlated.

Table No:13

Variance ratio test results of NSE Nifty and BSE Sensex for the whole Period.

	NSE	**BSE**
Var ratio	1.076	1.08
Z	3.405	3.837
P	0.0026	0.0005
Df	5451	5425

The variance ratio is more than one for both the NSE Nifty and BSE Sensex for the entire sub periods of study. Variance ratio is larger than unity, which indicates that the variances grow more than proportionally with time existing thus there is a positive autocorrelation of the daily closing prices. The Z statistic is also significant at 5% level of significance so the assumption of Indian stock markets follows random walk is not acceptable there is not random walk movement in the Indian stock market and the same situation is already revealed by Gupta(2014), Victor(2010), Ghada(2014), Daniel(2014).

Table No: 14

Variance Ratio Test Results of Sub Periods of NSE Nifty					**Variance Ratio Test Results of Sub Periods of BSE Sensex**			
Periods	Var ratio	Zvalue	Df	P value	Var Ratio	Z value	Df	P value
Introductory Stage	1.07	2.170	1492	0.1146	1.10	3.036	1466	0.0095
Bubble Period	1.11	2.145	798	0.1216	1.05	0.894	798	0.8437
Per Crisis Period	1.08	1.199	1184	0.6491	1.06	1.095	1184	0.7209
Crisis Period	1.05	1.029	476	0.7642	1.07	1.471	476	0.4562
Recovery Period	1.27	0.859	221	0.8615	1.32	1.024	221	0.7674
Period of Shapes	1.06	1.857	699	0.2299	1.06	1.730	699	0.2944
Period of Hope	1.09	2.194	575	0.1081	1.09	2.087	575	0.1395

The above table no:14 shows that variance ratio test results of various sub period of NSE Nifty and BSE Sensex. It can be seen from the results that the variance ratio of all the sub periods are greater than one in both cases. Variance ratio larger than unity, which indicates that the variance grow more than proportionally

with time existing thus a positive autocorrelation of the data series can be seen. The test result is significant and it is revealed that Indian stock market does not follow random walk, Gupta(2014), Victor(2010), Ghada(2014), Daniel(2014).

V CONCLUSION

This study discussed the empirical testing of market efficiency of Indian stock market based on the daily return of NSE Nifty and BSE Sensex form 1 January 1994 to 31 December 2015. To empirically test the weak form efficiency of Indian stock market four basic tools such as Unit root, Autocorrelation, Run test and Variance ratio have been applied in the study. The whole study period is divided into 7 sub-groups based on the trends and patterns in the movements of Indian market to test the consistency of market behaviour.

Form the descriptive statistics it is clear that the Indian stock market daily closing price series does not follow a normal distribution. The log value of the variable is used for further analysis except for run tests. The unit root tests like ADF and PP proved that the Indian stock market is non-stationary and contains a unit root. The auto correlation results are also revealed high degree of dependence on previous prices, which means that previous prices are related with current prices. The strong autocorrelation behaviour of the variable leads to non stationarity situation in data series, which means that the stock market movements are not in predictable manner. The run test results also proved that there is no randomness in Indian stock market. The actual runs are less than the expected runs. The variance ratio test results are also consistent with other results. It also shows that the Indian stock market does not follow a random walk model and contains a positive correlation. The results from the sub periods for each test are also giving the result which supports the whole study period results. It clearly proved real behaviour of Indian stock market. From the results, it is clear that the Indian stock market does not follow random walk and it is in inefficient in its weak form.

The efficiency of stock market explains the extent to which the stock prices reflects all available information in the market, and therefore by relying upon the information one can take decisions about buying and selling the stocks. Relevant investment strategies can also be adopted after deciding whether the market is efficient or not. On the basis of this empirical results proved by various tests, we can conclude that the Indian stock market does not show efficiency in its weak form. The practical implication of inefficiency in stock markets is that, it may lead to the variation in the expected returns of the securities in the market. This is because the changes in the price of securities would be more than the expectation on arrival of some new information in the market. In other words, there is possibility of earning extra income in the Indian market because abnormal returns are possible only when the market is inefficient as the future prices can be predicted using the past information. Thus, observation and the use of the past behaviour of stock price movement may help investors in generating excess profits.

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