Testing the Weak Form Efficiency with Respect to Sectoral Indices of National Stock Exchange Limited, India

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Abstract

The capital market is a vital institution as it facilitates economic development of a country. Investors need to know the efficiency of the stock market to invest their hard-earned money in a profitable way, while the policy makers need the latest information about different indices to devise appropriate policies. Thus, the efficiency of sectoral indices could also help the government to identify efficient sectors and to channel available resources for the growth of such sectors. This paper proposes to investigate the capital market efficiency in NSE (National Stock Exchange) sectoral indices by using daily share price returns. The aim of this study was to examine the weak form efficiency of the selected indices listed in NSE. The study found from the results of sectoral indices that NSE could not be considered under weak form efficiency during the study period.

Keywords : capital market, sectoral indices, NSE indices, runs test, and autocorrelation function test

JEL Classification: C22, C58, G10, G14.

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Capital market is defined as a market dealing in medium and long-term securities. It is an institutional arrangement for borrowing medium and long-term funds and which provides facilities for marketing and trading of securities such as shares, debentures, bonds, and so forth. Successful investors make money by purchasing stocks when they are undervalued and sell them when their price rises to meet or exceed their intrinsic value. Investors and academics have a wide range of viewpoints on how efficient the stock market actually is, as reflected in the strong, semi-strong, and weak versions of the efficient market hypothesis (EMH). The concept of efficient market hypothesis (EMH) explains how an anticipated price of an asset fluctuates randomly in the market. It has been widely accepted by academic researchers (Burton & Fama, 1970).

The notion of randomness in stock prices looks at measures of short-run serial correlations between successive stock price changes. It is also viewed that the stock market has no memory and ,therefore, the way a stock price behaved in the past is not useful in driving how it will behave in the future (Weiss, 1964). Another work by Lo and Craig (1999) found that short-run serial correlations are not zero, and that the existence of "too many" successive

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moves in the same direction enabled researchers to reject the hypothesis that the stock prices behave as true random walks.

Fama (1998) surveyed a considerable body of empirical work on "event studies" that sought to determine if stock prices responded efficiently to information. The "events" included announcements such as earnings, stock splits, dividend actions, mergers, new exchange listings, and initial public offerings. Burton and Fama (1970) found that apparent under-reaction to information is about as common as overreaction, and post event continuation of abnormal returns is as frequent as post event reversals. They also found that the share prices, under the weak form efficiency, reflect all the information found in the record of past prices and volumes. This means that there is no relationship between the past and future price movements.

✦ **Stock Markets in India :** There are 23 stock exchanges in India. Among them, two are national level stock exchanges, namely, Bombay Stock Exchange (BSE) and National Stock Exchange of India (NSE). The trade and business of the entire country is dependent on the performance of these two stock exchanges. The National Stock Exchange was incorporated in November 1992 as a tax-paying company unlike other stock exchanges in the country. The National Stock Exchange (NSE) is considered to be the leader in the stock exchange scenario in terms of the total volume traded. The National Stock Exchange provides access to investors from all across the country on an equal footing. Hence, in the present study, an attempt has been made to analyze the NSE sectoral indices.

Review of Literature

An attempt has been made in this section to review the earlier research works undertaken in the area of capital market efficiency to understand the research gap and methodology adopted by other researchers and findings of earlier studies.

Squalli (2006) compared the sectors of Dubai Financial Market (DFM) and the Abu Dhabi Securities Market (ADSM) using daily sectoral indexes between 2000 and 2005. The variance ratio tests rejected the random walk hypothesis in all sectors of the UAE financial markets except in the banking sector of the DFM. The runs test found that the ADSM was under weak-form efficient. Loh (2007) tested the weak form efficiency based on the practitioner's approach. By applying technical trading rules to data on five Asian-Pacific stock markets, the evidence clearly suggested that a test for weak form efficiency based only on trend indicators was noisy. The study found that the weak form efficiency was determined by factors other than technological progress.

Al - Abdulqader, Hannah, and Power (2007) examined the weak form of the efficient market hypothesis (EMH) for the Saudi Stock Market. Two different trading strategies were tested on weekly data for 45 sample companies spanning a period from 1990 to 2000. There was some evidence of predictability in share returns and the support for EMH was stronger than in previous studies. The efficiency of the Saudi Stock Market may be attributed to technological and regulatory developments introduced by the Saudi Government. Kim and Shamsuddin (2008), using Monte Carlo (non-parametric tests), found that the Hong Kong, Japanese, Korean, and Taiwanese markets were efficient in the weak form. The markets of Indonesia, Malaysia, and Philippines did not show any sign of market efficiency. The study found that the Singaporean and Thai markets became efficient after the Asian Crisis.

Ozdenir (2008) studied the efficient market hypothesis for the Istanbul Stock Exchange National 100 (ISEN 100) price index. The study found that the ISEN 100 Index did not follow the random walk during the period. Frimpong (2008) studied the weak form efficient market hypothesis in respect of the Ghana Stock Exchange (GSE), a developing market. The GSE daily returns series exhibited volatility clustering, an indication of inefficiency on the GSE. Hence, the weak form efficient market hypothesis was rejected.

Punithavathy and Queensly Jeyanthi (2008) attempted to test the weak form efficiency of National Stock

Exchange of India at the time of Rolling Settlement. The empirical results exhibited that the National Stock Exchange of India was efficient in absorbing the structural changes that took place in the rolling settlement. This ensures the weak form of market efficiency.

Mobarek, Mollah, and Bhuyan (2008) found that the return series on Bangladesh's Dhaka Stock Exchange (DSE) was independent and followed the random walk model. The sample primarily included all the listed companies on the DSE daily price index, over a period 1988 to 2000. The security returns did not follow the random walk model and the significant auto-correlation coefficient, at different lags rejected the null hypothesis of weak form efficiency. Lim (2009a) studied the weak form efficient market hypothesis (EMH). The study discussed the limitations of absolute market efficiency and surveyed some measures proposed for assessing relative efficiency in the extant literature. Lim (2009b) examined the existence of nonlinear serial dependence in five stock markets in the Middle East and Africa. The stock returns contained predictable nonlinearities that contradicted the unpredictable criterion of weak-form efficient markets hypothesis.

Jarrett (2010) indicated the existence of certain time series characteristics in daily stock returns of four small Asian (Pacific basin) financial markets. The study found that there were predictable properties of the time series of prices of traded securities on organized markets in Singapore, Malaysia, Korea and Indonesia. The study found that four of the smaller Pacific-basin stock markets recorded predictable properties which indicated to that the weak-form EMH did not hold for these markets. Walid (2010) tested the weak-form efficiency, using GARCH-M (1, 1) approach, along with state-space time-varying parameters for 11 Arab stock markets. All markets showed high sensitivity and they were found to be weak-form inefficient.

Alexeev and Tapon (2011) tested weak form efficiency in respect of individual stocks rather than a stock market index. The study found that the weak form efficiency on the TSX could not be rejected and some sectors of the Canadian Economy appeared to be less efficient than others. Kim, Shamsuddin, and Lim (2011) determined the strong evidence of time-varying return predictability of the Dow Jones Industrial Average Index from 1900 to 2009. During market crashes, no statistically significant return predictability was observed but return predictability was associated with a high degree of uncertainty. The study found that the return predictability was associated with stock market volatility and economic fundamentals. Rajesh, Ramkumar, Selvam, Vanitha, Gayathri, and Karpagam (2012) tested 13 sectoral indices of BSE and examined the market efficiency. The study found that the returns of eight indices out of 12 indices, namely, BSE Automobile Index, BSE Bankex, BSE capital Goods Index, BSE Consumer Durables Index, BSE Health Care Index, BSE Metal Index, BSE PSU Index and BSE Realty Index, followed normal distribution and earned better return.

Nurunnabi (2012) studied the weak-form efficiency in emerging economies. The level of efficiency could not be generalized because they were quite different in socio-cultural and political settings, including the behavioral aspects of investors and the strength of the capital market. Lim and Luo (2012) examined the weak-form efficiency of 14 Asian stock markets. The revealed shows that all the return series were not MDSs, indicating the presence of return predictability and hence market inefficiency. Lingaraja, Selvam and Vasanth (2014) investigated the efficiency of stock market and volatility behavior of eight Asian Emerging Market Indices. This study used the secondary daily time series data for a period of 10 years. The study found that there were significant evidences of market efficiency and randomness distribution in these emerging Asian Markets.

Aumeboonsuke and Dryver (2014) tested weak form efficiency by using data snooping for eight major stock market indices in Asia. According to authors, it was better to use a test that did not require data snooping, like the runs test for examining Weak Form Efficiency. Azad, Azmat, Fang, & Edirisuriya (2014) investigated how unchecked manipulations could cause frequent trade-induced manipulations and weak-form market inefficiency in South Asian stock markets like Bombay Stock Exchange (BSE), Dhaka Stock Exchange (DSE), and Karachi Stock Exchange (KSE). The study provided conclusive evidence of market inefficiency in these markets. It was found that there existed market-wide trading-induced manipulations where excessive buying and selling caused prices to inflate artificially before crashing down. It was found that South-Asian markets were inefficient in the weak-form.

Objectives of the Study

The study was based on the following objectives.

(1) To examine the stationarity and randomness of share price returns of NSE sectoral indices.

(2) To analyze the efficiency in the share price returns of NSE sectoral indices.

Materials and Methods

(1) Statement of the Problem : Since the Capital Market is essential for the progress of profitable development, more number of parties are interested in knowing the efficiency of the Capital Market. Small and medium investors in countries like India could be motivated to save and invest in the capital market only if their securities in the market are suitably priced. But many people suffer due to lack of awareness on how to invest their hard earned money in appropriate indices in the Indian stock market. Besides, majority of retail investors do not have an idea about which index is best to invest their money in Indian stock market.

The information about development of economy and performance of indices should be provided to the investors and other stakeholders on a periodical basis. The performance of each industry of economy gets reflected through sectoral indices. There are a few earlier studies which tested the efficiency of global stock markets in general and the random walk for various popular indices in particular. But in India, very few studies have examined the daily, weekly and monthly returns of stock indices like CNX Nifty, CNX 100 Index, CNX 200 Index, CNX 500 Index, CNX Midcap and Small Cap Index, CNX Nifty Junior, and so forth. It is to be noted that no researcher in India has compared the index returns among different sectoral indices in previous studies. Besides, there has been no comprehensive study carried out to test the efficiency of companies under different sectors and sectoral indices of a stock exchange in the Indian context. Hence the present study proposes to investigate the efficiency of Sectoral Indices, used in National Stock Exchange (NSE), by using the daily returns.

Hypotheses of the Study

In the light of the objectives of this study, the following three null hypotheses were developed and tested.

- **NH1:** There is no stationarity in the returns of NSE sample sectoral indices
- **NH2:** There is no random distribution in the returns of NSE sample sectoral indices.
- **NH3:** There is no weak form efficiency in the returns of NSE sample sectoral indices.

Methodology of the Study

(1) Sample Selection : The study attempted to test the behavior of Sectoral Indices in Daily Index Returns. The sample indices were taken from NSE Sectoral Indices. There are a total of 11 indices listed in NSE as on December 2014. The sample indices were selected, based on its top turnover value, as on 12.12.2014. As the required information was available for only nine indices, the study covered only nine indices. The details of sample indices are given in Table 1.

(2) Sources of Data : The study mainly depended on secondary data. The required data regarding daily index returns of NSE Sectoral Indices were collected from the CMIE Prowess Corporate Database and NSE official websites such as www.nseindia.com. The other required data were collected from various books, journals, and magazines.

Table 1. List of Selected Sectoral Indices and their Turnover Value in National Stock Exchange

Sl. No	Sectoral Indices	Turnover Value (in ₹ Crs) as on 12. 12.2014
1	CNX Auto Index	1097.38
2	CNX Bank Index	1651.15
3	CNX Energy Index	1084.51
4	CNX Finance Index	1898.52
5	CNX FMCG Index	526.17
6	CNX IT Index	1563.17
7	CNX Metal Index	814.55
8	CNX Pharma Index	680.84
9	CNX PSU Bank Index	1127.72

Source: www. nseindia.com

(3) Period of the Study : The study was an attempt to test the efficiency of the Indian Capital Market by analyzing the share price returns of sample indices from National Stock Exchange Ltd., during the study period from April 1, 2004 to March 31, 2014 (Total Observations = 2483).

(4) Tools Used for Analysis : For the purpose of analysis of sectoral indices in the National Stock Exchange Ltd. the following tools were used.

(i) Descriptive Statistics : Descriptive Statistics were used to identify the measure of average return and risk. Measures of central tendency include the mean while measures of variability include standard deviation, skewness, and kurtosis. Descriptive statistics provided a useful summary of security returns and the historical account of return behavior. Although past information is useful in any analysis, one should always consider the expectations of future events.

(ii) Mean : Mean is the average value of the series, obtained by adding up the series and dividing by the number of observations. It is the most common measure of central tendency. The mean is calculated by using the following formula :

$$\text{Mean}\,(\bar{x}) = \frac{\Sigma\, xi}{n}$$

where,

$\bar{x}$ = represents the mean,
Σ = Symbol of Summation
Xi = Value of the ith item x, $i = 1, 2, 3 \ldots . n$,
n = total number of items

(iii) Standard Deviation : Standard Deviation is the square root of the mean of the squared deviation from the arithmetic mean. It measures the absolute dispersion, greater the standard deviation, greater will be the magnitude of the deviation of the values from their mean. A small standard deviation means a high degree of uniformity of the observation as well as homogeneity of a series. A large standard deviation means just the opposite. The standard deviation of a random variable X is defined as:

$$\sigma = \sqrt{E\left((X - E(X))^2\right)} = \sqrt{E(X^2) - (E(X))^2}$$
$$= \sqrt{Var(X)}$$

where,
$E(X)$ is the expected variable of X
$Var(X)$ is the variance of X.

(iv) Skewness : Measures of skewness tells us the direction and the extent of skewness. Skewness is a measure of symmetry, or more precisely, the lack of symmetry. A distribution of data set is symmetric if it looks the same to the left and right of the centre point. The skewness for a normal distribution is zero and any symmetric data should have skewness near zero. Negative values for the skewness indicate that data are skewed left and positive values for the skewness indicate that data are skewed right. The skewness is calculated as follows :

$$\gamma_1 = \frac{\mu_3}{\sigma_3}$$

where,
$\mu_3$is the third movement about the mean,
$\sigma_3$is the standard deviation.

(v) Kurtosis : Kurtosis measures the amount of peakedness of distribution. A distribution flatter than normal distribution is called platykurtic. A distribution more peaked than the normal distribution is referred to as leptokurtic. Between these two types of distribution, there is a distribution which is normal in shape, referred to as a mesokurtic distribution. A negative kurtosis value implies a platykurtic distribution and a positive kurtosis value implies a leptokurtic distribution. The kurtosis is defined as :

$$\gamma_1 = \frac{\mu_4}{\sigma^4}$$

where,
μ_4 is the fourth movement about the mean,
σ is the standard deviation.

(vi) Augmented Dickey Fuller Test : In statistics and econometrics, an Augmented Dickey Fuller (ADF) Test is a test for a Unit Root in a time series sample. It is an augmented version of the Dickey Fuller Test for a larger and more complicated set of time series models. In the Augmented Dickey Fuller Test Statistic, more negative the number, stronger the reason for the rejection of the hypotheses and there is a Unit Root at some level of confidence. The ADF Test is calculated as follows :

$$\Delta y_t = \alpha + \beta_t + \gamma y_{t\text{-}1} + \delta 1 \Delta y_{t\text{-}1} + \cdots + \delta_p \Delta y_{t\text{-}p} + \varepsilon_t,$$

where,
α is a constant, β the coefficient on a time trend and p the lag order of the autoregressive process. Imposing the constraints $\alpha=0$ and $\beta=0$ corresponds to modeling a random walk and using the constraint $\beta=0$ corresponds to modeling a random walk with a drift.

(vii) Runs Test : Runs Test is used for measuring market performance. It does not require specification of the probability distribution. It depends only on the share price. It is essentially concerned with direction of changes in price. The randomness of the sample can be tested by using the Runs Test. A run is defined as the sequences of

identical occurrence of the elements (numbers or symbols), preceded or followed by different occurrence of the elements or by no elements at all. The following formula is used for the runs test :

$$M = \frac{N(N+1) - \Sigma^{3}_{i=1} n^{2}_{i}}{N}$$

where,

M = Expected number of runs,
ni = Number of price changes of each sign (*I* =1,2,3),
N = Total number of price changes.

(viii) Autocorrelation : Autocorrelation is the statistical tool used for measuring the indices successive terms in a given time series and dependence of the successive share price changes. One way to test for randomness in stock price changes is serial correlations (also called as Autocorrelation). If such auto correlations are negligible, the price changes are considered to be serially independent. Numerous serial correlation studies, different stocks, different time lags, and different time period, have been conducted to detect serial correlations. The following formula is used for autocorrelation :

$$M = \frac{\sum_{t=1}^{n-k} (R_t - \overline{R})(R_{t+k} - \overline{R})}{\sum_{t=1}^{n} (R_t - \overline{R})^2}$$

where,
K is the number of lags,
Rt represents the real rate of return,
n is the total number of observations,
Pk is the sample autocorrelation function for the lag K.

Analysis and Results

Analysis of Market Efficiency in NSE

The present study analyzed the stationarity and randomness of share price returns of NSE Sectoral returns. For the purpose of this study, the analysis of market efficiency of sample indices was made as follows:

(1) Results of descriptive statistics of index returns for NSE,

(2) Results of augmented Dickey Fuller test of index returns for NSE,

(3) Results of randomness for NSE sample sectoral indices by using runs test, and

(4) Analysis of market efficiency for NSE sample sectoral indices by using autocorrelation function test.

(1) Results of Descriptive Statistics of Index Returns for NSE : Table 2 presents the statistical description of index returns for National Stock Exchange (NSE). Descriptive statistics like mean, standard deviation, skewness and kurtosis were used. Statistical description was used to find out whether the data indicated normality or not. The results of descriptive statistics, for daily returns of the NSE sectoral indices (CNX Auto Index, CNX Bank Index, CNX Energy Index, CNX Finance Index, CNX FMCG Index, CNX IT Index, CNX Metal Index, CNX Pharma Index and CNX PSU Bank Index), during the study period from 01st April 2004 to 31st March 2014, in the Table. It is to be noted that among sample indices, the mean average returns for CNX Finance Index (0.0009) and

CNX FMCG Index (0.0009) were good compared to that of all other sectoral indices taken for this study. CNX Finance Index and CNX FMCG Index earned better return among selected sample indices. The values of standard deviation of return ranged from 0.01259 (CNX Pharma Index) to 0.02456 (CNX Metal Index) during the study period. The CNX Metal Index earned the highest standard deviation of 0.02456, which revealed the highest degree of risk. On the other hand, CNX Pharma Index recorded the lowest standard deviation of 0.01259, which indicated the lowest degree of risk during the study period.

According to the analysis of mean and standard deviation, two sample indices, namely, CNX Finance Index and CNX FMCG Index earned the same value (0.0009) of mean average returns. But CNX FMCG Index recorded low risk. It is clearly understood that the CNX FMCG Index earned high return as well as moderate risk during the study period. The analysis of skewness clearly indicated both positive and negative values for NSE indices. The positive value was recorded for CNX Bank Index (0.113), CNX Finance Index (0.178) and CNX Metal Index (0.685) and the other sample indices received negative value over the study period. According to the analysis of kurtosis, values for all sample indices were positive during the period of study. It is clear that all the sample indices earned values over the level of three. It is to be noted that any value above three indicates leptokurtic. The overall analysis of the Table shows the fact that CNX FMCG Index alone earned more return and suffered moderate risk. The analysis of skewness and kurtosis indicated that the returns of sample indices were not normally distributed over the period.

(2) Results of Augmented Dickey Fuller Test of Index Returns for NSE : A unit root is a necessary condition for a random walk. Hence the Augmented Dickey-Fuller test was used to test the null hypothesis of a unit root. The results of Augmented Dickey-Fuller for a unit root, for NSE's indices, during the study period, are presented in Table 3. The test critical values for all sample indices were analysed at 1%, 5% and 10% level of significance. The probability value for all the nine sample indices was zero. It is to be noted that the statistical values for all sample indices were negative, with values of -43.74659 for CNX Auto Index, -43.66923 for CNX Bank Index, -46.73299 for CNX Energy Index, -35.00676 for CNX Finance Index, -49.12257 for CNX FMCG Index, -47.10283 for CNX Pharma Index and -43.36753 for CNX PSU Bank Index during the study period. Besides, the statistical values for all sample indices were less than that of test critical values at 1%, 5% and 10% significant level. This indicated the fact that the returns data of all the nine sample companies attained stationarity. Thus, the null hypotheses (NH1) that there is no stationarity in the returns of NSE sample sectoral indices, is rejected.

(3) Results of Randomness for NSE Sample Sectoral Indices by Using Runs Test : The Runs Test converts the total number of runs into a *Z* statistic. For large samples, the *Z* statistics gives the probability of difference

Table 2. Results of Descriptive Statistics for NSE Sample Sectoral Indices During the Study Period from 01.04.2004 to 31.03.2014

Name of the Indices	Mean	Standard Deviation	Skewness	Kurtosis
CNX Auto Index	0.0008	0.01564	-0.046	5.922
CNX Bank Index	0.0008	0.02137	0.113	5.827
CNX Energy Index	0.0005	0.01731	-0.320	10.002
CNX Finance Index	0.0009	0.02061	0.178	6.878
CNX IT Index	0.0009	0.01394	-0.281	5.191
CNX Metal Index	0.0005	0.02574	-17.463	616.263
CNX Pharma Index	0.0007	0.01259	-0.338	7.392
CNX PSU Bank Index	0.0006	0.02256	-0.009	4.696

Source: Collected from Prowess Corporate Database and computed using SPSS (Version 19)

Table 3. Analysis of ADF Test for NSE Sample Sectoral Indices During the Study Period from 01.04.2004 to 31.03.2014

Name of the Indices	Statistical Value	1%	5%	10%	Probability Value
CNX Auto Index	-43.74659	-3.432779	-2.862499	-2.567326	0.0000000
CNX Bank	-43.66923	-3.432779	-2.862499	-2.567326	0.0000000
CNX Energy Index	-46.73299	-3.432779	-2.862499	-2.567326	0.0000000
CNX Finance Index	-35.00676	-3.432779	-2.862499	-2.567326	0.0000000
CNX FMCG Index	-49.12257	-3.432779	-2.862499	-2.567326	0.0000000
CNX IT Index	-50.20008	-3.432779	-2.862499	-2.567326	0.0000000
CNX Metal Index	-45.33748	-3.432779	-2.862499	-2.567326	0.0000000
CNX Pharma Index	-47.10283	-3.432779	-2.862499	-2.567326	0.0000000
CNX PSU Bank Index	-43.36753	-3.432779	-2.862499	-2.567326	0.0000000

Source: Collected from PROWESS Corporate Database and Computed using E Views (Version 7)

Note: Critical Value at 1%, 5%, and 10% level of significance.

Table 4. The Results of Runs Test for NSE Sample Sectoral Indices During the Study Period from 01.04.2004 to 31.03.2014

Name of the Indices	Number of Runs	*Z* Value*	Significant Value
CNX Auto Index	1157	-3.622	0.000
CNX Bank Index	1150	-3.925	0.000
CNX Energy Index	1236	-0.461	0.645
CNX Finance Index	1149	-3.946	0.000
CNX FMCG Index	1200	-1.903	0.057
CNX IT Index	1195	-2.104	0.035
CNX Metal Index	1183	-2.603	0.009
CNX Pharma Index	1180	-2.700	0.007
CNX PSU Bank Index	1135	-4.284	0.000

Source: Collected from PROWESS Corporate Database and Computed using SPSS

Note: * Z value calculated at 5% level of Significance

between the actual and expected number of runs. The *Z* value was greater than or equal to ± 1.96 and hence the null hypothesis needs to be accepted at 5% level of significance (Sharma & Kennedy, 1977).

The results of Runs Test, for the daily share price returns of the sample indices, during the study period from 2004 to 2014, are given in Table 4. For the purpose of analysis, 2483 observations for each index were taken during a period from 01st April 2004 to 31st March 2014. Runs for the sample indices were - CNX Auto Index (1157 runs), CNX Bank Index (1150 runs), CNX Energy Index (1236 runs), CNX Finance Index (1149 runs), CNX FMCG Index (1200 runs), CNX IT Index (1195), CNX Metal Index (1183 runs), CNX Pharma Index (1180 runs), and CNX PSU Bank Index (1135 runs). The analysis of runs test clearly indicated that the returns data of all sample indices earned negative Z values i.e -3.622 (CNX Auto Index), -3.925 (CNX Bank Index), -0.461 (CNX Energy Index), -3.946 (CNX Finance Index), -1.903 (CNX FMCG Index), -0.035 (CNX IT Index), -2.603 (CNX Metal Index), -2.200 (CNX Pharma Index), and -4.2820 (CNX PSU Bank Index). According to the results of Table 4, the returns data clearly revealed that Z values of two sample indices namely, CNX FMCG Index (-1.903) and CNX IT Index (-0.035) were randomly distributed, with values falling in between ± 1.96. The remaining seven indices earned negative Z values outside the value of ± 1.96 during the study period. In other words, the

results of runs test to individual indices daily share return clearly indicated that among the nine indices, Z values of seven indices were negative and greater than ±1.96. Hence the Null Hypothesis (NH2), namely, There is no random distribution in the returns of NSE sample Sectoral Indices, is accepted.

(4) Analysis of Market Efficiency for NSE Sample Sectoral Indices by using Autocorrelation Function : Autocorrelation Test is the most commonly used tool to test the weak from efficiency. It measures the correlation between series of returns and lagged series and examines whether the correlation coefficients are significantly different from zero.

The Table 5 shows the results of autocorrelation, for daily returns of the NSE sectoral indices, during the study period from 1st April, 2004 to 31 March 2014. A maximum of 30 lags were considered for the analysis during the study period. The results of CNX Auto Index revealed the fact that the values of autocorrelation coefficients were significant at 5% level of significance, with positive values of 0.131 for 1st lag and 0.064 for 10th lag. It is worth noting that the values of other lags were found insignificant at 5% level. The analysis of CNX Bank Index clearly showed that out of 30 lags, the value of only one lag (1st lag) was significant while the values of remaining lags were insignificant at the 95% confidence level during the study period. The autocorrelation analysis was performed for 30 lags in respect of daily returns of CNX Energy Index during the study period. It was found that the autocorrelation coefficients for 1st lag, and 14th lag for CNX Energy Index were significant at 5% level of significance. The analysis of CNX Finance Index revealed that out of 30 lags, only one lag (1st lag of 0.126) was significant and positive. The coefficient values for all the lags were insignificant at 5% level during the study period. The analysis of CNX FMCG Index showed that the value of autocorrelation coefficient was significant at 95% confidence level, with a positive sign for only one lag (14th lag). It is seen that out of 30 lags, all the lags were insignificant, except one lag (i.e 14th lag of 0.058). The autocorrelation for daily returns for CNX IT Index was computed for 30 lags. The analysis of co-efficient helps us to find out whether any of the price changes for 30 lags is likely to be of much help in predicting tomorrow's change. From the analysis of autocorrelation coefficient, it is noted that lag 9 was positively significant, with a value of more than 0.050 during the study period.

The autocorrelation analysis of CNX Metal Index, as given in the Table 5, covered 30 lags of daily returns during the study period. It is found that the autocorrelation coefficient of the 1st and 9th lag of daily returns data were significant at the 95% confidence level. The highest magnitude of coefficient was 0.096 at lag one. Regarding the analysis of CNX Pharma Index, the values of autocorrelation coefficients were significant at 5% level, with positive signs for 1st, 13th and 28th lags. It is significant that the highest magnitude of coefficient was 0.087 at lag 13 and the lowest magnitude of coefficient (0.51) was registered at lag 28 which was positive and significant at 95% confidence level during the study period. The analysis of CNX PSU Bank Index showed that the value of autocorrelation coefficient was significant at 95% of confidence level, with a positive sign for only two lags (1st & 9th lag). It is seen that out of 30 lags, all lags were insignificant except two lags (i.e 1st lag of 0.138 and 9th lag of 0.055) during the study period.

The overall results of Autocorrelation Function established that all the nine sample indices (CNX Auto Index, CNX Bank, CNX Energy Index, CNX Finance Index, CNX FMCG Index, CNX IT Index, CNX Metal Index, CNX Pharma Index and CNX PSU Bank Index) used in NSE did not follow significant autocorrelation during the study period. Hence, the null hypothesis (Nh3), that there is no weak form efficiency in the returns of NSE sample Sectoral Indices is accepted.

Discussion

The present study investigated the weak form efficiency of sectoral indices in NSE, using the Runs Test and Autocorrelation Function Test. The study found that all the NSE sample indices were not weak form efficient during the period of study.

Table 5. The Results of Autocorrelation for NSE Sectoral Indices During the Study Period from 01.04.2004 to 31.03.2014

Lags	NSE Auto Index	NSE Bank Index	NSE Energy Index	NSE Finance Index	NSE FMCG Index	NSE IT Index	NSE Metal Index	NSE Pharma Index	NSE PSU Bank Index
1	0.131*	0.133*	0.066*	0.126*	0.016	-0.006	0.096*	0.059*	0.138*
2	-0.002	-0.033	-0.031	-0.042	-0.015	-0.038	-0.011	0.003	-0.018
3	-0.032	-0.012	-0.036	-0.012	-0.019	-0.021	-0.007	0.016	-0.005
4	0.000	-0.019	-0.006	-0.018	0.002	-0.027	-0.010	0.018	-0.007
5	-0.021	-0.054	-0.031	-0.060	-0.003	0.000	-0.017	-0.006	-0.054
6	-0.009	-0.057	-0.049	-0.059	0.004	0.010	-0.025	-0.034	-0.041
7	0.038	0.000	0.035	0.004	-0.013	0.005	0.018	0.032	-0.004
8	-0.005	0.027	0.041	0.031	-0.010	-0.061	0.061*	0.000	0.017
9	0.013	0.037	0.031	0.032	0.014	0.065*	0.039	-0.008	0.055*
10	0.064*	0.033	0.022	0.040	0.022	0.038	0.009	0.035	0.034
11	0.004	0.025	-0.037	0.016	-0.031	-0.003	-0.020	-0.016	0.011
12	0.014	-0.004	-0.032	0.002	0.009	-0.016	0.000	0.001	-0.012
13	0.032	-0.005	0.040	0.009	0.023	0.012	0.021	0.087*	-0.014
14	0.033	0.033	0.102*	0.035	0.058*	0.011	0.045	0.040	0.035
15	0.002	0.007	0.008	-0.003	-0.019	0.002	0.010	-0.032	0.016
16	-0.009	0.014	-0.003	0.012	-0.040	-0.005	0.006	-0.012	0.023
17	0.043	0.031	0.018	0.035	0.004	0.031	0.041	0.047	0.031
18	0.022	-0.012	-0.053	-0.013	-0.025	-0.002	0.010	-0.011	-0.002
19	0.003	-0.021	-0.029	-0.025	-0.030	0.007	0.011	-0.005	0.001
20	-0.044	-0.034	-0.074	-0.035	-0.042	-0.023	-0.020	-0.015	-0.013
21	0.004	0.013	-0.003	0.025	-0.019	-0.020	0.014	-0.004	0.016
22	-0.018	0.021	-0.002	0.020	-0.006	0.013	0.017	-0.022	0.006
23	-0.011	-0.019	-0.015	-0.017	-0.056	0.010	-0.016	-0.041	-0.022
24	0.014	-0.004	0.021	0.000	0.039	0.001	0.014	0.013	0.016
25	0.023	0.022	0.021	0.026	-0.022	0.012	0.013	-0.024	-0.006
26	0.028	0.038	0.009	0.045	-0.008	0.011	0.031	0.026	0.016
27	0.009	-0.019	0.007	-0.011	0.021	0.009	-0.008	-0.030	-0.038
28	-0.025	0.018	0.017	0.013	0.008	0.029	-0.012	0.051*	0.021
29	-0.027	-0.019	-0.008	-0.022	-0.009	-0.001	-0.024	0.003	-0.027
30	-0.007	-0.012	-0.003	-0.024	0.017	-0.016	-0.001	0.002	-0.004

Source: Collected from PROWESS Corporate Database and Computed using SPSS (Version 19)

Note: * Positive value at 5% level of significance

The previous studies undertaken by Loh (2007) examined the daily returns of five Asian Pacific stock markets which recorded inefficient weak form. Walid *(*2010) clearly observed that the daily returns of 11 Arab stock market indices were not weak form efficient. Another study conducted by Azad et al. (2014) presented that the South Asian Stock markets did not conform to the market efficiency. The previous studies relating to African Stock Market, Bangaladesh Stock Exchange, Tokyo Stock Exchange, and Pacific Stock Markets also found that there was no weak form efficiency. However, Squalli (2006) observed that the daily returns of Dubai Financial

Markets followed the weak from efficiency. Hence, the result of present study confirmed the results of Loh (2007), Walid, A.*(*2010), Azad et al. (2014), and Squalli (2006).

Research Implications

The weak form efficiency of stock market has direct consequences for the action of investors in the market and the wealth of countries. It is of great interest to many to investigate which factors influence the stock market efficiency in general and different industries in particular. The efficient market hypothesis has been tested using different statistical techniques and in different markets over different time periods. The volume of research in this area has led to numerous advances in both theoretical modelling and statistical analysis surrounding the EMH. The study evaluates the normality, stationarity, randomness and weak form efficiency NSE sectoral indices on the basis of daily returns. The study proposes to identify which indices are best for investors to invest their money and earn maximum return from the NSE sectoral indices. Hence this study makes an attempt to evaluate the weak form efficiency of NSE sectoral indices to give a comprehensive view of the Indian stock market.

Conclusion

The development of financial markets has significant impact on economic growth. The regulators and policy makers may pay attention to the market efficiency of Indian Stock Market. Improved policies may assist in deepening the financial markets and further improving the market efficiency in future for helping the retail investors. An attempt was made in this study to investigate the weak form efficiency in the Indian Stock Market by examining the returns of nine sample indices, using Descriptive Statistics, Augmented Dickey Fuller Test, Runs Test and Autocorrelation Test. It is seen that out of nine indices, one index (CNX FMCG Index) was good compared to other sample indices. Based on runs test and autocorrelation function test carried out on the sample indices from NSE, it is concluded that the stock market returns (NSE) did not follow random distribution nor did they support the weak form of market efficiency. Finally, this study suggests that retail investors may invest their money in CNX FMCG Index which performed well during the period of study.

Limitations of the Study and Scope for Further Research

The limitations of the study is as follows :

(1) The study was purely based on secondary data and hence it could be riddled with certain limitations which are bound to be connected with secondary data.

(2) This study focused only on NSE sectoral indices, that is, nine indices out of 11 indices.

(3) The study period covered only the period from 2004 to 2014.

(4) All the limitations, associated with various tools like descriptive statistics, augmented Dickey Fuller (ADF) test, runs test, and autocorrelation function (ACF) test, were applicable to this study also.

The following suggestions can be considered for future research :

(1) A comparative study, with similar objectives, could be made to study the BSE sectoral indices.

(2) A study, with similar objectives, could be done on global stock market indices.

(3) A study could be made for a longer study period in future, say 10 years or more.

(4) The study with similar objectives could be made with reference to other sectors.

(5) The NSE Top Indices namely, Nifty Index, CNX Midcap Index, CNX Small Cap Index, CNX 100 Index, CNX 200 Index, and CNX 500 Index could be taken up for further studies.

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