AN EMPIRICAL STUDY ON EFFICIENT MARKET HYPOTHESIS OF INDIAN CAPITAL MARKETS

Anjala Kalsie[1,*], Jappanjyot Kaur Kalra[2]

[1]Assistant Professor, [2]Research Scholar, Dept. Of Management Studies, University of Delhi, New Delhi

***Corresponding Author:**
E-mail: kalsie_anjala@yahoo.co.in

ABSTRACT

The objective of this paper is to study the efficiency of Indian stock markets during the period 2001-2011. The weak form of efficient markets is extensively tested using NIFTY and 6 major NSE sectoral indices Pharma, IT, MNC, Bank, FMCG and Nifty Junior. Univariate time series analysis of indices returns is carried using tests for randomness / non-stationarity – runs test, unit root testing. ACF, correlograms and other relevant statistical methods. The study concludes that Indian markets are inefficient in its weak form for the study period.

Key words: *Efficient market, Efficient market hypothesis, Random walk theory, Runs test, Auto correlation test.*

INTRODUCTION

Efficiency Market Hypothesis (EMH) is an important theory in terms of the understanding of the equity markets and the cost of equity capital. In terms of capital market theory, the conception of market efficiency is used to explain the degree to which stock prices reflect available, relevant information in a timely manner.

The efficient market hypothesis is related to the random walk theory. There are three levels of efficiency: weak, semi-strong and strong form. These forms of efficient market depend upon the information set and its relation to prices. If the information set is historical prices, the market is its weak form. Weak form says that current price of a stock reflects all information found in the record of past prices and volumes. Therefore, technical analysis cannot be used to predict and beat a market.

Information set of all public information (annual earnings, stock split etc.) leads to semi-strong form of efficient markets. The semi-strong form holds that stock prices rapidly adjust to all publicly available information. Event study and portfolio studies are used to test semi-strong form of market efficiency. This means neither fundamental nor technical analysis can be used to achieve superior returns.

Lastly, if the information set is insider information the market is said to be in its strong form. The strong form holds that all available information public or private is reflected in stock prices. This is an extreme form of the hypothesis and there is no empirical evidence to support it. This means even insider information cannot give an investor any advantage.

Efficiency of equity markets has important implications for the investment policy of the investors. If the equity market in question is efficient researching to find miss-priced assets will be a waste of time. In an efficient market, prices of the assets will reflect market's best estimate for the risk and expected return of the asset, taking into account what is known about the asset at the time. Therefore, there will be no undervalued assets offering higher than expected return or overvalued assets offering lower than the expected return. All assets will be appropriately priced in the market offering optimal reward to risk. However, if the markets were not efficient, an investor will be better off trying to spot winners and losers in the market and correct identification of miss-priced assets will enhance the overall performance of the portfolio.

The understanding of efficiency of the emerging markets is becoming more important as a consequence of integration with more developed markets and free movement of investments across national boundaries. India is one of the fastest growing emerging economies in the world. At this transitional stage, it is necessary to assess the level of efficiency of the Indian equity market in order to establish its longer term role in the process of economic development.

The paper is divided into following sections section 2 is about the Literature Review, section 3 is about Objective and Methodology, section 4 talks about Analysis and Interpretation and section 5 finally concludes.

LITERATURE REVIEW

Fama (1970) presented a formal review of theory and evidence for market efficiency and subsequently revised it further on the basis of development in research (Fama 1991). Fama attempted to organize the growing empirical evidence on the theory and he presented the efficient market theory in terms of the current market price fully reflects all available information and the expected return based upon this price is consistent with its risk. Fama also divided market efficiency into three subhypotheses depending on the information set involved: (1) weak form efficiency, (2) semi-strong form efficiency and (3) strong form efficiency.

Poshakwale (1996) showed that Indian stock market was weak form inefficient; he used daily BSE index data for the period 1987 to 1994.

Hiremath & Kamaiah (2010) find that the Indian stock markets are weak form efficient but not all the time. Their tests showed that CNX Nifty Junior, CNX 500, CNX Bank Nifty, BSE 500, BSE Midcap and BSE Small cap reject the random walk hypothesis and return series are characterized by the presence of linear dependencies.

Patrick, A & Sushama, R. (2011) have compared the weak form of efficiency of NSE and NYSE and has presented the evidence of efficient form of NSE and inefficient form of NYSE. From autocorrelation analysis and runs test it was concluded that the series of stock indices of NSE is unbiased random time series whereas stock indices of NYSE is biased random time series.

More recently, R. Rajesh Ram Kumar (2012) have analysed the market efficiency of sectoral indices of BSE, India and found that the returns of 8 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 at 5 percent significant level.

OBJECTIVES AND METHODOLOGY

The objective of the paper is:

1. To test whether the Indian equity markets are weak form efficient.
2. To test the weak form efficiency of the different sectoral indices of NSE.

The weak form of market efficiency popularly known as random walk theory of Indian stock market in which prices reflect all information found in the record of past prices and volumes. The null hypothesis is constructed as price change is random.

- Null hypothesis Ho: Price change is random
- Alternate hypothesis Ha: Price change is not random

Data: The paper uses Daily Index Returns of selected indices for a ten year period from January 2, 2001 to December 30, 2011. The sample consisted of 2744 observations. The log returns or continuous compounding returns were used for analysis. Continuously compounding return or log return r of an asset is defined to be the natural logarithm of its gross return ($1+R_t$)

$r \cong \log(1+R_t) = log\frac{P_t}{P_{t-1}}$............Equ. 1

The data for Nifty and 6 major sectoral indices - Nifty Junior, Pharma, MNC, IT, Bank and FMCG attained from the National Stock Exchange of India website www.nseindia.com. Eviews 7 is used to analyses the results.

METHODOLOGY

Tests of Stationarity

Unit Root Test: A unit root test tests whether a time series variable is non-stationary using an autoregressive model.

If the autoregressive model is

$Y_t = \rho Y_{t-1} + u_t$

Where $-1 \leq \rho \leq 1$

In order to estimate the above equation, the first differences of Y_t are taken and regressed on Yt-1 to determine if the estimated slope coefficient ρ is zero or not. If it is zero it is concluded that the seried Y_t is stationary. If ρ=1 then the above equation become a random walk without drift.

The paper employs Augmented Dickey-Fuller (ADF) test to determine the unit root property of the stock market indices which requires regressing ΔY_i on a constant, a time trend ΔY_{t-1} and several lags of dependent terms as follows:

$$\Delta Y_t = \gamma_0 + \gamma_1 Y_{t-1} + \beta_i \sum Y_{t-1} + \varepsilon_t \quad \text{.... Equ. 2}$$

Where, Δ = first difference operator

$\gamma_0, \gamma_1 and\ \beta_i$ = coefficients to be estimated

Y_t = non-stationary time series

ε_t = error term at time *t*

The test statistics known as the tau statistics are checked against the critical values tabulated by Dickey and Fuller on the basis of Monte Carlo simulations. The null hypothesis of series contain a unit root is rejected if t-statistics is smaller (more negative) than the critical value respectively. The Durbin-Watson test values are also observed. DW test statistics value of 2 or very close to 2 will indicate that the test result is reliable i.e. indication of no autocorrelation problem.

Autocorrelation: The term autocorrelation is defined as correlation between members of series of observation ordered in time or space. It is the lag correlation of a given series with itself lagged by a number of time units. Autocorrelation is a reliable measure for testing of independence of random variables in return series.

Autocorrelation tests show whether the serial correlation coefficients are significantly different from zero. In an efficient market, the null hypothesis of zero autocorrelation will prevail. This test statistic is widely used to notice any perceptible trend in stock prices. In the present study we have considered time lags of 1-16 days.

Autocorrelation in the data was checked using Autocorrelation function (ACF) and correlograms utilizing the Ljung Box statistic, Dubin-Watson statistic.

The autocorrelation function (ACF) test is examined to identify the degree of autocorrelation in a time series. It measures the correlation between the current and lagged observations of the time series of stock returns. A series of data may have observations that are not independent of one another. Autocorrelation Coefficients measure correlations between observations a certain distance apart.

Based on the ordinary correlation coefficient 'r'. An autocorrelation coefficient at lag k can be found by:

$$r_k = \frac{\sum_{t=1}^{N-k}(x_t - \bar{x})(x_{t+k} - \bar{x})}{\sum_{t=1}^{N-1}(x_t - \bar{x})^2}$$ ....Equ. 3

A plot of r_k against k is known as correlogram.

If time series has unit root, than the autocorrelation function slowly decrease starting from the value of one and the partial auto correlation function has only first value which differs from zero. If one time series has two unit roots, ACF act the same way as for the one unit root series, but the PACF has only first two nonzero values.

The serial correlation matrices that measures correlation between price changes inconsecutive time periods and is a measure of how much price change in any period depends upon price change over the previous time period. A serial correlation of zero would imply that price changes in consecutive time periods are uncorrelated with each other, and can thus be viewed as a rejection of the hypothesis that investors can learn about future price changes from the past ones. A positive and statistically significant serial correlation could be viewed as evidence of price momentum in markets, and would suggest that returns in a period are more likely to be positive (negative) if the prior period returns were positive (negative). In a more precise way, serial correlation coefficients provide a measure of relationship between value of random variable (X), in time t and its value k-periods earlier. It indicates whether daily price changes in the period t are influenced by price changes occurring k-days earlier, where k=1,2,3…. n.

Runs / Geary Test for Randomness: It is a strong test for randomness in investigating serial dependence in share price movements and compares the expected number of runs from a random process with the observed number of runs. The test is non-parametric and is independent of the normality and constant variance of data.

A run is defined as a series of identical signs that are preceded or are followed by a different sign or no sign at all. That is given a sequence of observations, the runs test examines whether the value of one observation influences the values taken by later observations. If there is no influence (the observations are independent), the sequence is considered random. It is assumed that the sample proportion of positive, negative and zero price changes are good estimates of the population's proportions.

Runs test shows the cutting point, the number of runs, the number of cases below the cutting point, the number of cases greater than or equal to the cutting point, and the test statistics Z with its observed significance level. The total number of runs is a measure of randomness, since too many or too few runs, suggests dependence between observations.

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. A negative Z-value implies that the observed number of runs is less than the expected number of runs and thus positively correlated. The opposite is true for a positive Z-value. In addition to that, the observed numbers of run also indicates to reject or accept the random walk model.

When the expected number of run is significantly different from the observed number of runs, the test reject the null hypothesis that the daily returns are random. The expected number of runs is represented by:

$$E(r) = \frac{n + 2n_a n_b}{n}$$ ....Equ. 4

Where n represents the number of observations, n_a and n_b respectively represent observations above and below the sample mean (or median), and r represents the observed number of runs. The standard error can therefore be written as:

$$\sigma(r) = \left[\frac{2n_a n_b(2n_a n_b - n)}{n^2(n-1)}\right]^{1/2}$$ ....Equ. 5

The asymptotic (and approximately normal) Z-statistic can be written as follows:

$$Z(r) = \frac{r - E(r)}{\sigma(r)}$$ ....Equ. 6

ANALYSIS AND INTERPRETATIONS

The descriptive statistics of the indices are given in Table 1. From the kurtosis of the dataset, it was observed that none of the selected indices in the given time range were normally distributed. The distributions were leptokurtic and negatively skewed.

The unit root test ADF Table 2 indicates that for all the selected indices return time series, the null hypothesis that the series has unit root is rejected. Accordingly, the given time series are stationary. The test statistic is more negative than the critical value in all cases.

The ACF correlograms and LQ statistic Table 3 for determining serial correlation in the indices time series in indicate zero probability that the time series is non-stationary or random. The alternate hypothesis is accepted that the time series is stationery with serial co-relations present.

The runs test for randomness Table 4 of the selected return time series rejects the null hypothesis that the dataset is random (p>0.05) for all indices except IT indices. The runs test result for individual year Table 5 indicate that year 2001 and year 2005 NIFTY exhibits random walk. For all other years the index exhibits non-randomness or inefficiency.

Table 1: Descriptive Statistics

	Nifty	**Mnc**	**Junior**	**Fmcg**	**Bank**	**It**	**Pharma**
Mean	0.000475	0.000426	0.000451	0.000479	0.000765	-0.000563	0.000554
Median	0.001180	0.000726	0.001729	0.000485	0.000829	0.000590	0.000967
Maximum	0.163343	0.093089	0.138254	0.083038	0.172394	0.145567	0.111589
Minimum	-0.130539	-0.116100	-0.131333	-0.123824	-0.151380	-2.358266	-0.086336
Std. Dev.	0.016568	0.013937	0.018453	0.014190	0.021226	0.051038	0.013361
Skewness	-0.264146	-0.504955	-0.678972	-0.304437	-0.166363	-35.98786	-0.375394
Kurtosis	11.17066	9.370357	9.355893	7.960716	8.305927	1661.359	8.459193
Jarque-Bera	7664.769	4756.423	4829.598	2855.982	3231.468	3.15E+08	3471.900
Probability	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Sum	1.304747	1.167825	1.236799	1.313726	2.097822	-1.545144	1.520880
Sum Sq. Dev.	0.752964	0.532834	0.934025	0.552307	1.235841	7.145110	0.489679
Observations	2744	2744	2744	2744	2744	2744	2744

Table 2: Unit Root Test (ADF)

S. No.	**Index**	**T stat**	**Prob**
1.	Nifty	-37.59	0.000
2.	Nifty junior	-44.65	0.000
3.	Bank index	-36.50	0.000
4.	FMCG	-50.72	0.000
5.	IT Index	-52.10	0.000
6.	Pharma	-48.08	0.000
7.	MNC	-48.08	0.000

Table 3: Autocorrelation Result

i) Nifty

Null Hypothesis: Nifty Time series is not stationary

<table>
<tr><th>Autocorrelation</th><th>Partial Correlation</th><th></th><th>AC</th><th>PAC</th><th>Q-Stat</th><th>Prob</th></tr>
<tr><td>|* |</td><td>|* |</td><td>1</td><td>0.075</td><td>0.075</td><td>15.520</td><td>0.000</td></tr>
<tr><td>| |</td><td>| |</td><td>2</td><td>-0.049</td><td>-0.055</td><td>22.019</td><td>0.000</td></tr>
<tr><td>| |</td><td>| |</td><td>3</td><td>-0.005</td><td>0.003</td><td>22.094</td><td>0.000</td></tr>
<tr><td>| |</td><td>| |</td><td>4</td><td>0.018</td><td>0.015</td><td>22.963</td><td>0.000</td></tr>
<tr><td>| |</td><td>| |</td><td>5</td><td>-0.012</td><td>-0.015</td><td>23.359</td><td>0.000</td></tr>
<tr><td>| |</td><td>| |</td><td>6</td><td>-0.053</td><td>-0.049</td><td>30.978</td><td>0.000</td></tr>
<tr><td>| |</td><td>| |</td><td>7</td><td>0.008</td><td>0.015</td><td>31.160</td><td>0.000</td></tr>
<tr><td>| |</td><td>| |</td><td>8</td><td>0.045</td><td>0.038</td><td>36.766</td><td>0.000</td></tr>
<tr><td>| |</td><td>| |</td><td>9</td><td>0.020</td><td>0.015</td><td>37.905</td><td>0.000</td></tr>
<tr><td>| |</td><td>| |</td><td>10</td><td>0.026</td><td>0.030</td><td>39.819</td><td>0.000</td></tr>
<tr><td>| |</td><td>| |</td><td>11</td><td>-0.010</td><td>-0.014</td><td>40.080</td><td>0.000</td></tr>
<tr><td>| |</td><td>| |</td><td>12</td><td>-0.008</td><td>-0.008</td><td>40.277</td><td>0.000</td></tr>
<tr><td>| |</td><td>| |</td><td>13</td><td>0.034</td><td>0.036</td><td>43.462</td><td>0.000</td></tr>
<tr><td>| |</td><td>| |</td><td>14</td><td>0.061</td><td>0.060</td><td>53.858</td><td>0.000</td></tr>
<tr><td>| |</td><td>| |</td><td>15</td><td>-0.007</td><td>-0.011</td><td>53.996</td><td>0.000</td></tr>
<tr><td>| |</td><td>| |</td><td>16</td><td>-0.000</td><td>0.008</td><td>53.996</td><td>0.000</td></tr>
</table>

ii) Nifty Junior

Null Hypothesis: Nifty Junior Time series is not stationary

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
|* |	|* |	1	0.158	0.158	68.327	0.000
| |	| |	2	-0.018	-0.044	69.251	0.000
| |	| |	3	0.027	0.038	71.222	0.000
| |	| |	4	0.005	-0.007	71.286	0.000
| |	| |	5	-0.012	-0.010	71.674	0.000
| |	| |	6	-0.032	-0.030	74.441	0.000
| |	| |	7	0.006	0.016	74.539	0.000
| |	| |	8	0.032	0.028	77.446	0.000
| |	| |	9	0.050	0.044	84.387	0.000
| |	| |	10	0.052	0.039	91.870	0.000
| |	| |	11	0.005	-0.010	91.932	0.000
| |	| |	12	-0.007	-0.007	92.073	0.000
| |	| |	13	0.033	0.035	95.146	0.000
|* |	| |	14	0.080	0.073	112.65	0.000
| |	| |	15	0.012	-0.006	113.08	0.000
| |	| |	16	0.023	0.028	114.52	0.000

iii) Bank Index

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
|* |	|* |	1	0.135	0.135	49.941	0.000
| |	| |	2	-0.038	-0.058	53.987	0.000
| |	| |	3	-0.007	0.007	54.111	0.000
| |	| |	4	-0.011	-0.014	54.464	0.000
| |	| |	5	-0.053	-0.051	62.329	0.000
| |	| |	6	-0.064	-0.052	73.742	0.000
| |	| |	7	0.009	0.020	73.948	0.000
| |	| |	8	0.028	0.019	76.122	0.000
| |	| |	9	0.022	0.016	77.450	0.000
| |	| |	10	0.038	0.032	81.388	0.000
| |	| |	11	0.017	0.004	82.199	0.000
| |	| |	12	-0.006	-0.007	82.283	0.000
| |	| |	13	-0.003	0.004	82.316	0.000
| |	| |	14	0.033	0.038	85.260	0.000
| |	| |	15	0.002	-0.003	85.276	0.000
| |	| |	16	0.019	0.027	86.296	0.000

iv) Nifty Pharma

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
|* |	|* |	1	0.085	0.085	20.030	0.000
| |	| |	2	0.009	0.001	20.236	0.000
| |	| |	3	0.021	0.020	21.457	0.000
| |	| |	4	0.018	0.015	22.396	0.000
| |	| |	5	-0.010	-0.013	22.691	0.000
| |	| |	6	-0.025	-0.024	24.467	0.000
| |	| |	7	0.001	0.004	24.469	0.001
| |	| |	8	0.003	0.003	24.501	0.002
| |	| |	9	0.017	0.018	25.266	0.003
| |	| |	10	0.024	0.022	26.802	0.003
| |	| |	11	-0.017	-0.022	27.588	0.004
| |	| |	12	-0.012	-0.010	27.990	0.006
| |	| |	13	0.070	0.071	41.377	0.000
| |	| |	14	0.028	0.017	43.596	0.000
| |	| |	15	-0.025	-0.028	45.368	0.000
| |	| |	16	-0.018	-0.015	46.235	0.000

v) Nifty FMCG

<table>
<tr><th>Autocorrelation</th><th>Partial Correlation</th><th></th><th>AC</th><th>PAC</th><th>Q-Stat</th><th>Prob</th></tr>
<tr><td>| |</td><td>| |</td><td>1</td><td>0.032</td><td>0.032</td><td>2.7878</td><td>0.095</td></tr>
<tr><td>| |</td><td>| |</td><td>2</td><td>-0.042</td><td>-0.043</td><td>7.7298</td><td>0.021</td></tr>
<tr><td>| |</td><td>| |</td><td>3</td><td>-0.023</td><td>-0.021</td><td>9.2442</td><td>0.026</td></tr>
<tr><td>| |</td><td>| |</td><td>4</td><td>0.017</td><td>0.017</td><td>10.082</td><td>0.039</td></tr>
<tr><td>| |</td><td>| |</td><td>5</td><td>-0.003</td><td>-0.006</td><td>10.113</td><td>0.072</td></tr>
<tr><td>| |</td><td>| |</td><td>6</td><td>-0.005</td><td>-0.003</td><td>10.169</td><td>0.118</td></tr>
<tr><td>| |</td><td>| |</td><td>7</td><td>-0.009</td><td>-0.009</td><td>10.412</td><td>0.166</td></tr>
<tr><td>| |</td><td>| |</td><td>8</td><td>-0.002</td><td>-0.002</td><td>10.424</td><td>0.237</td></tr>
<tr><td>| |</td><td>| |</td><td>9</td><td>0.030</td><td>0.030</td><td>12.962</td><td>0.164</td></tr>
<tr><td>| |</td><td>| |</td><td>10</td><td>0.027</td><td>0.025</td><td>14.952</td><td>0.134</td></tr>
<tr><td>| |</td><td>| |</td><td>11</td><td>-0.029</td><td>-0.028</td><td>17.246</td><td>0.101</td></tr>
<tr><td>| |</td><td>| |</td><td>12</td><td>-0.004</td><td>0.001</td><td>17.301</td><td>0.139</td></tr>
<tr><td>| |</td><td>| |</td><td>13</td><td>0.011</td><td>0.008</td><td>17.608</td><td>0.173</td></tr>
<tr><td>| |</td><td>| |</td><td>14</td><td>0.056</td><td>0.054</td><td>26.350</td><td>0.023</td></tr>
<tr><td>| |</td><td>| |</td><td>15</td><td>0.003</td><td>0.001</td><td>26.372</td><td>0.034</td></tr>
<tr><td>| |</td><td>| |</td><td>16</td><td>-0.034</td><td>-0.029</td><td>29.488</td><td>0.021</td></tr>
</table>

vi) Nifty IT

<table>
<tr><th>Autocorrelation</th><th>Partial Correlation</th><th></th><th>AC</th><th>PAC</th><th>Q-Stat</th><th>Prob</th></tr>
<tr><td>| |</td><td>| |</td><td>1</td><td>0.005</td><td>0.005</td><td>0.0673</td><td>0.795</td></tr>
<tr><td>| |</td><td>| |</td><td>2</td><td>-0.013</td><td>-0.013</td><td>0.5521</td><td>0.759</td></tr>
<tr><td>| |</td><td>| |</td><td>3</td><td>-0.011</td><td>-0.011</td><td>0.9137</td><td>0.822</td></tr>
<tr><td>| |</td><td>| |</td><td>4</td><td>-0.012</td><td>-0.012</td><td>1.3191</td><td>0.858</td></tr>
<tr><td>| |</td><td>| |</td><td>5</td><td>-0.004</td><td>-0.004</td><td>1.3679</td><td>0.928</td></tr>
<tr><td>| |</td><td>| |</td><td>6</td><td>0.002</td><td>0.001</td><td>1.3742</td><td>0.967</td></tr>
<tr><td>| |</td><td>| |</td><td>7</td><td>-0.006</td><td>-0.007</td><td>1.4805</td><td>0.983</td></tr>
<tr><td>| |</td><td>| |</td><td>8</td><td>-0.032</td><td>-0.033</td><td>4.3674</td><td>0.823</td></tr>
<tr><td>| |</td><td>| |</td><td>9</td><td>0.044</td><td>0.044</td><td>9.6311</td><td>0.381</td></tr>
<tr><td>| |</td><td>| |</td><td>10</td><td>0.027</td><td>0.025</td><td>11.611</td><td>0.312</td></tr>
<tr><td>| |</td><td>| |</td><td>11</td><td>0.013</td><td>0.013</td><td>12.073</td><td>0.358</td></tr>
<tr><td>| |</td><td>| |</td><td>12</td><td>-0.013</td><td>-0.013</td><td>12.559</td><td>0.402</td></tr>
<tr><td>| |</td><td>| |</td><td>13</td><td>0.011</td><td>0.013</td><td>12.868</td><td>0.458</td></tr>
<tr><td>| |</td><td>| |</td><td>14</td><td>0.012</td><td>0.013</td><td>13.274</td><td>0.505</td></tr>
<tr><td>| |</td><td>| |</td><td>15</td><td>-0.005</td><td>-0.006</td><td>13.355</td><td>0.575</td></tr>
<tr><td>| |</td><td>| |</td><td>16</td><td>-0.008</td><td>-0.008</td><td>13.514</td><td>0.635</td></tr>
</table>

vii) MNC

<table>
<tr><th>Autocorrelation</th><th>Partial Correlation</th><th></th><th>AC</th><th>PAC</th><th>Q-Stat</th><th>Prob</th></tr>
<tr><td>|* |</td><td>|* |</td><td>1</td><td>0.087</td><td>0.087</td><td>20.987</td><td>0.000</td></tr>
<tr><td>| |</td><td>| |</td><td>2</td><td>-0.025</td><td>-0.033</td><td>22.730</td><td>0.000</td></tr>
<tr><td>| |</td><td>| |</td><td>3</td><td>0.007</td><td>0.013</td><td>22.881</td><td>0.000</td></tr>
<tr><td>| |</td><td>| |</td><td>4</td><td>-0.010</td><td>-0.013</td><td>23.175</td><td>0.000</td></tr>
<tr><td>| |</td><td>| |</td><td>5</td><td>0.005</td><td>0.008</td><td>23.240</td><td>0.000</td></tr>
<tr><td>| |</td><td>| |</td><td>6</td><td>-0.023</td><td>-0.025</td><td>24.635</td><td>0.000</td></tr>
<tr><td>| |</td><td>| |</td><td>7</td><td>-0.009</td><td>-0.004</td><td>24.860</td><td>0.001</td></tr>
<tr><td>| |</td><td>| |</td><td>8</td><td>0.033</td><td>0.032</td><td>27.772</td><td>0.001</td></tr>
<tr><td>| |</td><td>| |</td><td>9</td><td>0.026</td><td>0.021</td><td>29.640</td><td>0.001</td></tr>
<tr><td>| |</td><td>| |</td><td>10</td><td>0.007</td><td>0.004</td><td>29.767</td><td>0.001</td></tr>
<tr><td>| |</td><td>| |</td><td>11</td><td>-0.005</td><td>-0.005</td><td>29.826</td><td>0.002</td></tr>
<tr><td>| |</td><td>| |</td><td>12</td><td>0.012</td><td>0.013</td><td>30.219</td><td>0.003</td></tr>
<tr><td>| |</td><td>| |</td><td>13</td><td>0.046</td><td>0.044</td><td>36.050</td><td>0.001</td></tr>
<tr><td>| |</td><td>| |</td><td>14</td><td>0.061</td><td>0.056</td><td>46.334</td><td>0.000</td></tr>
<tr><td>| |</td><td>| |</td><td>15</td><td>0.008</td><td>0.002</td><td>46.523</td><td>0.000</td></tr>
<tr><td>| |</td><td>| |</td><td>16</td><td>-0.004</td><td>-0.003</td><td>46.574</td><td>0.000</td></tr>
</table>

Table 4: Run Test for Randomness Runs Test for Nifty and sectoral indices

Null Hypothesis: The data series is random indicating efficient capital markets.

	Nifty	Junior	IT	Bank	Pharma	FMCG	MNC
Test Value[a]	.0004754910	.0004507284	-.0005630991	.0007645124	.0005542565	.0004787630	.0004255922
Cases < Test Value	1312	1273	1293	1365	1327	1370	1333
Cases >= Test Value	1432	1471	1451	1379	1417	1374	1411
Total Cases	2744	2744	2744	2744	2744	2744	2744
Number of Runs	1294	1192	1331	1284	1270	1302	1291
Z	-2.922	-6.674	-1.435	-3.397	-3.881	-2.711	-3.092
Asymp. Sig. (2-tailed)	.003	.000	.151	.001	.000	.007	.002

Table 5: Run Test for Randomness Runs test Results for each year Nifty

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Cases < Test Value	123	121	118	118	121	110	129	118	128	116	131
Cases >= Test Value	124	130	136	136	130	140	120	128	115	136	116
Total Cases	247	251	254	254	251	250	249	246	243	252	247
Number of Runs	105	114	115	127	111	113	121	118	129	135	116
Z	-2.49	-1.56	-1.56	-0.05	-1.94	-1.44	-0.55	-0.74	0.88	1.12	-1.03
Asymp. Sig. (2-tailed)	0.013	0.118	0.118	0.963	0.052	0.150	0.581	0.458	0.377	0.264	0.303

CONCLUSIONS

The test results state that Indian markets are not weak form efficient. These results support the common notion that the equity markets in the emerging economies are not efficient and to some degree can also explain the less optimal allocation of portfolios into these markets.

The implication of rejection of weak form efficiency for investors is that passive index investment strategy shall not be suitable while investing in the Indian stock market.

On the other hand as financial market development have significant benefits on economic growth, the regulators and policy makers should pay much more attention on the market efficiency of India’s stock market. These policies may assist in deepening the markets and further improve the market efficiency in the future.

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