Testing the Weak Form of Efficiency of the Indian Stock Market : A Study of Selected Stocks Listed on the NSE

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Abstract

The efficient market hypothesis (EMH) is playing a crucial role in pricing and allocation of capital. In efficient capital markets, the security prices are assumed to quickly absorb all relevant information and reflect the same in their security prices. So, no investor in an efficient market will be able to earn abnormal profits. Fama (1970) categorized the EMH into three levels namely, weak form, semi strong form, and strong form. The purpose of this study was to test whether the weak form of efficient market hypothesis holds true for the Indian stock market. The study is empirical in nature and is based upon secondary data. The data used in the study consisted of monthly adjusted closing prices of 36 stocks of companies traded on the NSE. The stocks considered belong to different sectors such as automobile, banking, cement, FMCG, pharmaceutical, and textile sectors. The data for a 10-year period - from January 1, 2003 to December 31, 2013 were collected and runs test was applied to test the weak form of efficiency. The results showed that the price movements in share prices of National Stock Exchange of the Indian stock market are random in behavior, implying that one cannot use the historical prices for predicting the future prices. That is, all the information contained in historical prices is not revealed by the current prices. This proved that the weak form of the market efficiency hypothesis is applicable in the National Stock Exchange (based upon the share price movement of 36 sample companies chosen for the study).

Keywords: **efficient market, weak-form, semi-strong form, strong form, random walk**

JEL Classification: G02, G11, G15

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The efficient market hypothesis (EMH) has been playing a crucial role in pricing and allocation of capital. When a capital market is assumed to be efficient, it means that security prices fully reflect all available information. The cost of acquisition of such information as well as trading is zero. Fama (1970) was the first to develop the efficient market hypothesis (EMH). He formalized the EMH theory based upon empirical evidence. He defined a market as being efficient if prices fully reflect all available information and suggested three models for testing efficiency: the fair game model, the sub martingale model, and the random walk model. Fama (1970) categorized the EMH into three levels based upon the definition of the available information set, namely, weak form, semi strong form, and strong form. According to Fama (1970), the EMH supposes that share prices adjust rapidly to the appearance of new information. In efficient capital markets, the security prices are assumed to quickly absorb all relevant information and reflect the same in its security prices. This implies that no investor in an efficient market will be able to earn abnormal profits as there is no scope for *'under valuation'* or *'over valuation'* of prices of securities. Fama also argued that markets could be efficient at three levels, based upon what information was reflected in prices. They are weak form EMH, semi strong form EMH, and strong form EMH. There are various tests available to know the efficiency of capital markets of an economy.

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Theoretical Framework

The present paper is based on the theoretical framework presented below :

↳ **Weak Form of Efficient Market Hypothesis :** According to the weak form of efficient market hypothesis, current prices reflect all information found in the past prices and traded volumes. Future prices cannot be predicted by analyzing prices from the past (Pandian, 2011). In this weak form of efficient market, there is a possibility of earning profits for the market participants. So, technical analysis cannot be used if a market is weak form efficient. The weak form of efficient market is (thus) a direct repudiation of technical ananlysis (Kevin, 2011).

↳ **Semi-Strong Form of Efficient Market Hypothesis :** In the semi-strong efficient markets, security prices fully reflect all publicly available information. In such markets, the prices not only reflect the past price data, but also the available information regarding the earnings of the corporate, dividend, bonus issue, right issue, mergers, acquisitions and so on (Pandian, 2011). In such markets, the investors have fewer opportunities to make profits, and it is the insiders (who have knowledge about the market) who make profits. Thus, the semi-strong hypothesis repudiates fundamental analysis (Kevin, 2011).

↳ **Strong Form of Efficient Market Hypothesis :** The strong form of EMH states that all information is fully reflected on security prices. Information, whether it is public or inside cannot be used consistently to earn superior investors' return in the strong form (Pandian, 2011). Thus, the strong form hypothesis represents the extreme case of market efficiency (Kevin, 2011).

Need for the Study

Currently, the stock markets are highly volatile. The investors know about the stock market reactions based upon the information they get through announcements made by companies on crucial issues like bonus issue, rights issue, stock-split, change in the composition of the Board, the change in political leadership and the like. As the Indian stock market is also highly volatile and unpredictable in nature, an investor faces many risks in the Indian stock market. Information is not available freely. The available information is also not transmitted to all the participants of the stock market. There exists insider trading too. The investors' awareness, their level of education, and their information processing capabilities are very low. They are not in a position to clearly understand market manipulation. Thus, investors find it difficult to select securities on a long term basis. Thus, the efficiency of the Indian stock market needs to be tested for weak form of efficiency. The studies of this type thus enable the investors to take appropriate decisions and subsequently help in strengthening the capital market of an economy.

Problem Statement

Capital markets in emerging countries are not efficient in their strong form because of their operating characteristics and the nature of investors. The investors are generally less educated about the stock market operations in these markets and so, such markets will either be weak form efficient or semi-strong form efficient. The Indian financial market had protectionist policies until economic reforms were initiated in the 1990s. So, the Indian stock market is still not developed and is in the emerging stage. The present study is, therefore, more relevant to test the weak form efficiency hypothesis of the Indian stock market based on selected stocks listed on the NSE.

Literature Review

The review covers studies conducted both in the Indian stock market as well as in its neighboring countries. Nikita and Soekarno (2012) studied the Indonesian stock market considering the daily closing prices from January 1, 2008 to December 31, 2011. The daily closing values of IHSG and LQ45 composite index were considered as samples for the study. The results did not support the weak form of efficient market hypothesis for the Indonesian Stock Market. The authors, thus, concluded that both the HISG and LQ45 composite index provide evidences to reject the study's hypothesis. The non-randomness behavior and significant result of all the above tests confirmed the weak form of market efficiency.

Nisar and Hanif (2012) examined the weak form of EMH in four major stock exchanges of South-Asia, which included India, Pakistan, Bangladesh, and Sri Lanka. This study focused on the historical index values on a daily, weekly, and monthly basis from July 1, 1997 to June 30, 2011. The results of this study also did not support the weak form of efficient market hypothesis for South-Asia's four major stock exchanges. The authors concluded that there were no undervalued or overvalued securities and no investor can earn abnormal returns at a given level of risk based on technical analysis. Khandoker, Siddik, and Azam (2011) analyzed the weak form efficiency of Dhaka Stock Exchange in Bangladesh considering a sample of daily price indices of all securities listed on the Dhaka Stock Exchange and the daily closing prices of 30 companies operating in the banking sector for a period of 11 years. The results of the study showed that the Dhaka Stock Exchange was also not efficient in the weak form of efficient market hypothesis.

Fernando (2012) studied the applicability of the weak form of efficiency of the emerging Colombo Stock Exchange (CSE) considering the daily market closing prices of all share price index (ASPI) for 25 years from January 2, 1985 to December 31, 2010. The results of the study did not support weak form of efficiency. Rabbani, Kamal, and Salim (2013) studied the efficient market hypothesis on the basis of historical data relating to the Karachi Stock Exchange (KSE) considering daily closing prices of the KSE 100 from January 1999 to December 2010. The data was divided into groups to evaluate the link of certain economic conditions. It was concluded that the overall KSE of Pakistan was weak form efficient.

Ryaly, Kumar, and Urlankula (2014) investigated the behaviour of daily stock returns for the period from July 1997 to November 2013 in five selected Asian markets namely, India, South Korea, Singapore, Hong Kong, and Japan, and the results of their study proved the existence of weak form of market efficiency in these markets. Gupta (2010), considering the daily data for four indices BSE 100, BSE 500, CNX 100, and SNX CNX 500 from January 1, 2006 to December 31, 2010 concluded that the current stock prices fully reflect information of historical sequence of stock prices and prices follow random trends. And so, the results revealed the existence of weak form efficiency of the Indian stock market. Sapate and Ansari (2011) found results that supported that the weak form efficient market hypothesis is true for the Indian stock market.

Zafar (2012) conducted a similar test on BSE listed companies before the recession, considering market price of 52 weeks for all the 30 companies in the BSE Sensex for the period from January 1, 2008 to December 31, 2008 and found that the share price movement in the share prices of BSE was not affected by past prices. The author concluded that the weak form of market efficiency is applicable to BSE. Jain and Jain (2013), considering data relating to the BSE Sensex for a 20-year period, too found that weak form of efficiency hypothesis holds true for the Indian stock market.

Srinivasan (2010) considered daily closing prices of two major Indian stock market indices like S and P CNX Nifty and Sensex from July 1, 1997 to August 31, 2010 and concluded that the results did not support the validity of weak form efficiency for stock market returns of Indian stock exchanges. Khan, Ikram, and Mehtab (2011) also concluded that the Indian capital market has evolved and developed, and so, is not weak form market efficient. Joshi (2012) also did not support the weak form of market efficiency of BSE. Harper and Jin (2012) analyzed the daily index returns of the Bombay Stock Exchange from July 1997 to December 2011 and found that the Indian stock market is not efficient in the weak form. Kumar and Singh (2013) examined whether the Indian stock market is efficient or inefficient at the weak level considering data on daily closing values of the S and P CNX

Nifty and CNX Nifty Junior from January 1, 2000 to March 31, 2013. The authors concluded that the Indian stock markets do not exhibit weak form of market efficiency. Thus, the studies on testing EMH in the Indian capital market produced mixed results. The present study is unique considering the time period and the samples chosen for the study.

Objectives of the Study

(1) To understand the applicability of EMH for the Indian stock market;

(2) To understand the weak form of efficient market hypothesis;

(3) To find out whether there is any relationship between the future prices of the stocks and their past performances.

Research Methodology

The study is empirical in nature. Secondary data relating to monthly adjusted closing prices of stocks of 36 companies traded on the NSE were extracted from www.yahoofinance.com. Sample companies were chosen from different sectors such as the automobile sector, banking sector, cement sector, FMCG sector, pharmaceutical sector, and textile sector. The data for a 10 year period from January 1, 2003 to December 31, 2013 were considered for the study. Monthly return was calculated based on the monthly change in the share prices as shown below :

$$R_t = [P_t\text{-}(P_t\text{-}1)/ P_t\text{-}1] \times 100$$

where,

R_t = Return in the period *'t'*,
P_t = Monthly closing share price on day *'t'*,
P_t-1 = Monthly closing share price for the preceding period *'(t-1)'*.

The runs test was applied to test the weak form efficiency of the Indian stock market. Runs test is a non-parametric test. It depends only on the sign of the price changes but not on the magnitude of the price. It does not require the specification of the probability distribution. It depends only on the sign of the price. It is essentially concerned with the direction of changes in the time series. In the runs test, the actual number of runs is compared with the expected number of runs. The expected number of runs can be obtained using the following formula:

$$E(r) = (2n_1n_2)/n_1+n_2+1$$

where,
n_1 = number of positive runs,
n_2 = number of negative runs.

In order to obtain the actual number of runs, one has to first calculate the mean and compare the same with each return value. If the return value is more than the mean value, then it has to be considered as positive movement, and if the return value is less than the mean value, then it may be considered as a negative movement. By doing this, one can know values above and below the mean.

The standard error of the expected number of runs can be obtained as :

$$S.E. = \sqrt{2n_1n_2(2n_1n_2 - n_1 - n_2)} / (n_1+n_2)^2(n_1+n_2-1)$$

In order to test the significant difference between the actual number of runs and the expected number of runs, the test statistics employed will be:

$$Z = R - E(r)/S.E.$$

If the Z value lies within ±1.96, the Ho is accepted, and the results of this study show that the price movements in the share prices of all the sectors are random in behavior and hence, there is existence of a weak form of market efficiency.

Hypotheses of the Study

- **H_o:** The price movement in the share prices of each sector is not affected by the past prices.
- **H_1:** The price movement in the share prices of each sector is affected by the past prices.

Analysis and Results

Descriptive statistics like mean, standard deviation, variance, maximum, minimum, skewness, and kurtosis were calculated for the sample companies chosen for the study. SPSS 16.0 was used for data analysis and interpretation. Statistical description is necessary in order to find out whether the data shows normality or not. If the data is not normal, parametric tests cannot be applied. The values of skewness and kurtosis determine the normality of the data. If the critical values of skewness and kurtosis are 0 and 3, they imply that the observed data is perfectly normally distributed. Non-parametric tests ignore normality assumptions. The results presented in

Table 1. Descriptive Statistics for the Automobile Sector

Company Name	Descriptive Statistics						
	Mean	*S.D.*	Variance	Maximum	Minimum	Skewness	Kurtosis
Escorts Ltd.	2.1458	16.76029	280.907	62.10	-47.66	0.454	1.848
Hero MotoCorp	2.0036	8.35964	69.884	23.78	-17.86	0.093	-0.290
HMT Ltd.	1.9641	20.08172	403.276	107.12	-34.60	2.0981	7.867
Maharashtra Scooters Ltd.	2.5610	15.22583	231.826	94.88	-58.76	1.644	11.641
M&M Ltd.	1.7707	11.12820	123.837	53.69	-39.57	0.511	5.012
Tata Motors Ltd.	6.1653	38.87423	1511.206	423.02	-50.58	9.449	101.829

Table 2. Descriptive Statistics for the Banking Sector

Company Name	Descriptive Statistics						
	Mean	*S.D.*	Variance	Maximum	Minimum	Skewness	Kurtosis
Canara Bank	2.1669	12.94884	167.673	41.92	-33.77	0.318	0.160
HDFC Bank	5.6367	34.1491	1166.182	383.78	-27.37	10.427	116.145
ICICI Bank	2.3418	12.63489	159.640	53.02	-28.64	0.565	2.134
State Bank of India	2.1295	11.64536	135.614	44.83	-27.58	0.415	0.949
Syndicate Bank	2.5147	14.32106	205.093	41.49	-33.29	0.145	0.471
Union Bank of India	2.3610	13.30938	177.140	44.60	-31.89	0.304	0.485

Table 3. Descriptive Statistics for the Cement Sector

Company Name	Descriptive Statistics						
	Mean	*S.D.*	Variance	Maximum	Minimum	Skewness	Kurtosis
ACC Ltd.	1.9413	9.56671	91.522	24.89	-25.44	-0.360	-0.062
Ambuja Cement Ltd.	2.4611	10.08320	101.671	46.29	-21.36	0.662	2.896
Birla Corporation Ltd.	3.4056	17.45728	304.757	89.63	-37.37	1.244	4.618
India Cements Ltd.	1.9686	15.00199	225.060	60.70	-32.47	0.864	1.981
Mangalam Cements Ltd.	3.0818	17.50709	306.498	85.55	-28.47	1.305	3.460
Shree Cements	4.2709	13.22909	175.009	40.34	-23.55	0.270	-0.187

Table 4. Descriptive Statistics for the FMCG Sector

Company Name	Descriptive Statistics						
	Mean	*S.D.*	Variance	Maximum	Minimum	Skewness	Kurtosis
AgroTech Foods Ltd.	2.9775	14.37315	206.587	44.72	-31.64	0.706	0.806
Britannia Industries Ltd.	5.3441	38.32513	1468.816	434.16	-17.54	10.767	121.190
Dabur India Ltd.	4.7716	16.42326	269.723	124.20	-18.92	4.874	31.512
ITC Ltd.	6.8908	25.20721	635.403	182.89	-18.38	4.824	26.049
KRBL Ltd.	12.2007	95.06985	9038.276	1074.88	-41.94	10.753	120.728
Wipro Ltd.	4.3498	23.21919	539.131	214.23	-29.73	6.256	52.478

the statistical description have been obtained on the basis of the monthly closing price of 36 companies, which are listed on the NSE. The Tables 1 to 6 bring out the results of descriptive statistics of the sample companies belonging to various sectors chosen for the study.

The Table 1 shows the descriptive statistics of monthly returns of automobile sector stocks. It shows that the mean returns of M & M Limited are the lowest (1.7707), while the mean returns of Tata Motors Limited are the highest at 6.1653. The risk measured using standard deviation is also the highest in the case of Tata Motors Limited followed by HMT Limited. The skewness of all the companies in the automobile sector is greater than 0, and the kurtosis is less than 3 in case of Escorts Limited and Hero Motocorp Limited; it is greater than 3 for the remaining companies, which implies that the data does not show normality.

The Table 2 reveals the descriptive statistics of monthly returns of banking sector stocks. The lowest mean returns are observed in the case of State Bank of India with a value of 2.1295, while HDFC Bank earns the highest returns (5.6367). The risk measured using standard deviation is high in the case of HDFC Bank and Syndicate Bank. The skewness of all the companies in the banking sector is greater than 0, and the kurtosis is less than 3 in all the cases with HDFC Bank being an exception, in whose case, it is greater than 3, which implies that data does not show normality.

The Table 3 shows the descriptive statistics of monthly returns of cement sector stocks. One can observe that in this sector, the lowest mean returns are observed in the case of ACC Limited with a value of 1.9431, while the stocks of Shree Cements earned the highest mean returns (4.2709). The risk measured using standard deviation is high for Mangalam Cements Limited and Birla Corporation Limited. The skewness of all the companies in the cement sector is greater than 0, except in the case of ACC Limited, where it is less than 0 with a value of -0.360. The kurtosis is less than 3 in the case of ACC Limited, Ambuja Cements Limited, India Cements Limited, and Shree Cements. The kurtosis values of Birla Corporation Limited and Mangalam Cements Limited are greater than 3, which implies that the data does not show normality.

The Table 4 shows the descriptive statistics of monthly returns of FMCG sector stocks. It may be observed

Table 5. Descriptive Statistics for the Pharmaceutical Sector

Company Name	Descriptive Statistics						
	Mean	*S.D.*	Variance	Maximum	Minimum	Skewness	Kurtosis
Ajanta Pharma Ltd.	5.9629	20.25932	410.440	123.46	-27.86	2.824	13.706
Aventis Pharma Ltd.	2.0982	8.68499	75.429	32.28	-21.12	0.620	1.395
Dr.Reddy Laboratories Ltd.	2.5310	12.63792	159.717	106.69	-26.59	4.206	34.431
Elder Pharmaceuticals Ltd.	2.0982	11.69105	136.681	45.60	-27.01	1.114	2.249
GlaxoSmithline Pharmaceutical Ltd.	2.2264	7.86468	61.853	36.05	-20-09	0.612	2.396
Lupin Ltd.	7.4763	35.36244	1250.502	374.47	-18.67	8.866	89.872

Table 6. Descriptive Statistics for the Textile Sector

Company Name	Descriptive Statistics						
	Mean	*S.D.*	Variance	Maximum	Minimum	Skewness	Kurtosis
Bombay Dyeing	6.6652	44.67784	1996.109	468.63	-49.40	8.563	87.799
Century Textiles	2.7695	16.70812	279.161	95.47	-50.15	1.047	6.655
Gangothri Textiles Ltd.	0.7580	20.51234	420.756	115.76	- 34.38	1.989	7.860
Raymond Ltd.	1.8141	14.91170	222.359	75.99	-37.77	1.185	4.997
Sangam India Ltd.	2.1868	18.39463	338.362	68.22	-35.99	0.942	2.461
Vardhaman Textiles Ltd.	2.4216	15.59099	243.079	88.16	-32.62	2.2489	12.157

from this table that the mean returns are the lowest in AgroTech Foods Limited with a value of 2.9775, and the highest mean returns are observed in the case of KRBL Limited (12.2007). The risk measured using standard deviation is high for KRBL Limited and Britannia Industries Limited. The skewness of all the companies in the FMCG sector is greater than 0. The kurtosis is less than 3 for AgroTech Foods Limited and for the remaining companies, it is greater than 3, which implies that the data does not show normality.

The Table 5 shows the descriptive statistics of monthly returns of pharmaceutical sector stocks. This table exhibits that the mean return is the lowest for Aventis Pharma Limited and Elder Pharmaceuticals Limited with a value of 2.0982. The highest mean returns are observed in the case of Lupin Limited, with a value of 7.4763. The risk measured using standard deviation is high in the case of Lupin Limited and Ajanta Pharma Limited. The skewness of all the companies in the pharmaceutical sector is greater than 0, and the kurtosis is less than 3 in Aventis Pharma Limited, Elder Pharmaceuticals Limited, GlaxoSmithKline Pharmaceutical Limited, and Dr. Reddy's Laboratories Limited. The kurtosis values for Ajanta Pharma Limited and Lupin Limited are greater than 3, which implies that the data does not show normality.

The Table 6 shows the descriptive statistics of monthly returns of textile sector stocks. It is observed that the lowest mean returns are observed for Gangothri Textiles Limited with a value of 0.7580 and the highest mean returns are observed for Bombay Dyeing & Manufacturing India Limited, which is 6.6652. The risk measured using standard deviation is high for Bombay Dyeing & Manufacturing India Limited and Gangothri Textiles Limited. The skewness of all the companies in the textile sector is greater than 0. The kurtosis is less than 3 for Sangam India Limited. The kurtosis values of Bombay Dyeing & Manufacturing India Limited, Century Textiles & Industries Limited, Gangothri Textiles Limited, Raymond Limited, and Vardhaman Textiles Limited are greater than 3, which implies that the data does not show normality.

Z test was applied to know whether the returns from the selected stocks follow a random path or not. The *Z* values obtained using runs test were computed by applying the formula:

$$Z = R - E(r) / SD$$

Table 7(a) *Z*-Values Using Run Test: Automobile Sector

Sl.No	Company Name	*Z* Values
1.	Escorts Ltd.	0.615
2.	Hero MotoCorp Ltd.	-0.328
3.	HMT Ltd.	1.038
4.	Maharashtra Scooters Ltd.	-0.604
5.	Mahindra & Mahindra Ltd.	1.649
6.	Tata Motors Ltd.	-1.637

Table 7(b). *Z*- Values Using Run Test: Banking Sector

Sl.No	Company Name	*Z* Values
1.	Canara Bank	-0.579
2.	HDFC Bank	1.450
3.	ICICI Bank	0.119
4.	State Bank of India	-0.404
5.	Syndicate Bank	0.958
6.	Union Bank of India	-1.235

Table 7(c). *Z*- Values Using Run Test: Cement Sector

Sl.No	Company Name	*Z*-Values
1.	ACC Limited	0.615
2.	Ambuja Cement Ltd.	-0.430
3.	Birla Corporation Ltd.	-1.579
4.	India Cements Ltd.	-1.270
5.	Mangalam Cements Ltd.	-0.150
6.	Shree Cements	-2.325

The *Z* values for each company's mean returns belonging to various sectors are depicted in the following part of the study. The Tables 7(a) to Table 7(f) show the *Z* values obtained for the stock returns of various companies chosen from different sectors of the economy.

The Table 7(a) reveals the *Z* values obtained using runs test for the sample companies in the automobile sector. The positive *Z* values indicate that the computed values are more than the mean value, and the negative *Z* values show that the computed values are less than the mean value. It may be observed that the *Z* value is the highest for HMT Limited, while it is the lowest in case of Mahindra & Mahindra Limited, where the *Z* value is negative. The positive *Z* values are observed for Escorts Limited and HMT Limited, while negative *Z* values are observed in the case of Hero Motocorp Limited, Maharashtra Scooters Limited, Mahindra & Mahindra Limited, and Tata Motors Limited.

The Table 7(b) reveals the *Z* values obtained using runs test for the sample companies in the banking sector. It may be observed that the *Z* value is the highest for HDFC Bank, while it is the lowest in case of Union Bank of India, where the *Z* value is negative. The *Z* values of HDFC Bank, ICICI Bank, and Syndicate Bank are positive, while the *Z* values of Canara Bank, State Bank of India, and Union Bank of India are negative.

The Table 7(c) reveals the *Z* values obtained using runs test for the sample companies in the cement sector. It may be observed that the *Z* value is the highest for ACC Limited, while the lowest is that of Shree Cements, whose *Z* value is negative. The positive *Z* values of ACC Limited show that the value is more than the mean value, while

Table 7(d) *Z*- Values Using Run Test: FMCG Sector

Sl.No.	Company Name	*Z* Values
1.	AgroTech Foods Ltd.	0.414
2.	Britannia Industries Ltd.	-1.231
3.	Dabur India Ltd.	-0.245
4.	ITC Ltd.	1.430
5.	KRBL Ltd.	0.344
6.	Wipro Ltd.	0.942

Table 7(e). *Z*-Values Using Run Test: Pharmaceutical Sector

SI.No	Company Name	*Z*-Values
1.	Ajanta Pharma Ltd.	-2.136
2.	Aventis Pharma Ltd.	0.564
3.	Dr. Reddy's Laboratories Ltd.	0.200
4.	Elder Pharmaceuticals Ltd.	-1.159
5.	GlaxoSmithKline Pharmaceutical Ltd.	-1.031
6.	Lupin Ltd.	-0.035

Table 7(f). *Z*- Values Using Run Test: Textile Sector

SI.No	Company Name	*Z*-Values
1.	Bombay Dyeing & Manufacturing India Ltd.	-1.268
2.	Century Textiles & Industries Ltd.	-1.126
3.	Gangothri Textiles Ltd.	0.514
4.	Raymond Ltd.	-1.207
5.	Sangam India Ltd.	-0.081
6.	Vardhaman Textiles Ltd.	-1.222

the negative *Z* values of the remaining companies show that the values are less than the mean value.

The Table 7(d) reveals the *Z* values obtained using the runs test for the sample companies in the FMCG sector. It may be observed that the *Z* value is the highest for ITC Limited, while the lowest is that of Britannia Industries Limited, whose *Z* value is negative. The *Z* values are positive in the case of AgroTech Foods Limited, ITC Limited, KRBL Limited, and Wipro Limited, while it is negative in the case of Britannia Industries Limited and Dabur India Limited.

The Table 7(e) reveals the *Z* values obtained using runs test for the sample companies in the pharmaceutical sector. It may be observed that the *Z* value is the highest for Aventis Pharma Limited, while the lowest is that of Ajanta Pharma Limited, whose *Z* value is negative. The *Z* values are positive for Aventis Pharma Limited and Dr. Reddy's Laboratories Limited, while the *Z* values of Ajanta Pharma Limited, Elder Pharmaceuticals Limited, GlaxoSmithKline Pharmaceutical Limited, and Lupin Limited are negative.

The Table 7(f) reveals the *Z* values obtained using runs test for the sample companies in the textile sector. It may be observed that the *Z* value is the highest for Gangothri Textiles Limited, while the lowest is that of Bombay Dyeing & Manufacturing India Limited, whose *Z* value is negative. The *Z* value is positive in the case of Gangothri Textiles Limited, while it is negative in the case of the remaining companies.

In order to analyze the *Z* values obtained in the above Tables - from Table 7(a) to Table 7(f), the calculated values of runs test *(Z)* are compared with the critical value at the 5% level of significance. Out of the six sectors (36 companies), the value of *Z* of all companies except Shree Cements and Ajanta Pharma Limited is less than the critical value of 1.96 at the 5% level of significance. So, the null hypothesis that the price movement in the share prices of National Stock Exchange is not affected by past prices is accepted. The results show that the price movements in share prices of the National Stock Exchange of the Indian stock market are random in behavior. This implies that one cannot use the historical prices for predicting the future prices. That is, all the information contained in historical prices is not revealed by the current prices. This proves that the weak form of the market efficiency hypothesis is applicable in the National Stock Exchange based upon the share price movement of 36 sample companies chosen for the study.

Major Findings

This study aimed at testing the weak form of market efficiency of the Indian stock market by selecting stocks of companies belonging to six sectors. The runs test was applied to find out whether there is any relationship between the future prices of stocks and their past performances. It was hypothesized that the price movement in the share prices of each sector is not affected by the past prices. The findings of the study are as follows :

(1) Descriptive statistics like mean, standard deviation, variance, maximum, minimum, skewness, and kurtosis were calculated. It is observed that Hero Motocorp Limited's standard deviation is the lowest in the automobile sector; State Bank of India's standard deviation is the lowest in the banking sector; ACC Limited's standard deviation is the lowest in the cement sector; AgroTech Foods Limited's standard deviation is the lowest in the FMCG sector; GlaxoSmithKline Pharmaceutical Limited's standard deviation is the lowest in the pharmaceutical sector; Raymond Limited's standard deviation is the lowest in the textile sector.

(2) The values of skewness and kurtosis determine the normality of the data. Theoretical values of skewness and kurtosis are 0 and 3, which represent that the observed data is perfectly normally distributed. It was found that the values of skewness are positive for all the companies except ACC Limited. It is also found that the values of kurtosis are positive for all the companies except Hero Motocorp Limited, ACC Limited, and Shree Cements.

(3) *Z* values for each of the six sectors were obtained using runs test. The calculated values of run test *(Z)* were compared with the critical value at the 5% level of significance. A positive *Z* value implies that the value obtained for a particular company is above its mean value, and a negative *Z* value obtained for any company reveals that the value obtained is less than the mean value of that company.

(4) In the automobile sector, the positive *Z* values are observed in the case of Escorts Limited and HMT Limited, while negative *Z* values are obtained in the case of Hero Motocorp Limited, Maharashtra Scooters Limited, Mahindra & Mahindra Limited, and Tata Motors Limited.

(5) In the banking sector, the positive *Z* values are observed in the case of HDFC Bank, ICICI Bank, and Syndicate Bank, while negative *Z* values are observed for Canara Bank, State Bank of India, and Union Bank of India.

(6) In the cement sector, the *Z* value is positive for ACC Limited, while the *Z* values obtained in the case of the remaining companies in this sector are negative.

(7) In the FMCG sector, the *Z* values of AgroTech Foods Limited, ITC Limited, KRBL Limited, and Wipro Limited are positive *Z* values ; however, the *Z* values of Britannia Industries Limited and Dabur India Limited are negative.

(8) In the pharmaceutical sector, the *Z* values obtained are positive in the case of Aventis Pharma Limited and Dr. Reddy's Laboratories Limited, while the *Z* values are negative for Ajanta Pharma Limited, Elder Pharmaceuticals Limited, GlaxoSmithKline Pharmaceutical Limited, and Lupin Limited.

(9) In the textile sector, the *Z* values are positive for Gangothri Textiles Limited, while the *Z* values are negative for the remaining companies.

(10) It is found that out of the six sectors (comprising of 36 companies), the values of *Z* for all the companies except Shree Cements and Ajanta Pharma Limited are less than the critical value of 1.96 at the 5% level of significance.

This implies that in majority of the cases, the past prices do not have an influence on current prices of shares. So, the null hypothesis is accepted, and the alternate hypothesis is rejected, that is, the hypothesis that "the movement in the share prices of NSE traded companies is not affected by past prices" is accepted. Thus, the results of this study indicate that the assumption of weak form efficiency of the market is true with respect to the Indian capital market. The results hold true for the samples and for the time period chosen for this study.

Conclusion

To conclude, the present study revealed that the movement in share prices of companies traded in India through the National Stock Exchange is not affected by their past prices. The price movements in share prices of stocks traded through the National Stock Exchange of the Indian stock market are random in behavior. Therefore, no investor can use the historical prices for predicting the future prices of stocks. It was, thus, proved that the EMH for weak form of market efficiency is applicable in the National Stock Exchange based upon the share price movement of 36 sample companies chosen for the study. In other words, the Indian capital market has proven to be efficient in its weak form.

Research Implications

The movement of the stock prices provides an insight to investors relating to buying and selling of shares and other securities to make profits. The results of the study may be used by the participants in the financial markets such as individual investors, commercial banks, stock exchanges, non-financial institutions, foreign banks, and insurance companies. The stock exchange plays an important role in economic development of an economy to determine the economic health and has an essential role in mobilizing the resources for development of the capital markets. The efficient market assumes that the past information will be reflected on the current prices. The information is used by the investors to buy, sell, or hold the stock or security. Thus, the study relating to the efficient market hypothesis helps the individuals, fund managers, and institutional investors to take appropriate investment decisions.

Limitations of the Study and Scope for Further Research

The Indian capital market is becoming more attractive to foreign investors as well as domestic investors. The number of stocks listed in BSE and NSE are also increasing year after year, which helps the investors to have different types of portfolios to satisfy their varied goals. The stock markets are assumed to be potentially more efficient than other markets due to location independence feature, which implies that the value of securities are independent of location. This feature attracts many potential investors towards the Indian stock market. So, more micro level research studies with different samples from different sectors allow the prospective investors to

understand the efficiency of the Indian stock market. In turn, this helps India in capital mobilization as well as promotes healthy speculation.

Every rational investor is interested in knowing whether the securities in which he/she intends to invest are under-valued or over-valued and to decide if there is any scope of reaping gains through price variations. The changes taking place in the accounting arena through IFRS convergence as well as in the legal arena through amendments to the Indian Companies Act, 1956 (amended in 2013) enables prospective investors to better understand the Indian capital market. As capital market efficiency is more about informational efficiency, the above changes are expected to have an impact on the efficiency of the Indian capital market.

The study has the following limitations : (a) future prices of stocks cannot be predicted by analyzing prices in the past, (b) excess returns cannot be expected to be earned in the long run by using investment strategies based on historical share prices, (c) technical analysis cannot help investors to make a continuous gain from the market.

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