Test of Random Walk Theory in the National Stock Exchange

S. Mathivannan[1] and M. Selvakumar[2]

[1]Associate Professor, PG and Research Department of Commerce, Sri S R N M College,
Sivakasi, Tamil Nadu, India
[2]Assistant Professor, PG and Research Department of Commerce, Ayya Nadar Janaki Ammal College,
Sivakasi, Tamil Nadu, India
E-mail:professorselvakumar@gmail.com

Abstract - **Capital market being a vital institution which facilitates economic development. It is true that so many parties are interested in knowing the efficiency of the capital market. The small and medium investors can be motivated to save and invest in the capital market only if their securities in the market are appropriately priced. The information content of events and its disseminations determine the efficiency of the capital market. That is, how quickly and correctly security prices reflect these information show the efficiency of the capital market.**

The term market efficiency is used to explain the relationship between information and share prices in the capital market. The three forms of market efficiency are weak form, semi – strong form and strong form. A market is considered as weak form if current prices fully reflect all information contained in historical prices. Thus, no investor can devise a trading rule based on past price patterns to earn abnormal return. A market is semi-strong efficient, if stock prices instantly reflect any new publicly available information. A market is said to be strong form efficient, if prices reflect all types of information whether available publicly or privately.

It is usually believe that the markets in developing and less developed countries are not efficient in semi-strong form or strong form. In the developed countries, many research studies have been conducted to test the efficiency of the capital market. In India, very few studies have been conducted to test the efficiency of the capital market.

The weak form of efficient market hypothesis also known as Random Walk Hypothesis states that at a given point of time, the size and direction of the next price change is at random.

Hence, this paper has made an attempt to analyse whether prices in National Stock Exchange follow a random walk process as required by market efficiency.

Keywords: **Random Walk Theory, Stock Exchange, Security Analysis and Run Test**

I. INTRODUCTION

Securities Market in India has grown in terms of amount raised from the market, the number of listed stocks, market capitalization, trading volume and turnover on stock exchanges and other intermediaries. Qualitative parameters such as establishment of nationwide screen based trading system, dematerialization and electronic transfer of securities, rolling settlement and sophisticated risk management have also been introduced in the stock markets. These qualitative and quantitative parameters have also grown exponentially in the National Stock Exchange. These changes have greatly improved the efficiency, transparency, depth and safety of the market.

Market efficiency has an influence on the investment strategy of an investor because if market is efficient, trying to predict winners will be a waste of time. In an efficient market there will be no undervalued securities offering higher than deserved or expected returns, given their risk. On the other hand if markets are not efficient, excess returns can be made by correctly picking the winners.

The Random Walk Hypothesis is concerned with the question of whether one can predict future prices from past prices. In its simple form, it states that price changes cannot be predicted from earlier changes in any meaningful manner. Successive price changes in individual securities are independent over time. Thus, past prices contain no useful information to predict their future price behaviour.

Efficient Market Hypothesis (EMH) states that security prices fully reflect all available information. The weak form of EMH (Random Walk Theory) states that the current prices fully reflect the information implied by the past prices (historical sequence of prices). In an efficient market at a given instant of time, the prices are assumed to reflect all available information. One would expect the current price of security to be good estimates of its intrinsic values. If the adjustment to new information is instantaneous, successive price changes will be independent.

II.STATEMENT OF THE PROBLEM

Capital market being a vital institution which facilitates economic development. It is true that so many parties are interested in knowing the efficiency of the capital market. The small and medium investors can be motivated to save and invest in the capital market only if their securities in the market are appropriately priced. The information content of events and its disseminations determine the efficiency of the capital market. That is, how quickly and correctly security prices reflect these information show the efficiency of the capital market.

The term market efficiency is used to explain the relationship between information and share prices in the capital market. The three forms of market efficiency are weak form, semi – strong form and strong form. A market is considered as weak form if current prices fully reflect all information contained in historical prices. Thus, no investor can devise a trading rule based on past price patterns to earn abnormal return. A market is semi-strong efficient, if stock prices instantly reflect any new publicly available information. A market is said to be strong form efficient, if prices reflect all types of information whether available publicly or privately.

It is usually believe that the markets in developing and less developed countries are not efficient in semi-strong form or strong form. In the developed countries, many research studies have been conducted to test the efficiency of the capital market. In India, very few studies have been conducted to test the efficiency of the capital market.

The weak form of efficient market hypothesis also known as Random Walk Hypothesis states that at a given point of time, the size and direction of the next price change is at random.

Hence, this paper has made an attempt to analyse whether prices in National Stock Exchange follow a random walk process as required by market efficiency.

III.OBJECTIVES OF THE STUDY

1. To empirically test whether the Random Walk Hypothesis or Weak Form of Efficient Market Hypothesis holds well in the Indian Stock Market.
2. To offer suitable suggestions to the investors for security analysis.

IV.SCOPE OF THE STUDY

The study covers only ten companies which are included in the Nifty of National Stock Exchange. It doesn't cover other companies included in the Nifty. The study covers the weak form of the efficiency only.

V.METHODOLOGY

The present study is based on the secondary data. Data have been collected from SEBI Bulletin, RBI annual reports, journals, books and internet.

A.Period of the Study
The study covers a period of two years from January 2008 to December 2009.

B.Hypothesis of the Study
The price movements in the share prices of National Stock Exchange are not affected by past prices. That is, price changes are random.

C.Plan of Analysis
Statistical tools like runs test and serial correlation test have been used to analyse the data.

D.Sampling Design
The sample covered in this study consists of ten actively traded companies which are listed on the National Stock Exchange representing various sectors. Two sets of data are collected for the present study. Weekly closing price data of ten companies have been collected from the period 1st January 2008 to 31st December 2009. Another set of data that is monthly price data have been used from the period 1st January 2009 to 31st December 2009.

E.Random Walk Theory
The financial theory known as the "Random Walk Hypothesis" proposes stock prices in the stock market, prices are completely unpredictable. This hypothesis is widely accepted by economists, investors and other financial behaviorists, who continue to believe that stock prices are random making it impossible to consistently outperform market averages.

Economists and stock market analysts use random walk techniques as a model for the behaviour of share prices on stock markets, as well as commodity prices and currency exchange rates. This practice presumes that investors act rationally and without bias, estimating the value of an asset based on expectations for the future. All existing information affects the share price, which can only change when new information becomes available. Since new information appears randomly, it follows that the share price is influenced randomly.

F.Empirical Tests of Random Walk Model
1. To empirically test the Random Walk Model
2. Runs Test and Serial Correlation Test are applied.

G.Runs Test
Runs analysis or Runs test is one of a non – parametric test. Runs test has been used to judge the randomness in the behaviour of share prices in stock markets. The runs test examines that given a sequence of observations, 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.

Runs test has been applied through the following formulae:

$$\text{Runs Test (Z)} = \frac{R - \overline{X}}{\sigma}$$

R = Number of runs

$$\text{Mean } (\overline{X}) = \frac{2n_1 n_2}{n_1 + n_2} + 1$$

$$\text{Variance } (\sigma^2) = \frac{2n_1 n_2 (2n_1 n_2 - n_1 - n_2)}{(n_1 + n_2)^2 (n_1 + n_2 - 1)}$$
Where

n_1 = Number of occurrences of '+' in the series
n_2 = Number of occurrences of '−' in the series
σ = Standard Deviation.
Z = Standard Normal Variate.

To analyze the result, if the Z value is less than the critical value of 5 per cent level of significance, it accepts the null hypothesis (H_O) i.e. the price movements in the share prices of NSE is not affected by past prices. If the Z value is greater than the 5 per cent level of significance, it rejects the null hypothesis i.e. the price movements in the share prices of NSE is affected by past prices.

An attempt has been made to analyse the price behaviour of the following ten companies which are included in the Nifty of National Stock Exchange. The Z value is calculated from weekly closing prices covering two years from January 2008 to December 2009.

1. Associated Cement Company (ACC).
2. Bharat Heavy Electrical Limited (BHEL).
3. Delhi Land and Finance (DLF).
4. Hero Honda.
5. Hindustan Unilever Limited (HUL).
6. Maruti.
7. National Thermal Power Corporation (NTPC).
8. Ranbaxy.
9. Sun Pharma.
10. Wipro.

VI. RESULTS AND DISCUSSION

TABLE I RESULTS OF RUNS TEST FOR THE SAMPLE COMPANIES

Sl.No.	Name of the Company	Z Value	5% Level of Significance Value	S or NS
1	Associated Cement Company	−1.443	1.96	S
2	Bharat Heavy Electrical Limited	1.893	1.96	S
3	Delhi Land and Finance	−0.297	1.96	S
4	Hero Honda	−0.901	1.96	S
5	Hindustan Unilever Limited	1.496	1.96	S
6	Maruti	0.869	1.96	S
7	National Thermal Power Corporation	0.520	1.96	S
8	Ranbaxy	0.520	1.96	S
9	Sun Pharma	0.899	1.96	S
10	Wipro	−1.219	1.96	S

Legend : S – Significant at 5%
NS – Not Significant at 5%

Table 1 reveals that, according to the analysis of Runs test, the Z value of all the ten companies are less than the critical value of 5 per cent level of significance. Hence, the null hypothesis is accepted, that is the price movements in the National Stock Exchange do not follow any pattern. It also states that the price movements of all the ten sample companies follow Random Walk Model.

Serial Correlation

Serial Correlation or Auto Correlation test is one of the parametric tests. Auto Correlation has been used for testing the dependence of random variables in a series. Serial correlation measures the correlation co – efficient in a series of numbers with the lagging values of the same series. Serial correlation test is widely used for testing the Efficient Market Hypothesis in the weak form.

Serial correlation co – efficient provides a measure of relationship between the value of a random variable in time (t) and its value (k) periods earlier. They will indicate whether price changes at time (t) is influenced by the price changes occurring (k) periods earlier.

The following formula is used to calculate the serial correlation test:

$$r_k = \frac{C_K}{C_o}$$

Where

$$C_k = \frac{1}{N} \sum_{t=1}^{N-k} (X_1 - \overline{X})(X_{t+k} - \overline{X})$$

K = 1, 2 …………..

$$\overline{X} = \frac{1}{N} \sum_{t=1}^{N} X_t$$

C_o = Variance of X_t

To analyze the result, three limits of correlation co – efficient have been taken. These limits are – 0.25 to 0.25 (low correlation), – 0.25 to – 0.75 or 0.25 to 0.75 (moderate correlation) and – 0.75 to – 1 or 0.75 to 1 (high correlation).

The Serial Correlation is calculated for monthly share prices of ten companies from January 2009 to December 2009. In serial correlation test, lag t is compared with lag t +1, lag t +2, lag t +3 and so on.

TABLE II VALUES OF AUTO CORRELATION CO-EFFICIENT FOR SAMPLE COMPANIES

S.No.	Company Name	t+1	t+2	t+3	t+4	t+5	t+6	t+7	t+8	t+9	t+10	t+11
1	ACC	0.651	0.403	0.102	-0.115	-0.167	-0.304	-0.194	-0.219	-0.219	-0.232	-0.175
2	BHEL	0.723	0.448	0.185	-0.100	-0.203	-0.254	-0.296	-0.344	-0.276	-0.229	-0.154
3	DLF	0.677	0.414	0.113	-0.116	-0.249	-0.396	-0.342	-0.285	-0.164	-0.101	-0.051
4	HERO HONDA	0.729	0.492	0.251	0.031	0.130	-0.302	-0.331	-0.397	-0.348	-0.323	-0.171
5	HUL	0.518	-0.013	-0.0007	0.017	-0.152	-0.304	-0.300	-0.195	-0.060	-0.0003	0.0004
6	MARUTI	0.737	0.552	0.305	0.027	-0.196	-0.394	-0.420	-0.430	-0.029	-0.253	-0.140
7	NTPC	0.406	0.346	0.166	-0.012	-0.0007	-0.303	-0.077	-0.295	-0.334	-0.232	-0.157
8	RANBAXY	0.718	0.478	0.274	0.027	-0.156	-0.276	-0.345	-0.453	-0.371	-0.275	-0.117
9	SUN PHARMA	0.615	0.258	0.063	-0.027	-0.0001	-0.139	-0.180	-0.263	-0.363	-0.329	-0.154
10	WIPRO	0.787	0.540	0.297	0.066	-0.149	-0.353	-0.404	-0.428	-0.395	-0.301	-0.159

It is observed from Table II that, large number of companies show moderate or low correlation. It shows that the price changes are independent and the past prices are not useful in predicting future prices. Hence, the serial correlation result confirms that the NSE is efficient in the weak form.

According to Runs test, the price movements of all the ten sample companies follow Random Walk Model. The serial correlation test result reveals that the series of price changes are not dependent. Hence, the historical share prices of NSE are not useful to predict the future share prices. It is concluded that, the NSE is efficient in the weak form.

VII.FINDINGS OF THE STUDY

The analysis of Runs test shows that in every case the null hypothesis is accepted. It means the share prices of sample companies do not make any pattern or trend. The share prices of all sample companies in the NSE move randomly. It implies that historical prices are in no way useful to predict future prices. According to Runs test results, the NSE is efficient in weak form. It is concluded that the Random Walk theory holds good in the NSE.

In Serial correlation test, more companies have shown moderate and low correlation. So, it shows that the price movements of the sample companies are independent. It confirms that the historical price data are not useful in predicting the future. It can be concluded that the price movements on NSE are occurring by chance. According to the Serial correlation test, the NSE is efficient in weak form of EMH. Hence, it is concluded that the Random Walk Theory holds good in NSE.

VIII.SUGGESTIONS

1. Investors should not invest in the stock market on the basis of past trends. The stock market is affected by various external factors like political conditions, natural calamities and other socio–economic factors and is different each time.
2. Fundamental analysis of the stocks is the most effective way to find out the stocks for long term investment that have a healthy financial standing and good potential to grow as a company.
3. It is a known fact that reliability of accounting information is important. The regulation of accounting norms and audit practices will improve the reliability of accounting information. The regulatory authorities may monitor the reliability or the truth in the information released by the companies.

IX.CONCLUSION

Understanding the nature of Stock market efficiency is important to the investors who seek to find whether the opportunity of making excess return does exist in a given stock market. If a market is efficient, no arbitrate opportunities can be usurped to make excess profits as all the available information has been discounted in current prices. In the light of this, this study has investigated the efficiency of NSE in the weak – form by employing Runs test and Serial Correlation test. The result of the study confirms that the NSE follows a random walk and is efficient in the weak form. The implication is that expectation about overvaluation or undervaluation of stock prices in the market is ruled out.

REFERENCES

[1] Choudhury, S. K., "Short-Run Share Price Behaviour: New Evidence on Weak Form of the Market Efficiency", Vikalpa, Vol.16, No.4, 1991, pp.17-21.
[2] Fama, E.F., "Efficient Capital Markets: II", Journal of Finance, Vol.46, No.5, 1991, pp.1575-1617.
[3] Sharma, J. L., "Efficient Capital Market and Random Character of Stock Prices Behaviour in a Developing Economy", Indian Journal of Economics, Vol.63, No.251, 1983, pp.395-400.
[4] Chatfield, C., The Analysis of Time Series- An Introduction, Chapman and Hall, London, 1980.

[5] Rao, N.K. and Mukherjee, K., "Random-walk Hypothesis: An Empirical Study", Arthaniti, Vol.4, No.1, 1971.

[6] Yalawar, Y. B., "Bombay Stock Exchange: Rate of Return and Efficiency", Indian Economic Journal, Vol.35, No.4, 1988, pp.68-121.

[7] Poshakwale, S., "Evidence on Weak Form Efficiency and Day of the Week Effect in the Indian Stock Market", Finance India, Vol.10, No.3, 1996, pp.605- 616.

[8] Alexander S. S., "Price Movements in Speculative Markets: Trends or Random Walks", Industrial Management Review, Vol.2, No.2,1961.

[9] Belgaumi, M.S., "Efficiency of the Indian Stock Market: An Empirical Study", Vikalpa, Vol.20, No.2, 1995, pp 43-47.

[10] Gupta, O.P., Behaviour of Share Prices in India – A Test of Market Efficiency, National Publishing House, New Delhi, 1985.

[11] Prasanna Chandra, Investment Analysis and Portfolio Management, Tata McGraw Hill Publishing Company Limited, New Delhi, 2002.

[12] Punithavathy Pandian., Security Analysis and Portfolio Management, Vikas Publishing House Private Limited, New Delhi, 2001.

[13] Chander, R., Mehta, K. and Sharma, R., "Empirical Evidences on Weak Form Stock Market Efficiency: The Indian Experience", Decision, Vol.35, No.1, 2008, pp.75-109.

[14] Chander, S., and Phillip, "Behaviour of Stock Market Prices at BSE and NSE: An Application of Runs Test", Journal of Accounting and Finance, Vol.17, No.2, 2003, pp.41-57.

[15] Fama, E.F., "The Behavior of Stock-Market Prices", The Journal of Business, Vol. 38, No. 1, January 1965, pp.34-105.

[16] Gupta, O. P., "A Study of Stock Market Efficiency in India", Finance India, Vol.15, No.2, 2001, pp.665-673.