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Testing of Efficient Market Hypothesis: A Study on Bombay Stock Exchange (BSE)

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Abstract

This study examines the efficient market hypothesis by adopting runs test to test weak form of efficient market hypothesis. Efficient market hypothesis theory states that the stock markets are efficient and the security prices fully reflect all the information that is available. As EMH assumes that markets are efficient, it is not possible to any investor to earn extra ordinary or above average returns by trading in the stock markets. It means that all the available information is absorbed by the stock prices hence no investor will be able to outperform the stock market. The paper examines only the dependence of successive price changes on its past using the runs test of randomness. Secondary Data, comprises of 30 companies listed at BSE, is employed to test the hypothesis. The daily adjusted closing prices of these 30 companies for a period of 3 months were taken into consideration. The results show that the adjusted closing prices do not follow the randomness in any of the selected companies for the selected duration.

Key Words:

Efficient Market Hypothesis (EMH); Bombay Stock Exchange (BSE); Randomness; Runs test.

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Introduction

This study is based on the testing of efficiency of movement of the closing prices of companies listed at Bombay Stock Exchange at weak form with the help of test of randomness i.e. Runs Test over a period of time. In efficient Market, as per assumptions, it is assumed that prediction of future prices using the past price pattern with the help of the technical analysis is not possible as all the available information has already been absorbed in the current prices of securities. As per the EMH developed by Fama in 1960 in his Ph. D. dissertation, states that if the market is efficient, price will follow a random walk model. Random walk model explains that if stock prices are following random walk, movement in stock prices are independent from its past. The assumption of independent relation to the random walk hypothesis is studied and found valid as available in the literature and it is discussed that the past pattern of the series of price movement cannot be used to get unexpected gains. If any stock market is not efficient then, any stock outperforming the stock market will create positive sentiments among investors but any stock underperforming may create panic among investors. In this study the randomness efficiency of price movement of companies listed on BSE is tested by applying the runs test. The adjusted closing stock prices of selected companies are collected from yahoo finance and are then necessary statistical tools are applied to obtain whether here lies random walk model or not. The study is to check the efficiency of prices of selected companies at weak form with the help of runs test of randomness applied in the closing prices over a period of time.

Literature Review

Sharma and Kennedy (1977) found that three stock exchanges viz. London, New York and Bombay Stock Exchange have random walk movement using runs test for the period of 11 years period during 1963-1973.

Pandey (2003) in his study to test efficiency level in Indian Stock Market conducted runs test and found that the series of stock indices in Indian Stock Market are biased random time series during the study period of 1996 to 2002.

Pradhan et al. (2009) found Indian Stock Market inefficient in weak form during the period of 2007 to 2009 comprises of NSE and BSE to examine the Efficient Market Hypothesis. The study was conducted including the period of financial crises of 2008.

Khan and Ikram (2010) in their study to test efficiency of Indian capital market in its semi-strong form of Efficient Market Hypothesis to analyse the impact of FII during the period of 2000 to 2010 and found that Indian capital market is efficient in semi-strong form.

Dasilas and Stergios (2011)

Gupta and Gedam (2014) used runs test to test weak form of Efficient Market Hypothesis during the period of January 2014 to March 2014 on selected companies of different sector listed at NSE and found that the stock prices are independent from its past prices and favour random walk theory.

Pan et al. (2003) studied 18 national stock markets by applying unit root and co-integration tests and found that world equity markets are weak form efficient during 1961-92.

Pinches et. al (1980) studied events like accounting changes, stock splits on the risk adjusted return of securities and concludes with their methodology that it directly affects the result of market efficiency.

Bhuyan et. al (2008) conducted study to check whether Bangladesh's Dhaka stock Exchange (DSE) follows random walk model or not. Study concluded that either through parametric test or non parametric test provided evidence that the security returns in particular market do not follow the random walk model.

Sanger and McConnell (1986) in their event study of over the counter stocks listed on the NYE and found that market is insensitive to variations in empirical methodology.

Dow and Gorton (1997) studied the difference or connection between economic efficiency and stock market efficiency and found that stock price efficiency is not sufficient for economic efficiency.

Jegadeesh and Titman (1993) studied the holding period return pattern based on past and found that the stocks performed well in past generates positive returns over the 3 to 12 months holding period. Bondt and Thaler (1985) examined effects of overreaction of stock prices and substantial weak form market inefficiencies are discovered.

Lanste in et al (1998) examined market efficiency through different strategies and found the persuasive evidence of market inefficiency. . Lim and Brooks (2011) also studied the weak form market efficiency by examining return predictability from past price changes. Wang et al (2010) analyzed the market efficiency for the shanghai stock market by using three different measures.

Allvine and Neill (1980) studied the market reaction prior and thereafter election and found that stock prices rising relative to trend over the two years prior to a presidential election

Objectives of the study

1. To find out the randomness (independence) of the share prices of selected companies for the selected period of time.
2. To find out whether the weak form of market efficiency holds true or not.

Research Methodology

The study considered 30 companies listed at BSE for the purpose of study. The adjusted closing prices of these companies were collected from yahoo finance for the period ranging from 1st November 2018 to 31st January 2019.

Research Plan

There are two hypotheses that have been consider examining the randomness of the prices in weak form efficiency, these two hypotheses are:

H0: Past prices are not reflected on the present prices.

H1: Past prices are reflected on the present prices.

This study examines the efficient market hypothesis, by employing Runs test of randomness. Runs test is a non-parametric test, and helps to test the randomness of the series. In this paper it is taken to judge the randomness in the behavior of selected closing prices of Bombay Stock Exchange.

The Runs test was applied in MS-Excel. All the movement above the average of the series are known as above cut-off (+) and all the movement below the average are known as below the cut-off (-). Every time series crosses the average line counted as one run.

To test the independence of the prices following are needed:

Total number of observation (o)	
Number above cut off	(n1)
Number below cut off	(n2)
Number of runs	(r)
Mean/ Expected Runs/{E(r)} (μ)	
Standard Deviation	(σ)

To test the hypotheses any of the following three criteria's can be used:

1. If no. of actual runs are less than expected runs E(r) for a given series of prices, it means price changes are not random and past prices are reflected on present prices (H₀ is rejected) and if no. of actual runs are more than expected runs E(r) for a given series of prices, it means price changes are random and past prices are not reflected on present prices (H₀ is accepted).
2. A second criterion is Z score at 5% level of significance. The Table value of Z is 1.96 at 5% level of significance. If the calculated value lies between -1.96 and 1.96 then null hypothesis is rejected in our study other than this null hypothesis is accepted, which indicates market is inefficient and random walk not follows.
3. If number of runs falls within the upper and the lower limit, it indicates that prices are independent at 5% level of significance (H₀ is accepted) and market is weekly efficient. If no. of runs is beyond the upper limit and lower limit market seems to be inefficient in weak form.

Calculating lower limit and Upper Limit

$$\text{Lower limit: } \{\mu - 1.96 * (\sigma)\}$$

$$\text{Upper limit: } \{\mu + 1.96 * (\sigma)\}$$

Where $\mu = \text{mean} / E(r)$

$\sigma = \text{standard deviation}$

Data Analysis

Table: 1 showing the result of hypothesis testing

Company's Name	O	n	n	r	μ	σ	Lower Limit	Z-value	p-value	Upper Limit	Hypothesis testing at 5% level of significance
ITC Ltd	62	28	34	13	31.71	3.87	24.13	-4.84	0.000	39.289	H1 is accepted
Reliance Industries Ltd	62	23	39	10	29.94	3.64	22.8	-5.48	0.000	37.069	H1 is accepted
HDFC Bank Ltd	62	43	19	6	27.36	3.31	20.87	-6.54	0.000	33.843	H1 is accepted
Infosys Ltd	62	22	40	8	29.39	3.57	22.39	-5.99	0.000	36.384	H1 is accepted
ICICI Bank Ltd	60	29	31	10	30.97	3.84	23.45	-5.47	0.000	38.486	H1 is accepted
Housing Development Finance Corporation Ltd	62	38	24	9	30.42	3.7	23.16	-5.79	0.000	37.675	H1 is accepted
Larsen & Toubro Ltd	62	38	24	7	30.42	3.7	23.16	-6.33	0.000	37.675	H1 is accepted
Oil & Natural Gas Corporation Ltd.	62	26	36	8	31.19	3.8	23.74	-6.1	0.000	38.644	H1 is accepted
Tata Consultancy Services Ltd	63	27	36	11	31.86	3.86	24.3	-5.41	0.000	39.413	H1 is accepted
Tata Motors Ltd	63	30	33	9	32.43	3.93	24.73	-5.97	0.000	40.126	H1 is accepted
State Bank Of India	62	28	34	8	31.71	3.87	24.13	-6.13	0.000	39.289	H1 is accepted
Hindustan Unilever Ltd	62	35	27	8	31.48	3.84	23.96	-6.12	0.000	39.008	H1 is accepted
Mahindra & Mahindra Ltd	62	33	29	6	31.87	3.89	24.25	-6.65	0.000	39.491	H1 is accepted
Bharti Airtel Ltd	61	28	33	7	31.3	3.85	23.76	-3.72	0.000	38.833	H1 is accepted
Tata Steel Ltd	62	30	32	8	31.97	3.9	24.32	-6.15	0.000	39.612	H1 is accepted
Sun Pharmaceutical Industries Ltd	63	20	43	2	28.3	3.4	21.63	-7.73	0.000	34.972	H1 is accepted
Dr. Reddys Laboratories Ltd	62	40	22	4	29.39	3.57	22.39	-4.31	0.000	36.384	H1 is accepted
Bajaj Auto Ltd	62	30	32	9	31.97	3.9	24.32	-5.89	0.000	39.612	H1 is accepted
Coal India Ltd	62	29	33	8	31.87	3.89	24.25	-6.14	0.000	39.491	H1 is accepted
NTPC Ltd	62	29	33	0	31.87	3.89	24.25	-5.63	0.000	39.491	H1 is accepted
Cipla Ltd	62	22	40	6	29.39	3.57	22.39	-3.75	0.000	36.384	H1 is accepted
Wipro Ltd	62	23	39	8	29.94	3.64	22.8	-6.03	0.000	37.069	H1 is accepted

Bharat Heavy Electricals limited	6 2	3 2	3 0	8	31.97	3.9	24.32	-6.15	0.00 0	39.61 2	H1 is accepted
Sesa Sterlite limited	6 2	2 4	3 8	8	30.42	3.7	23.16	-6.06	0.00 0	37.67 5	H1 is accepted
Hero MotoCorp Ltd	6 3	2 9	3 4	7	29.39	3.91	32.3	-6.47	0.00 0	92.69 9	H1 is accepted
Maruti Suzuki India Ltd	6 2	3 7	2 5	1 5	30.84	3.76	23.48	-4.22	0.00 0	38.20 1	H1 is accepted
Tata power company limited	6 1	2 8	3 3	1 1	31.3	3.85	23.76	-5.28	0.00 0	38.83 3	H1 is accepted
GAIL (India) Limited	6 1	3 0	3 1	1 0	31.49	3.87	23.9	-5.55	0.00 0	39.07 9	H1 is accepted
Jindal steel & power limited	6 1	3 0	3 1	8	31.49	3.87	23.9	-6.07	0.00 0	39.07 9	H1 is accepted
Hindalco Industries Limited	6 4	3 2	3 2	1 0	33	3.97	25.22	-5.8	0.00 0	40.77 7	H1 is accepted

Interpretation

Table: 2 Runs Test Results for ITC

Number of obs	62
Number above cut off	28
Number below cut off	34
Number of runs	13
E(R)	31.710
Stdev (R)	3.867
Z-value	-4.838
p-value (2-tailed)	0.000

Since the observed number of runs(13) does not falls under the lower(24.13068) and upper limit(39.28932) and actual runs(13) is less than expected runs(31.71). It can be concluded that the prices are not random at 5% level of significance, and market is not weak form efficient. This leads to acceptance of H1 hypothesis.

Table: 3 Runs Test Results for Reliance industries limited

Number of obs	62
Number above cut off	23
Number below cut off	39
Number of runs	10
E(R)	29.935
Stdev (R)	3.640
Z-value	-5.476
p-value (2-tailed)	0.000

Since the observed number of runs(10) does not falls under the lower(22.8006) and upper limit(37.0694) and actual runs(13) is less than expected runs(29.955). It can be concluded that the prices are not random at 5% level of significance, and market is not weak form efficient. This leads to acceptance of H1 hypothesis.

Table: 4 Runs Test Results for HDFC Bank ltd

Number of obs	62
Number above cut off	43
Number below cut off	19
Number of runs	6
E(R)	27.355
Stdev (R)	3.310
Z-value	-6.452
p-value (2-tailed)	0.000

Since the observed number of runs(6) does not falls under the lower(20.8674) and upper limit(33.8426) and actual runs(6) is less than expected runs(27.355). It can be concluded that the prices are not random at 5% level of significance, and market is not weak form efficient. This leads to acceptance of H1 hypothesis.

Table: 5 Runs Test Results for Infosys limited

Number of obs	62
Number above cut off	22
Number below cut off	40
Number of runs	8
E(R)	29.387
Stdev (R)	3.570
Z-value	-5.991
p-value (2-tailed)	0.000

Since the observed number of runs(8) does not falls under the lower(22.3898) and upper limit(36.3842) and actual runs(8) is less than expected runs(29.387). It can be concluded that the prices are not random at 5% level of significance, and market is not weak form efficient. This leads to acceptance of H1 hypothesis.

Table: 6 Runs Test Results for ICICI Bank limited

Number of obs	60
Number above cut off	29
Number below cut off	31
Number of runs	10
E(R)	30.967
Stdev (R)	3.836
Z-value	-5.466
p-value (2-tailed)	0.000

Since the observed number of runs (10) does not falls under the lower(23.4484) and upper limit(38.48556) and actual runs(10) is less than expected runs(30.967). It can be concluded that the prices are not random at 5% level of significance, and market is not weak form efficient. This leads to acceptance of H1 hypothesis.

Table: 7 Runs Test Results for Housing Development Finance Corporation Limited

Number of obs	62
Number above cut off	38
Number below cut off	24
Number of runs	9
E(R)	30.419
Stdev (R)	3.702
Z-value	-5.786
p-value (2-tailed)	0.000

Since the observed number of runs(9) does not falls under the lower(23.16308) and upper limit(37.67492) and actual runs(9) is less than expected runs(30.419). It can be concluded that the prices are not random at 5% level of significance, and market is not weak form efficient. This leads to acceptance of H1 hypothesis.

Table:8 Runs Test Results for Larsen & Toubro Limited

Number of obs	62
Number above cut off	38
Number below cut off	24
Number of runs	7
E(R)	30.419
Stdev (R)	3.702
Z-value	-6.326
p-value (2-tailed)	0.000

Since the observed number of runs (7) does not falls under the lower(23.16308) and upper limit(37.67492) and actual runs(7) is less than expected runs(30.419). It can be concluded that the prices are not random at 5% level of significance, and market is not weak form efficient. This leads to acceptance of H1 hypothesis.

Table: 9 Runs Test Results for Oil & Natural Gas Corporation Limited

Number of obs	62
Number above cut off	26
Number below cut off	36
Number of runs	8
E(R)	31.194
Stdev (R)	3.801
Z-value	-6.101
p-value (2-tailed)	0.000

Since the observed number of runs(8) does not falls under the lower(23.74404) and upper limit(38.64396) and actual runs(8) is less than expected runs(31.194). It can be concluded that the prices are not random at 5% level of significance, and market is not weak form efficient. This leads to acceptance of H1 hypothesis.

Table: 10 Runs Test Results for Tata Consultancy Services Limited

Number of obs	63
Number above cut off	27
Number below cut off	36
Number of runs	11
E(R)	31.857
Stdev (R)	3.855
Z-value	-5.411
p-value (2-tailed)	0.000

Since the observed number of runs(11) does not falls under the lower(24.3012) and upper limit(39.4128) and actual runs(11) is less than expected runs(31.857). It can be concluded that the prices are not random at 5% level of significance, and market is not weak form efficient. This leads to acceptance of H1 hypothesis.

Table: 11 Runs Test Results for Tata Motors Limited

Number of obs	63
Number above cut off	30
Number below cut off	33
Number of runs	9
E(R)	32.429
Stdev (R)	3.927
Z-value	-5.965
p-value (2-tailed)	0.000

Since the observed number of runs(9) does not falls under the lower(24.73208) and upper limit(40.125) and actual runs(9) is less than expected runs(32.42). It can be concluded that the prices are not random at 5% level of significance, and market is not weak form efficient. This leads to acceptance of H1 hypothesis.

Table: 12 Runs Test Results for State Bank of India

Number of obs	62
Number above cut off	28
Number below cut off	34
Number of runs	8
E(R)	31.710
Stdev (R)	3.867
Z-value	-6.131
p-value (2-tailed)	0.000

Since the observed number of runs(8) does not falls under the lower(24.130) and upper limit(39.28932) and actual runs(8) is less than expected runs(31.71). It can be concluded that the prices are not random at 5% level of significance, and market is not weak form efficient. This leads to acceptance of H1 hypothesis.

Table: 13 Runs Test Results for Hindustan Unilever Limited

Number of obs	62
Number above cut off	35
Number below cut off	27
Number of runs	8
E(R)	31.484
Stdev (R)	3.839
Z-value	-6.118
p-value (2-tailed)	0.000

Since the observed number of runs(8) does not falls under the lower(23.95) and upper limit(39.0082) and actual runs(8) is less than expected runs(31.48). It can be concluded that the prices are not random at 5% level of significance, and market is not weak form efficient. This leads to acceptance of H1 hypothesis.

Table: 14 Runs Test Results for Mahindra & Mahindra Limited

Number of obs	62
Number above cut off	33
Number below cut off	29
Number of runs	6
E(R)	31.871
Stdev (R)	3.888
Z-value	-6.654
p-value (2-tailed)	0.000

Since the observed number of runs(6) does not falls under the lower(24.25) and upper limit(39.49) and actual runs(6) is less than expected runs(31.871). It can be concluded that the prices are not random at 5% level of significance, and market is not weak form efficient. This leads to acceptance of H1 hypothesis.

Table: 15 Runs Test Results for Bharti Airtel Limited

Number of obs	61
Number above cut off	28
Number below cut off	33
Number of runs	17
E(R)	31.295
Stdev (R)	3.846
Z-value	-3.717
p-value (2-tailed)	0.000

Since the observed number of runs(17) does not falls under the lower(23.75) and upper limit(38.83) and actual runs(17) is less than expected runs(31.29). It can be concluded that the prices are not random at 5% level of significance, and market is not weak form efficient. This leads to acceptance of H1 hypothesis.

Table: 16 Runs Test Results for Tata Steel Limited

Number of obs	62
Number above cut off	30
Number below cut off	32
Number of runs	8
E(R)	31.968
Stdev (R)	3.900
Z-value	-6.145
p-value (2-tailed)	0.000

Since the observed number of runs(8) does not falls under the lower(24.32) and upper limit(39.61) and actual runs(8) is less than expected runs(31.96). It can be concluded that the prices are not random at 5% level of significance, and market is not weak form efficient. This leads to acceptance of H1 hypothesis.

Table: 17 Runs Test Results for Sun Pharmaceuticals Industries Limited

Number of obs	63
Number above cut off	20
Number below cut off	43
Number of runs	2
E(R)	28.302
Stdev (R)	3.403
Z-value	-7.728
p-value (2-tailed)	0.000

Since the observed number of runs(2) does not falls under the lower(21.63) and upper limit(34.97) and actual runs(2) is less than expected runs(28.30). It can be concluded that the prices are not random at 5% level of significance, and market is not weak form efficient. This leads to acceptance of H1 hypothesis.

Table: 18 Runs Test Results for Dr. Reddy's Laboratories Limited

Number of obs	62
Number above cut off	40
Number below cut off	22
Number of runs	14
E(R)	29.387
Stdev (R)	3.570
Z-value	-4.310
p-value (2-tailed)	0.000

Since the observed number of runs(14) does not falls under the lower(22.38) and upper limit(36.38) and actual runs(14) is less than expected runs(29.38). It can be concluded that the prices are not random at 5% level of significance, and market is not weak form efficient. This leads to acceptance of H1 hypothesis.

Table: 19 Runs Test Results for Bajaj Auto Limited

Number of obs	62
Number above cut off	30
Number below cut off	32
Number of runs	9
E(R)	31.968
Stdev (R)	3.900
Z-value	-5.888
p-value (2-tailed)	0.000

Since the observed number of runs(9) does not falls under the lower(24.32) and upper limit(39.61) and actual runs(9) is less than expected runs(31.96). It can be concluded that the prices are not random at 5% level of significance, and market is not weak form efficient. This leads to acceptance of H1 hypothesis.

Table: 20 Runs Test Results for Coal India Limited

Number of obs	62
Number above cut off	29
Number below cut off	33
Number of runs	8
E(R)	31.871
Stdev (R)	3.888
Z-value	-6.140
p-value (2-tailed)	0.000

Since the observed number of runs(8) does not falls under the lower(24.25) and upper limit(39.49) and actual runs(8) is less than expected runs(31.871). It can be concluded that the prices are not random at 5% level of significance, and market is not weak form efficient. This leads to acceptance of H1 hypothesis.

Table:21 Runs Test Results for NTPC Limited

Number of obs	62
Number above cut off	29
Number below cut off	33
Number of runs	10
E(R)	31.871
Stdev (R)	3.888
Z-value	-5.625
p-value (2-tailed)	0.000

Since the observed number of runs(10) does not falls under the lower(24.25) and upper limit(39.49) and actual runs(10) is less than expected runs(31.871). It can be concluded that the prices are not random at 5% level of significance, and market is not weak form efficient. This leads to acceptance of H1 hypothesis

Table: 22 Runs Test Results for Cipla Limited

Number of obs	62
Number above cut off	22
Number below cut off	40
Number of runs	16
E(R)	29.387
Stdev (R)	3.570
Z-value	-3.750
p-value (2-tailed)	0.000

Since the observed number of runs(16) does not falls under the lower(22.38) and upper limit(36.38) and actual runs(16) is less than expected runs(29.387). It can be concluded that the prices are not random at 5% level of significance, and market is not weak form efficient. This leads to acceptance of H1 hypothesis.

Table: 23 Runs Test Results for Wipo Limited

Number of obs	62
Number above cut off	23
Number below cut off	39
Number of runs	8
E(R)	29.935
Stdev (R)	3.640
Z-value	-6.026
p-value (2-tailed)	0.000

Since the observed number of runs (8) does not falls under the lower(22.800) and upper limit(37.06) and actual runs(8) is less than expected runs(29.935). It can be concluded that the prices are not random at 5% level of significance, and market is not weak form efficient. This leads to acceptance of H1 hypothesis.

Table: 24 Runs Test Results for Bharat heavy Electricals Limited

Number of obs	62
Number above cut off	32
Number below cut off	30
Number of runs	8
E(R)	31.968
Stdev (R)	3.900
Z-value	-6.145
p-value (2-tailed)	0.000

Since the observed number of runs(8) does not falls under the lower(24.32) and upper limit(39.61) and actual runs(8) is less than expected runs(31.968). It can be concluded that the prices are not random at 5% level of significance, and market is not weak form efficient. This leads to acceptance of H1 hypothesis.

Table:25 Runs Test Results for Sesa Sterlite limited

Number of obs	62
Number above cut off	24
Number below cut off	38
Number of runs	8
E(R)	30.419
Stdev (R)	3.702
Z-value	-6.056
p-value (2-tailed)	0.000

Since the observed number of runs(8) does not falls under the lower(23.16) and upper limit(37.67) and actual runs(8) is less than expected runs(30.41). It can be concluded that the prices are not random at 5% level of significance, and market is not weak form efficient. This leads to acceptance of H1 hypothesis.

Table: 26 Runs Test Results for Hero Motocorp limited

Number of obs	63
Number above cut off	29
Number below cut off	34
Number of runs	7
E(R)	32.302
Stdev (R)	3.911
Z-value	-6.469
p-value (2-tailed)	0.000

Since the observed number of runs(7) does not falls under the lower(32.302) and upper limit(92.69) and actual runs(7) is less than expected runs(32.30). It can be concluded that the prices are not random at 5% level of significance, and market is not weak form efficient. This leads to acceptance of H1 hypothesis.

Table:27 Runs Test Results for Maruti Suzuki India Limited

Number of obs	62
Number above cut off	37
Number below cut off	25
Number of runs	15
E(R)	30.839
Stdev (R)	3.756
Z-value	-4.217
p-value (2-tailed)	0.000

Since the observed number of runs(15) does not falls under the lower(23.47) and upper limit(38.20) and actual runs(15) is less than expected runs(30.839). It can be concluded that the prices are not random at 5% level of significance, and market is not weak form efficient. This leads to acceptance of H1 hypothesis.

Table:28 Runs Test Results for Tata Power Company limited

Number of obs	61
Number above cut off	28
Number below cut off	33
Number of runs	11
E(R)	31.295
Stdev (R)	3.846
Z-value	-5.277
p-value (2-tailed)	0.000

Since the observed number of runs(11) does not falls under the lower(23.75) and upper limit(38.83) and actual runs(11) is less than expected runs(31.29). It can be concluded that the prices are not random at 5% level of significance, and market is not weak form efficient. This leads to acceptance of H1 hypothesis.

Table:29 Runs Test Results for GAIL (India) Limited

Number of obs	61
Number above cut off	30
Number below cut off	31
Number of runs	10
E(R)	31.492
Stdev (R)	3.871
Z-value	-5.551
p-value (2-tailed)	0.000

Since the observed number of runs(10) does not falls under the lower(23.75) and upper limit(38.83) and actual runs(10) is less than expected runs(31.49). It can be concluded that the prices are not random at 5% level of significance, and market is not weak form efficient. This leads to acceptance of H1 hypothesis.

Table: 30 Runs Test Results for Jindal steel & power limited

Number of obs	61
Number above cut off	30
Number below cut off	31
Number of runs	8
E(R)	31.492
Stdev (R)	3.871
Z-value	-6.068
p-value (2-tailed)	0.000

Since the observed number of runs(8) does not falls under the lower(23.90) and upper limit(39.07) and actual runs(8) is less than expected runs(31.49). It can be concluded that the prices are not random at 5% level of significance, and market is not weak form efficient. This leads to acceptance of H1 hypothesis.

Table: 31 Runs Test Results for Hindalco Industries Limited

Number of obs	64
Number above cut off	32
Number below cut off	32
Number of runs	10
E(R)	33.000
Stdev (R)	3.968
Z-value	-5.796
p-value (2-tailed)	0.000

Since the observed number of runs(10) does not falls under the lower(25.22) and upper limit(40.77) and actual runs(10) is less than expected runs(33). It can be concluded that the prices are not random at 5% level of significance, and market is not weak form efficient. This leads to acceptance of H1 hypothesis.

Limitation

The results are limited to the selected stock exchange, selected companies and duration of study. The results may vary with the change of any or all criterion. The findings are on the basis of run test hence findings are subject to the limitation of non-parametric test.

Conclusion

In the above study in all cases the stock prices are dependent of the past prices and null hypothesis is rejected. The market is not weekly efficient as observed runs do not fall between upper and lower limit therefore this study does not favors random walk theory.

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