

A Study on the Semi Strong Form of Efficiency in Indian Stock Market

Effulgence

Vol. 16 No. 1

January - June, 2018

Rukmini Devi Institute of Advanced Studies

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<http://effulgence.rdias.ac.in/user/default.aspx>

<https://dx.doi.org/10.33601/effulgence.rdias/v16/i1/2018/94-107>

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Abstract

Purpose- The main purpose of this research study is to investigate semi strong form of efficient market hypothesis of the firms constituting Nifty 50.

Design/Methodology- The Research Design is Descriptive. The variables in the study are daily closing prices of sample firms, NIFTY 50 index and the time period. Prior to the testing of semi strong form of efficiency, weak form of efficiency has been tested by using Serial Correlation (parametric) test (Reilly and Brown, 2012). Then, Event study methodology (Elton and Gruber, 2002) using daily returns and Ordinary Least Square (OLS) market model (Brown and Warner, 1985) have been used in the study to test the semi strong form of efficiency. The event taken in the study is demonetisation announcement made in 2016. Z test has been used to test the significance of the abnormal returns around the demonetisation announcement date (Das et.al. 2014). t- test has been used to test the significant difference in the average abnormal returns before and after the demonetisation announcement date (Ramachandran, 2012; Lahiri, 2012).

Findings- The market is found to be efficient in its both weak and semi strong form i.e. no investor can earn the abnormal return based on the historical and current publicly available information.

Research limitations and Future Scope - The study has been undertaken using the firms constituting NIFTY 50. The study with reference to firms listed in other indices may provide different sets of results. For future research, share prices reaction to other microeconomic and macroeconomic events taking different sectors can be considered.

Contribution of the Paper - The research on EMH is important as it has significant real world implications for investors and portfolio managers. To protect the interest of the investors in the capital market, the efficiency of the market plays a vital role (Kummeta, 2015). The investors now pay more attention to all the events and patterns that influences the share price

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movements in the stock market. The events influencing the security prices may be either controlled by the companies or may be forced by the external factors. Therefore, knowing the efficiency of Indian Stock Market is required.

Keywords: *Event study, Demonetisation, Nifty 50, T test, Z test, Serial Correlation test, OLS Market model, Weak form, Semi strong form, Efficient Market Hypothesis.*

INTRODUCTION

A market in which prices always “fully reflect” available information is called efficient (FAMA, 1970). The Efficient Market Hypothesis (EMH) suggest that profiting from predicting price movements is very difficult and unlikely (Clarke et.al). Fama divided EMH into three sub hypotheses depending upon information involved: (1) weak form EMH i.e. all historical information is reflected in the current prices, (2) semi strong form EMH i.e. publicly available information is reflected in the current prices, (3) strong form EMH i.e. all information whether public or private is fully reflected in the stock prices (Reilly & Brown, 2012). Fama presented the efficient market theory in terms of a “fair game model” which says that there is no way to use “information” available at a point of time (t) to earn a return above the normal. A more restricted version of fair game model is “Random Walk Model” which assumes that successive returns are independent and returns are independently distributed over time (Elton and Gruber, 2002). The literature on the evidence of EMH is mixed. Some have supported the hypotheses and others have revealed some anomalies indicating that do not support hypothesis. Researchers have formulated two groups of tests of weak form of EMH: (1) Statistical tests of independence that includes auto correlation and runs test (2) Tests of trading rules. Studies that have tested semi strong form EMH can be divided into two sets: (1) Studies to predict future rates of return using available public information beyond pure market information such as prices and trading volume as in weak form tests. (2) Event studies that examine how fast the stock prices adjust to economic events (Reilly & Brown, 2012). This study aims to test the hypothesis of market efficiency

of the Indian stock market in its weak form using runs test and semi strong form by studying the stock market reaction to the demonetisation announcement made in the year 2016 using the Event Study Methodology. The framework is based on the discussion of Event Study by Elton and Gruber, 2002.

LITERATURE REVIEW

Fama et. al (1969) examined the behaviour of the stock prices in the months around the split and found that information implication of stock split was fully reflected in the prices of shares indicating efficiency of the Market. Howe (1986) examined the over reaction of the US stock market to the favourable and unfavourable events leaving the opportunity to earn significant abnormal returns. Olowe (1998) revealed the inefficiency of the Nigerian Stock Market in its semi strong form as significant abnormal returns could be earned till two months after the stock split announcement month. Ahmed (2002) revealed the inefficiency of the Bangladesh's stock market in its weak form as the auto correlation coefficient is different from zero thus rejecting the random walk hypothesis. Huang (2004) revealed inefficiency of the China's stock market in its semi strong form as significant abnormal returns could be earned with the positive and negative financial announcements. Robinson (2005) revealed the inefficiency of the Jamaica stock market in its weak form as the daily returns data do not follow random walk. Ahmad et. al. (2006) revealed the inefficiency of Indian stock market in its weak form using Runs test, Unit root test and ACF test. Raja (2008) revealed inefficiency of the Indian stock market by examining the share price reactions on the announcements namely Merger and Acquisition, Stock Split, Buy back, Right Issue,

Bonus Announcement. Stock Market positively received the information leaving the opportunity for earning abnormal returns. Patten (2008) revealed the opportunity of earning significant positive abnormal returns around the corporate philanthropy announcement in South Asian Countries as the stock market positively reacted to the information. Lahiri (2012) revealed that the market is neither efficient in its weak nor in semi strong form as the market do not follow random walk model and significant abnormal returns could be earned during the Stock Split and Corporate Earnings announcements thus rejecting EMH. Kumar et. al. (2012) found that the dividend announcement did not have any impact on the stock return behaviour indicating efficiency of the Indian Stock Market. Bapusaheb (2012) examined efficiency of Indian stock market in its weak form and obtained mixed results. Unit root tests supported the random walk hypothesis whereas Auto correlation and Runs test rejected the same. Ramachandran (2013) examined no change in the security prices and trading volume before and after the announcements namely dividend, bonus issue, stock split and Merger thereby supporting the EMH. Kummata (2015) revealed the efficiency of the Indian stock market in its semi strong form by examining share price reaction to announcements namely Bonus share, Merger and Acquisition, Dividend, Right Issue. The information did not influence the market in significant manner. Gupta (2015) examined that the stock market seemed to adjust Union Budget information within a short period itself i.e. three days surrounding the budget announcement thus indicating the efficiency of the Indian stock market. Biktimirov and Durrani (2017) examined the share price reactions of Toronto Stock Exchange listed companies to the announcements of corporate name changes and found significant run up in the prices and the trading volume.

RESEARCH METHODOLOGY

Objective of the Study

The main objective of the study is to investigate semi

strong form of Efficient Market Hypothesis of the firms constituting NIFTY 50 by studying stock market reaction to the demonetisation announcement made in the year 2016. The study also tests the weak form of market efficiency using actual returns earned on share prices of firms constituting NIFTY 50 applying the Runs test.

Hypotheses of the Study

H01: The Indian stock market is efficient in its weak form.

H02: The Indian stock market is efficient in its semi strong form i.e., no abnormal profit can be reaped by the investors in the Indian stock market on the basis of publicly available demonetisation information. To test this two hypothesis have been formulated H02a- The AARs of the sample firms is zero in the event window (Das et.al. 2014). H02b- There is no significant difference in the AARs before and after the announcement of demonetisation (Das et.al. 2014).

Data and their Source

The study is based on 50 firms in NSE constituting NIFTY 50. Variables used in the study are daily closing prices of the firms ranging from 1st January – 1st December 2016 have been taken up for the study from website of NSE.

Statistical Tools Used

In order to test for weak-form efficiency, Serial (Auto) Correlation test has been used. The term serial correlation may be defined as “correlation between members of series of observations ordered in time series data or in cross sectional data. In regression context, linear regression model assumes that such auto correlation does not exist in the disturbances e_i .

The Durbin Watson Test and Breusch Godfrey (LM) are used to test the significance of auto correlation in residuals (disturbances). The Hypothesis for the test

are:

H0 = There is no auto correlation

H1 = The auto correlation exists in the series.

The test statistic is calculated with the following formula:

$$DW = \frac{\sum_{t=2}^T (e_t - e_{t-1})^2}{\sum_{t=1}^T e_t^2}$$

Where, e_t are the residuals from the regression equation.

The Durbin Watson test reports a test statistic, with a value from 0 to 4, where:

- 2 is no autocorrelation.
- 0 to <1 is positive autocorrelation
- >3 to 4 is negative autocorrelation
- 1 to 3 is zone of indecision

But Durbin Watson test can be used to detect first order correlation and it has a zone of indecision, therefore along with this we will use Breusch Godfrey (LM) test which helps in identification of higher order correlation as in LM test lagged values of the regressand can be added to the OLS model. The LM test involves the following steps:

1. Estimate the regression equation by OLS and obtain the residuals.
2. Regress e_t on the original X_t and e_{t-1}, e_{t-2}, \dots i.e. lagged values of estimated residuals in step 1.
3. If the sample size is large, Breusch and Godfrey have shown that:

$$(n-p)R^2 \sim \chi^2_p$$

Where, $(n-p)$ times the R^2 follows the chi square distribution with p df. If in an application, $(n-p) R^2$ exceeds the critical chi-square value at the chosen level of significance, we reject the null hypothesis of no serial correlation in the residuals (Gujarati 2016).

Both the tests are used in the study to detect the presence of serial correlation.

Further, for semi strong form, Event study methodology (Elton and Gruber, 2002) using daily

returns and market model (Warner and Brown, 2012) is used. The demonetisation announcement was made on 8th November (5: 15 p.m.) after closing of stock market. Therefore, the announcement day for the study is considered as 9th November, 2016 and defined as “ t ” = 0. An event window of 31 days ($t = -15$ to $t = +15$) is considered for the research. The daily returns of the firms (R_{it}) and the market index (R_m) is calculated using formulae: Current daily return = (Current day price - Previous day price) / Previous day price. The Expected return (normal return) is calculated using the market model. For any security i , the market model is:

$$E(R_{it}) = \alpha_i + \beta_i R_{mt} + \epsilon_{it}$$

where, $E(R_{it})$ is the expected return on security i on day t ; R_{mt} is the return on the market index on day t ; and ϵ_{it} is the zero mean disturbance term. α_i , β_i and ϵ_{it} are the parameters of the market model. To determine the parameters of the market model, Ordinary Least square method has been applied on the estimation window of 195 days prior to the event window. The NIFTY 50 is used as a proxy for the market index. Some of the earlier studies related to semi strong form of efficiency also adopted similar method where the firms constituting the index and market index are same (Ramachandran, 2013; Gupta, 2015). The Abnormal return (AR) for the firm i in the event window is calculated as:

$$AR_i = R_{it} - E(R_{it})$$

where, R_{it} is the actual return for the security i during time t and $E(R_{it})$ is the Expected return calculated using market model. The abnormal returns of individual securities are averaged for each day before and after the event day in the event window and the Average Abnormal Return (AAR) is obtained using formulae:

$$AAR_t = \sum_{i=1}^N (AR)_{it} / N, \text{ where } t = -15 \text{ to } +15.$$

Where, $(AR)_{it}$ represents abnormal returns of the i th firm on the event day t and N refers to total number of firms.

Further, Z test has been used to test the significance

of the abnormal returns around the demonetisation announcement date. t- test has been used to test the significant difference in the average abnormal returns before and after the demonetisation announcement date.

FINDINGS OF THE STUDY

Testing Weak form of Efficient Market Hypothesis

To test the weak form of EMH, firstly the actual returns on the daily closing share prices of the sample companies have been calculated. To test the movements of the calculated returns, serial correlation test has been used as described in the research methodology. The results are given in the following table 1.

Table 1: Company wise result on Serial Correlation Test

Sr No.	Name of the Company (1 st January - December 16)	Durbin Watson	LM test prob (chisquare)	Weak Form
1	ACC Ltd.	2.024	0.97	Supported
2	Adani Ports and Special Economic Zone Ltd.	2.08	0.81	Supported
3	Ambuja Cements Ltd.	2.066	0.39	Supported
4	Bharti Airtel Ltd.	2.259	0.11	Supported
5	Asian Paints	2.091	0.65	Supported
6	Aurobindo Pharma Ltd.	2.175	0.032	Rejected
7	Axis Bank Ltd.	1.9	0.55	Supported
8	Bajaj Auto Ltd	2.05	0.87	Supported
9	Bharat Heavy Electricals Ltd	1.97	0.91	Supported
10	Bank of Baroda	2.27	0.001	Rejected
11	Bosch Ltd.	1.97	0.52	Supported
12	Bharat Petroleum Corporation Ltd.	2.03	0.91	Supported
13	Cipla Ltd.	2.229	0.21	Supported
14	Coal India Ltd.	2.089	0.134	Supported
15	Dr. Reddy's Laboratories Ltd.	1.818	0.15	Supported
16	Eicher Motors Ltd.	1.867	0.71	Supported
17	GAIL (India) Ltd.	2.162	0.232	Supported
18	Grasim Industries Ltd.	2.044	0.941	Supported
19	HCL Technologies Ltd.	1.734	0.148	Supported
20	HDFC Bank Ltd.	2.136	0.35	Supported
21	Housing Development Finance Corporation Ltd.	2.094	0.23	Supported
22	Hero MotoCorp Ltd.	2.022	0.97	Supported
23	Hindalco Industries Ltd.	2.219	0.147	Supported

24	Hindustan Unilever Ltd.	2.257	0.11	Supported
25	ICICI Bank Ltd.	1.853	0.505	Supported
26	Idea Cellular Ltd.	2.022	0.169	Supported
27	Indusland Bank Ltd.	2.239	0.158	Supported
28	Infosys Ltd.	1.907	0.043	Rejected
29	Bharti Infratel Ltd.	1.95	0.038	Rejected
30	I T C Ltd.	1.846	0.521	Supported
31	Kotak Mahindra Bank Ltd.	2.274	0.1	Supported
32	Larsen & Toubro Ltd.	2.331	0.04	Rejected
33	Lupin Ltd.	2.129	0.413	Supported
34	Mahindra & Mahindra Ltd.	2.078	0.731	Supported
35	Maruti Suzuki India Ltd.	1.953	0.946	Supported
36	NTPC Ltd.	2.081	0.817	Supported
37	Oil & Natural Gas Corporation Ltd.	1.92	0.591	Supported
38	Power Grid Corporation of India Ltd.	2.178	0.038	Rejected
39	Reliance Industries Ltd.	2.089	0.665	Supported
40	State Bank of India	2.038	0.707	Supported
41	Sun Pharmaceutical Industries Ltd.	2.011	0.774	Supported
42	Tata Consultancy Services Ltd.	2.03	0.0009	Rejected
43	Tata Motors Ltd DVR	2.019	0.06	Supported
44	Tata Motors Ltd.	2.189	0.3332	Supported
45	Tata Power Co. Ltd.	1.966	0.648	Supported
46	Tata Steel Ltd.	1.857	0.561	Supported
47	Tech Mahindra Ltd.	1.99	0.11	Supported
48	UltraTech Cement Ltd.	2.054	0.084	Supported
49	Wipro Ltd.	2.216	0.163	Supported
50	Yes Bank Ltd.	1.98	0.99	Supported
51	Zee Entertainment Enterprises Ltd.	2.36	0.018	Rejected

*Significance at 5% level.

From the above table, it is analysed that Durbin Watson test supports the Weak Form of EMH for all the sample firms as no value is less than 1 and more than 3. But due to the presence of zone of indecision, Breusch Godfrey test has also been used. Further, since it is a time series data, Durbin Watson test may not be able to detect the higher order correlation therefore; Breusch Godfrey (LM) test has been used for the detection of the serial correlation in the residuals. According to LM test, 8 companies out of 51 companies rejected the weak form of EMH due to presence of serial correlation in the residuals. However, rest 43 companies supported the weak form of EMH. Thus the study supports the weak form of EMH.

Testing Semi strong form of EMH

To test the semi strong form of EMH, firstly expected returns are to be calculated. For this, regression coefficients using actual returns for each company and NIFTY 50 index are calculated. These are used as the parameters in the Ordinary Least Square Market Model to compute the expected returns. The following table 2 shows the computed regression coefficients. The abnormal returns of the individual companies are then calculated and averaged to provide Average Abnormal Return (AAR).

Table 2: Regression Coefficients of the sample companies.

Company	Intercept	Beta
ACC Ltd.	.001	.905
Adani Ports and Special Economic Zone Ltd.	0.000	1.486
Ambuja Cements Ltd.	0.001	.942
Asian Paints	0.000	0.773
Aurobindo Pharma Ltd.	-0.001	1.225
Axis Bank Ltd.	0.000	1.332
Bajaj Auto Ltd.	0.000	0.886
Bank of Baroda	-.001	1.745
Bharat Heavy Electricals Ltd.	-.002	1.579
Bharat Petroleum Corporation Ltd.	-0.001	0.728
Bharti Airtel Ltd.	-.001	0.694
Bharti Infratel Ltd.	-0.001	0.593
Bosch Ltd.	0.001	0.854
Cipla Ltd.	-0.001	0.564
Coal India Ltd.	-0.001	0.688
Dr. Reddy's Laboratories Ltd.	0.000	0.719
Eicher Motors Ltd.	0.000	0.980
GAIL (India) Ltd.	0.000	0.980
Grasim Industries Ltd.	-0.003	0.978
HCL Technologies Ltd.	0.000	0.637

HDFC Bank Ltd.	0.000	0.763
Hero MotoCorp Ltd.	0.001	1.009
Hindalco Industries Ltd.	0.002	1.935
Hindustan Unilever Ltd.	0.000	0.626
Housing Development Finance Corporation Ltd.	0.000	1.031
I T C Ltd.	-0.001	0.868
ICICI Bank Ltd.	0.000	1.694
Idea Cellular Ltd.	-0.004	0.794
Indusland Bank Ltd.	0.001	0.957
Infosys Ltd.	-0.001	0.769
Kotak Mahindra Bank Ltd.	0.000	0.914
Larsen & Toubro Ltd.	0.000	1.486
Lupin Ltd.	-0.001	0.727
Mahindra & Mahindra Ltd.	0.000	0.953
Maruti Suzuki India Ltd.	0.001	1.162
NTPC Ltd.	0.000	0.862
Oil & Natural Gas Corporation Ltd.	0.000	0.969
Power Grid Corporation of India Ltd.	0.001	0.714
Reliance Industries Ltd.	0.000	0.876
State Bank of India	0.000	1.728
Sun Pharmaceutical Industries Ltd.	-0.001	0.779
Tata Consultancy Services Ltd.	0.000	0.730
Tata Motors Ltd DVR	0.001	1.529
Tata Motors Ltd.	0.001	1.851
Tata Power Co. Ltd.	0.000	1.028
Tata Steel Ltd.	0.002	1.552
Tech Mahindra Ltd.	-0.001	0.987
UltraTech Cement Ltd.	0.001	0.982
Wipro Ltd.	-0.001	0.591
Yes Bank Ltd.	0.002	1.332
Zee Entertainment Enterprises Ltd.	0.001	1.028

The analysis of semi strong form has been divided into two sections. First section analyses that whether demonetisation information yields any abnormal return on any of the days surrounding the

announcement of information. Second section analyses the significant differences if any between the average abnormal returns before and after the announcement using paired t-test.

(1) AAR on each day surrounding the Announcement date.

The AAR and CAAR of the companies were found out for the event window. With regards to this the hypothesis formulated is H02a -The AARs of the sample firms is zero in the event window (Das et.al. 2014). The test of significance of AAR has been done in the following manner:

If Z is the test statistic for AAR, then ZAAR is defined as follows:

$$Z_{AAR} = AAR_t / \sigma(AAR_t)$$

The Z values in the following table 3 represent the values of test statistic for AAR. The test has been carried out at 1per cent level of significance.

Table 3: Z test for each day

Day	AAR	Z value	Significance level
-15	0.004457	1.38971	0.165
-14	0.001220	.23217	0.816
-13	0.000552	-.00670	0.995
-12	-0.000834	-.50233	0.615
-11	0.001999	.51074	0.610
-10	0.001120	.19641	0.844
-9	-0.006274	-2.44766	0.014
-8	0.001689	.39989	0.689
-7	0.001208	.22788	0.820
-6	0.002173	.57296	0.567
-5	-0.000630	-.42938	0.668
-4	-0.000696	-.45298	0.651
-3	-0.003922	-1.60659	0.108
-2	0.002608	.72852	0.466
-1	-0.000584	-.41293	0.680
0	0.001194	.22288	0.824
1	0.006125	1.98618	0.0470
2	-0.002505	-1.09988	0.272
3	-0.000413	-.35178	0.725
4	-0.000759	-.47551	0.634
5	-0.000021	-.21160	0.832
6	0.003580	1.07610	0.282
7	-0.003737	-1.54043	0.124

8	0.001890	.47176	0.637
9	0.003460	1.03319	0.301
10	0.002171	.57225	0.567
11	-0.003220	-1.35556	0.175
12	0.004977	1.57566	0.115
13	0.003615	1.08862	0.276
14	-0.001765	-.83525	0.404
15	-0.000985	-.55633	0.578

***significant at 1% level;**

The value of Z lies between -2.58 and + 2.58 for all the days in the event window. This means that the AARs in the event window are not significant. This implies that these AARs are not significantly different from zero. Therefore, the hypothesis (H02a) that abnormal returns earned surrounding the announcement date in the event window is zero is not rejected.

(2) Average Abnormal Returns Before and After the Demonetisation Announcement

The AARs of the company before and after the event are given below in the following table 4. With regards to this the hypothesis formulated is: H02b: There is no significant difference in the AARs before and after the announcement of demonetisation (Das et.al. 2014).

Table 4: AAR Before and After the Demonetisation Announcement

Event Window	Average Abnormal Return (Before)	Average Abnormal Return (After)
1	-0.00058	0.00613
2	0.00261	-0.00250
3	-0.00392	-0.00041
4	-0.00070	-0.00076
5	-0.00063	-0.00002
6	0.00217	0.00358
7	0.00121	-0.00374
8	0.00169	0.00189
9	-0.00627	0.00346

10	0.00112	0.00217
11	0.00200	-0.00322
12	-0.00083	0.00498
13	0.00055	0.00362
14	0.00122	-0.00176
15	0.00446	-0.00099

To test the statistical difference between AAR before and after the announcement, Paired t- test is applied and the result is shown in the following table 5.

Table 5: t-value for AAR before and after the Demonetisation Announcement

	Paired Differences	T	df	Sig. (2-tailed)	
					Mean
Pair 1 Before After	- .000554758	.004709507	-.456	14	.655

The test result indicates that the difference between AAR before and after the demonetisation announcement is not significant at 5 percent level of significance. Therefore, the hypothesis (H02b) that there is no significant difference in the average abnormal returns before and after the announcement is not rejected.

CONCLUSION

The Serial Correlation test used in the study indicates that the residuals of the stock are not correlated. Thus it can be concluded that the market is efficient in weak form of Efficient Market Hypothesis. The Z test indicates that the average abnormal returns earned around the demonetisation announcement are not significantly different from zero. Further, paired t test used in the study also indicates that there is no difference in the abnormal returns earned before and after the demonetisation

announcement. Therefore, it can be safely concluded that the market is efficient in semi strong form. An investor cannot earn abnormal returns using historical and current publicly available information.

Implication: Informational efficiency is one of the major criteria for assessing the strength of the stock market. A number of studies related to informational efficiency have been done, the debate still continues. Enhancing the efficiency of the market could create confidence in the market for Foreign Institutional Investors. This would facilitate more capital flows and will lead to further development of the Nation

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