

Efficient Market Hypothesis: A Case Study on National Stock Exchange

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The EMH means that stocks always trade at their fair value on stock exchanges, and thus, it is impossible for investors to either purchase undervalued stocks or sell stocks for inflated prices. Thus, the crux of the EMH is that it should be impossible to outperform the overall market through expert stock selection or market timing, and that the only way an investor can possibly obtain higher returns is by purchasing riskier investments. This paper investigates whether prices of stocks in National Stock Exchange follow a random walk process.

Key Words: Weak form efficiency, Efficient market, Auto correlation, Runs test, NSE Nifty

Introduction

In an efficient capital market, prices fully and instantaneously reflect all available information. This means that when stocks are traded, prices are accurate signals for capital allocation. Market efficiency is described in three forms – weak, semi-strong and strong. Weak form market efficiency says that stock prices have no memory. Yesterday has nothing to do with tomorrow. Weak form market efficiency is synonymous with random walk model. Stock prices would behave like random walk as per weak form of market efficiency.

While semi-strong form of efficiency deals only with publicly known information, strong form of efficiency deals with all information. The research work was to test the Efficient Market Hypothesis: the study of National stock exchange in the weak form.

Weak Form

In **weak-form efficiency**, future prices cannot be predicted by analyzing prices from the past. Excess returns cannot be earned *in the long run* by using investment strategies based on historical share prices or other historical data. Share prices exhibit no serial dependencies, meaning that there are no

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“patterns” to asset prices. This implies that future price movements are determined entirely by information not contained in the price series. Hence, prices must follow a random walk. This ‘soft’ EMH does not require that prices remain at or near equilibrium, but only that market participants not be able to *systematically* profit from market ‘inefficiencies’. However, while EMH predicts that all price movement (in the absence of change in fundamental information) is random (i.e., non-trending), many studies have shown a marked tendency for the stock markets to trend over time periods of weeks or longer and that, moreover, there is a positive correlation between degree of trending and length of time period studied.

Semi-strong Form

In semi-strong-form efficiency, it is implied that share prices adjust to publicly available new information very rapidly and in an unbiased fashion, such that no excess returns can be earned by trading on that information. To test for semi-strong-form efficiency, the adjustments to previously unknown news must be of a reasonable size and must be instantaneous. To test for this, consistent upward or downward adjustments after the initial change must be looked for. If there are any such adjustments it would suggest that investors had interpreted the information in a biased fashion and hence in an inefficient manner.

Strong Form

In strong-form efficiency, share prices reflect all information, public and private, and no one can earn excess returns. If there are legal barriers to private information becoming public, as with insider trading laws, strong-form efficiency is impossible, except in the case where the laws are universally ignored. To test for strong-form efficiency, a market needs to exist where investors cannot consistently earn excess returns over a long period of time.

Review of Literature

Srinivasan (2010) examined the random walk hypothesis to determine the validity of weak-form efficiency for two major stock markets in India. The study uses daily observation over the span from 1st July 1997 to 31st August 2010, comprising a total of 3244 observations. The empirical results do not support the validity of weak-form efficiency for stock market returns of Indian stock exchanges.

Bhanu Pant and Bishnoi T.R. (2002) conducted a research on Testing Random Walk Hypothesis for Indian Stock Market Indices. The analyses of the behavior of daily and weekly returns of Indian market indices for random walk during April 1996-June 2001 shows that the Indian stock market indices

do not follow random walk. The results were based on the tests of Indian stock market indices for normality, autocorrelation using Q-statistic and Dickey-fuller test and also the analysis of variance ratio using homoscedastic and heteroscedastic test estimates.

Ramasastri, A.S. (2001), conducted a study on stock market efficiency spectral analysis. This research studies efficiency of Indian stock market since the beginning of 1996 to 1998 using a powerful technique Spectral analysis, Correlogram based on Sensex, establishes that Indian stock market has been efficient. Spectral analysis finds that there is a presence of periodic cycles in the movements of share prices. Yet, confirms market efficiency as power functions flatten at higher frequencies. They have initially calculated that auto correlation have been found to be statistically insignificant. Correlogram falls steeply and hovers around zero for k greater than 0 from correlogram, we can conclude that daily sensex return series are random.

Parameswaran (2000) performed variance ratio tests corrected for bid-ask spread and non-synchronous trading on the weekly returns derived from CRSP daily returns file for a period of 23 years. His results show that eight out of ten size sorted portfolios do not follow a random walk. He observed that non-trading is not a source of serial correlation in large sized firms.

Mitra (2000) for long time empirical testing of efficient market hypothesis was based on rejection of forecast ability of asset return. Ability of any model to predict future stock price fairly accurately itself proves that the market does not follow random walk. The study based on technical analysis and neural networks disprove random walk hypothesis by proving that future prices can be accurately forecasted.

Objectives of the Study

1. To understand the Efficient Market Theory and its practical applicability.
2. To investigate whether prices of stocks in National Stock Exchange follow a random walk process.
3. To open new vistas for further research.

Research Methodology

The research was descriptive in nature. For the purpose of statistical analysis of the weak form of efficient market hypothesis, the market prices of thirty companies involved in the formation of index of National Stock Exchange. Nifty for fifty-two weeks has been taken.

Sampling Design

Population

The research contained all the companies and firms listed on National Stock Exchange, and closing prices of fifty-two weeks were collected for analysis.

Sampling Frame

The sampling frame consisted of the fifty companies involved in the formation of index of National Stock Exchange i.e. Nifty.

Sampling Element

Fifty individual companies forming index of National Stock Exchange i.e. Nifty have been analysed.

Sampling Size

It contained 50 companies involved in the formation of NSE index: NIFTY.

Sampling Technique

Judgment sampling technique has been used.

Description of Data Sample

In this study, the researcher calculates the daily returns using daily index values for the National Stock Exchange (NSE). The data obtained from the data Stream, are collected on basis of the daily closing prices for weekdays (Mondays to Fridays).

Data Collection

Secondary sources were used to collect data. Daily price data was collected from National Stock Exchange site for all firms for the period 1st April 2012 to 1st April 2013.

Tools used for analysis

Autocorrelation and Run test has been used to check the weak form of efficiency. Autocorrelation has been used to check the correlation (positive or negative) between share prices. Following hypothesis has been formed:

Null Hypothesis H_0 : The price movements in the share prices of National Stock Exchange are not affected by past prices.

Alternate Hypothesis H_a : The price movements in the share prices of National Stock Exchange are affected by past prices.

Run test has been applied using the following formula

$$\text{Run} = \frac{2n_1n_2+1}{n_1+n_2}$$

$$\text{Standard deviation } (\hat{\sigma}^2) = \frac{2n_1n_2(2n_1n_2-n_1-n_2)}{(n_1+n_2)^2 (n_1+n_2-1)}$$

n_1+n_2 – Number of observations in each category

$$Z = \frac{\text{run mean}}{\sigma}$$

Z – Standard normal variate

Results and Discussion

Results of Run Test

Table 1 gives a clear picture about the share price movements of National Stock Exchange. The calculated values of run test (Z) are compared with the critical value at 5% level of significance. Out of the 50 companies, the value of Z of all the companies was less than the critical value of 1.96 at 5% level of significance. So, the null hypothesis that the price movement in the share prices of National Stock Exchange is not affected by the past prices is accepted. The result shows that the price movements in the share prices of National Stock Exchange are random in behavior. This study has proved that the weak form of efficient market hypothesis or the random walk theory is applicable in the National Stock Exchange.

Table 1. Analysis of Run Test

Company Name	Z	Company Name	Z
ACC	-14.483	IDFC	-13.471
Ambuja Cements	-13.218	Jaiprakash Associates	-13.471
Asian Paints	-15.622	Jindal Steel & Power	-15.495
Axis Bank	-14.989	Kotak Mahindra Bank	-14.610
Bajaj Auto	-14.230	Larsen & Toubro	-13.977
Bank of Baroda	-12.839	Lupin	-15.622
BHEL	-14.230	Mahindra & Mahindra	-14.610
BPCL	-12.080	Maruti Suzuki India	-14.104
Bharti Airtel	-12.459	NTPC	-13.471
Cairn India	-14.104	ONGC	-13.942
Cipla	-12.333	Power Grid	-12.675
Coal India	-13.724	Punjab National Bank	-12.421
DLF	-14.104	Ranbaxy	-14.796
Dr. Reddy's Laboratories	-12.080	Reliance Industries	-11.914
GAIL (India)	-13.345	Reliance Infrastructure	-12.421
Grasim	-14.736	Sesa Goa	-12.928
HCL	-15.116	Siemens	-2.408

HDFC Bank	-13.977	SBI	-14.829
HeroHonda	-11.574	Sun Pharmaceutical	-14.322
Hindalco	-14.357	TCS	-13.562
Hindustan Unilever	1.328	Tata Motors	-12.421
HDFC	-15.242	Tata Power	-12.586
I T C	-14.483	Tata Steel	-14.829
ICICI Bank	-13.471	UltraTech Cement	-14.796
Infosys	-14.357	Wipro	-14.483

Results of Autocorrelation

The serial correlation is calculated for daily share prices of Nifty for the period 1st April 2012 to 1st April 2013. The correlation is calculated between the share prices of any period 't' & 't+1', between 't' and 't+2', between 't' and 't+3', between 't' and 't+4' and between 't' and 't+5'. To analyse the results, the three limits of correlation coefficient have been taken. These limits are ± 0 to ± 0.25 (low correlation), ± 0.25 to ± 0.75 (moderate correlation) and ± 0.75 to ± 1 (high correlation).

From the Table 2, it is analysed that out of 50 companies analysed for correlation between 't' & 't+1', 9 companies have shown moderate correlation and 37 companies have shown high correlation. From the table it also analysed that out of 50 companies, for correlation between 't' & 't+2', 15 companies have shown moderate correlation and 25 companies have shown high correlation. For correlation between 't' & 't+3', 16 companies have shown moderate correlation and 24 companies have shown high correlation. For correlation between 't' & 't+4', 16 companies have shown moderate correlation and 25 companies have shown high correlation. For correlation between 't' & 't+5', 8 companies have shown low correlation, 21 companies have shown moderate correlation and 21 companies have shown high correlation. The number of companies in the low and moderate group were increasing after the period 't+1' and 't+2' significantly.

Large number of companies shows moderate or low correlation as the time period increases. If there is little correlation between stock prices over time, it shows that it is not useful in predicting the future using historical data. So, after seeing the correlation, it is clear that the stock prices of companies in Nifty are not related or connected to each other. This implies that share price returns are not auto correlated and therefore moves at random.

It can be observed that the behavior of the share price returns over a period does not display any definite pattern. Hence it can be concluded that the share prices in general move at random, and reflects weak form of market efficiency.

Table 2.

Company Name	t+1	t+2	t+3	t+4	t+5
ACC	.972	.943	.916	.888	.860
Ambuja Cements	.986	.969	.955	.942	.928
Asian Paints	.973	.947	.923	.896	.869
Axis Bank	.991	.981	.971	.960	.950
Bajaj Auto	.991	.982	.973	.964	.955
Bank of Baroda	.973	.950	.926	.899	.866
BHEL	.846	.693	.629	.569	.517
BPCL	.979	.960	.942	.925	.909
Bharti Airtel	.937	.877	.857	.826	.800
Cairn India	.872	.751	.695	.638	.590
Cipla	.975	.951	.938	.923	.910
Coal India	.962	.920	.870	.823	.777
DLF	.511	.024	.028	.030	.032
Dr. Reddy's Laboratories	.979	.958	.938	.918	.900
GAIL (India)	.548	.108	.098	.094	.082
Grasim	.840	.691	.686	.687	.684
HCL	.781	.573	.567	.561	.559
HDFC Bank	.794	.589	.583	.568	.551
HeroHonda	.791	.573	.551	.533	.510
Hindalco	.489	-.021	-.022	-.023	-.021
Hindustan Unilever	.945	.892	.880	.864	.853
HDFC	-.426	.941	-.418	.925	-.419
I T C	.977	.958	.940	.922	.902
ICICI Bank	.671	.344	.345	.337	.332
Infosys	.781	.556	.526	.499	.473
IDFC	-.015	.224	-.015	-.015	.406
Jaiprakash Associates	.981	.958	.931	.907	.882
Jindal Steel & Power	.957	.917	.875	.839	.802
Kotak Mahindra Bank	.973	.951	.928	.906	.878
Larsen & Toubro	.983	.965	.949	.934	.916
Lupin	.983	.965	.949	.934	.916
Mahindra & Mahindra	.859	.716	.706	.700	.692
Maruti Suzuki India	.811	.632	.622	.607	.598
NTPC	.602	.193	.169	.157	.160
ONGC	.598	.192	.184	.185	.190
Power Grid	.038	.032	.025	.021	.027
Punjab National Bank	.604	.584	.564	.507	.508
Ranbaxy	.788	.758	.735	.720	.698
Reliance Industries	.983	.965	.947	.929	.913
Reliance Infrastructure	.795	.732	.679	.627	.563
Sesa Goa	.940	.870	.808	.758	.714
Siemens	.767	.735	.714	.697	.669
SBI	-.253	-.256	-.149	.039	.270
Sun Pharmaceutical	.813	.798	.783	.764	.744
TCS	.548	.533	.514	.488	.470
Tata Motors	.972	.947	.924	.903	.882

Tata Power	.534	.503	.483	.465	.415
Tata Steel	.932	.865	.813	.764	.720
UltraTech Cement	.160	.160	.162	.156	.159
Wipro	.914	.876	.842	.808	.775

Conclusion

The random walk model says that previous price changes or changes in return are useless in predicting the future price or return changes. If we attempt to predict future prices in absolute terms using only historical price change information, we will not be successful. After applying the statistical test like Run test and Correlation, it can be concluded that the price movements of the shares of the companies in NSE Nifty are random i.e, nobody can be successful in predicting the future prices on the basis of historical data only. In almost all the companies, Run test has rejected the null hypothesis that the price movements in the share prices of National Stock Exchange are not affected by past prices and accepted the alternate hypothesis that the price movements in the share prices of National Stock Exchange are affected by past prices. Moreover, results of correlation test also support the weak form of efficiency for NSE Nifty. So, it can be concluded that the price movements of shares on NSE Nifty are occurring by chance. Before, investing in the shares of the company listed on National Stock Exchange, an investor should not rely only on the historical prices of the shares of that company.

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Annexure – I

List of Companies

Company Name	Industry Group	Company Name	Industry Group
ACC Ltd.	Cement	IDFC	Finance
Ambuja Cements Ltd.	Cement	Jaiprakash Associates Ltd.	Engineering
Asian Paints Ltd.	Paint	Jindal Steel & Power Ltd.	Steel
Axis Bank Ltd.	Bank	Kotak Mahindra Bank Ltd.	Bank
Bajaj Auto Ltd.	Automobile	Larsen & Toubro Ltd.	Engineering
Bank of Baroda	Bank	Lupin Ltd.	Pharma
Bharat Heavy Electricals Ltd.	Elec Equip	Mahindra & Mahindra Ltd.	Automobile
Bharat Petroleum Corporation Ltd.	Refinery	Maruti Suzuki India Ltd.	Automobile
Bharti Airtel Ltd.	Telecom	NTPC Ltd.	Power
Cairn India Ltd.	Oil Explore	ONGC	Oil Explore
Cipla Ltd.	Pharma	Power Grid	Power
Coal India Ltd.	Gas	Punjab National Bank	Bank
DLF Ltd.	Real Estate	Ranbaxy Laboratories Ltd.	Pharma
Dr. Reddy's Laboratories Ltd.	Pharma	Reliance Industries Ltd.	Refinery
GAIL (India) Ltd.	Gas	Reliance Infrastructure Ltd.	Infrastructure
Grasim Industries Ltd.	Diversified	Sesa Goa Ltd.	Steel
HCL Technologies Ltd.	Info Tech	Siemens Ltd.	Elec Equip
HDFC Bank Ltd.	Bank	State Bank of India	Bank
Hero MotoCorp Ltd.	Automobile	Sun Pharmaceutical Industries	Pharma
Hindalco Industries Ltd.	Aluminum	TCS	Info Tech
Hindustan Unilever Ltd.	FMCG	Tata Motors Ltd.	Automobile
HDFC	Bank	Tata Power Co. Ltd.	Power
I T C Ltd.	Cigarettes	Tata Steel Ltd.	Steel
ICICI Bank Ltd.	Bank	UltraTech Cement Ltd.	Cement
Infosys Ltd.	Info Tech	Wipro Ltd.	Info Tech