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AN EMPIRICAL ANALYSIS OF THE INDIAN CAPITAL MARKET'S EFFICIENCY USING THE UNIT ROOT AND RUN TEST

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Abstract: Economists have invested considerable time and effort in investigating the market efficiency hypothesis. It can be viewed as an effective way to guide investors while trading in the securities market. An analysis of the Indian stock market is conducted to determine whether it is efficient if the stock returns follow a random walk. In this study, daily closing prices of 15 companies listed in NSE Nifty 50 and 7 sectoral indices for the period 1st April 2008 - 31st March 2018 are used. The run test has been used to investigate whether NSE Stocks and Index were efficient in the weak form during the testing period. According to the results, Indian stock prices do not reflect all the information in past stock prices, allowing investors to exploit market inefficiencies and achieve abnormal returns.

Key Words: Indian Capital Market; Efficient market Hypothesis; Random Walk Theory; Run Test; Stock Market

1. INTRODUCTION

Investors appear to be always looking for "Superior" investment techniques that will enable them to "beat" the market and produce higher profits. Evidently, both rational and irrational psychological and fundamental variables have an impact on stock values. There are essentially two distinct theories that account for the behaviour of stock prices in a broad sense and make an effort to account for the effect of factors that affect stock prices. These methods, "technical analysis" and "fundamental analysis," might be seen as being completely at odds with one another.

The two main methods used to try to explain and forecast stock price behaviour are fundamental analysis and technical analysis. Both techniques' primary goals are to forecast stock prices' future movements and explain their behaviour in order to help investors purchase and sell stocks to get the highest possible returns on their investments. Market professionals use these methods to explain and forecast stock price movements as well as to develop and put into practice trading and investing strategies that are intended to

help investors achieve higher returns. The "Random Walk Hypothesis," a rival theory, presented a challenge to the idea that stock prices can be anticipated within the confines of academia in the 1960s. The fundamental premise upon which the random walk theory is founded is the independence of stock price fluctuations. The third method of investment analysis therefore evolved. That strategy is explained in more detail in the next section.

In the middle of the 1960s, Eugene Fama established the idea of an efficient market. "A market which reacts swiftly to new information and completely reflects all available information," is how he characterised a "efficient market." Alternatively said, an efficient market is one in which market prices for assets represent an objective estimate of their inherent values. This indicates that although the market price of a security may deviate from its intrinsic worth, the difference is random and unrelated to other factors. Market efficiency, according to Andrei Shleifer, results from three factors:

1. Rationality of investors
2. Effective arbitrage process
3. Independent deviation from rationality

Nobody can generate an abnormal return by using various trading methods and policies in an efficient market. The EMH is based on the "Random walk theory," which claims that share prices are equally distributed and independent of past prices in the future. As a result, successive share prices defy any form of prior sequence. This is due to the market's immediate and simple availability of information.

2. LITERATURE REVIEW

Some of the earliest research on the behaviour of stock markets were conducted in the US, and the majority of them supported the random walk hypothesis theory by finding that the US stock markets were efficient in "weak as well as semi-strong" form (Alexander, 1961; Cootner, 1962; Granger and Morgenstern, 1963,70; Fama, 1965; King, 1966).

Yalawar (1988) carried out a thorough investigation into the effectiveness of the Bombay Stock Exchange and discovered that stock price behaviour was unpredictable. Rao and Bhole (1991) disputed Yalawar's findings, arguing that his sample was limited to a few firms that investors and speculators were interested in, and as a result, they were likely to be those companies that did well at the time. The link between the Indian stock market, as represented by the Bombay Stock Exchange Index, and other significant worldwide stock markets was examined by Venkateswar in 1991. The Indian stock market, he discovered, was protected from other global stock markets.

Mishra (2005) looked at the long-term impact of a share repurchase transaction on a company's stock price. The study's time frame included the years 1999 to 2001. 25 share buyback occurrences from SEBI were used as a total sample. Different ratios and stock returns were analysed in the study. Based on the findings, the study came to the conclusion that share buybacks in India did not offer shareholders the chance to get excess profits, demonstrating the stock market's semi-stable efficiency.

In their 2008 study, Dhar and Chhaochharia examined the impact of bonus issues and stock split announcements on the Indian capital market from 2000 to 2007. The sample includes 90 stock split announcements and 82 bonus issuance announcements from corporations that were listed on the BSE 500 index. The event research approach, based on a market model, took 81 days as of the event window, and a t-test was performed. The outcomes demonstrated the presence of a semi-strong type of EMH efficiency in the setting of bonus issues and stock splits on the Indian stock market.

Raja and Sudhahar (2010) tested the effectiveness of the semi-strong form for the notification of bonus issues in the Indian IT sector. 43 equities from firms with BSE listings make up the sample. Analysis tools included AAR, CAAR, SRV, ASRV, and daily stock returns. T-test was used, and it was discovered that the IT sector wasn't particularly effective.

In the context of the announcement of a stock split, Chakraborty (2011) examined "the semi-strong form efficiency of the Indian stock market." The time frame used was 2000 to 2010, and the sample consisted of 17 S&P CNX Nifty equities. No significant AARS were created during the course of the 41-day event window in the standard event study based on the market model, which supports the market efficiency but the results of the CAAR failed to support semi-strong form efficiency. It may be inferred from this that the study did not offer sufficient proof in this regard.

Purohit et al. (2012) assessed how the announcement of a share repurchase affected stock returns. 45 firms that were included in the S&P CNX 500 index from 2006 to 2010 make up the sample. The t-test was performed, and event study approach was employed. The findings revealed no indication of sizable anomalous gains after the announcement of a share repurchase.

P.S. Nirmala (2012) examined the impact of NIFTY additions from September 1996 to September 2010 in her study. According to the findings of her event analysis, stock additions to the NIFTY have a favourable price impact on the effective day of revision as well as an increase in trading volume.

Hua and Ramesh (2013) examined the impact of the stock split on stock returns in Sri Lanka's CSE. 64 incidents total from the 2009 to 2012 research period comprised the sample. A common event research technique was used for the analysis. AARs and CAARs were computed, and the t-test was used to assess their significance at the 5% and 10% significance levels. The outcomes supported EMH's semi-strong form efficiency for stock split announcements in CSE.

Using the P/E ratio anomaly, Lakshmi and Roy (2013) empirically tested the applicability of the semi-strong variant of the EMH in India. The sample consists of 90 NSE equities that were traded between March 2006 and June 2012. Five different portfolios were built using the P/E ratio, with portfolios I, II, and III having very high P/E ratios and portfolios IV and V having low P/E ratios. To assess the performance of the portfolio, the study used the sharpe ratio, treynor ratio, and jensens' alpha. The findings demonstrated that a low P/E ratio portfolio produces higher returns than a high P/E ratio portfolio. As a result, the analysis indicates that the Indian stock market is inefficient in terms of the P/E ratio anomaly.

There was no indication of abnormally favourable returns 43 linked with the announcement of additions to NIFTY, according to Mayank Joshipura and Sundaram Janakiraman's (2015) investigation on price and volume impacts related with scheduled modifications to NIFTY for the years 1995 to June 2009. They have discovered large positive abnormal returns on the change's effective day, but these abnormal returns do not last for very long. They found no appreciable long-term changes in trade volume with inclusions.

After adjusting for local macroeconomic variables, such as GDP, inflation, and interest rates, Mukherji (2015) examined the stock market efficiency in India, Brazil, and China and tested the impact of US stock returns on the stock returns in these three countries. For the years 1999 through 2013, monthly data on three factors and stock returns were gathered. For the analysis, FMOLS (fully modified ordinary least squares) was used for the long term and vector-auto regression for the short term. The findings indicated both short- and long-term inefficiencies for China, Brazil, and India.

Over the study period from 2013 to 2016, Chavannavar and Patel (2016) tested the efficiency of the weak and semi-strong version. 100 stocks were chosen as the sample, and analytic methods included autocorrelation, run testing, residual testing, and event studies. Finding that events had no influence on returns and drawing the conclusion that the market was efficient in both forms.

In India, Chakrabarti et al. (2017) looked at how stock split announcements and splits really affected stock returns. Twenty-three samples of stock were obtained across the time frame of 2010 to 2015. The t-test was utilised with three distinct event window periods (90, 30 and 10 days) for the event research approach. The findings show that while the impact of the stock split was minor on the other days, it was statistically significant on the day of the announcement. Over the various event windows, CAARs were likewise determined to be inconsequential. Results so indicate effectiveness.

In their 2017 study, Ayodele and Maxwell explored the semi-strong variant of the EMH from 2005 to 2013. The "Nigerian Stock Market Index" was the output series from the modified transfer function model, and the calculated index was the input series. The outcome demonstrated a substantial coefficient of transfer function, which caused the semi-strong form efficiency to be rejected.

Thangaraju (2018) looked on the effectiveness of the weak and semi-strong Indian capital market from 2009–10 to 2016–17. For the study, nine NSE indices and eleven BSE indices were collected. We sampled 2349 dividend announcements, 63 stock splits, 23 rights issues, and 83 bonus issues. Event study technique was utilised, and additional statistical tools for analysis included the unit root test, PP test, ADF test, KPSS test, GARCH test, autocorrelation test, run test, and Ljung-Box Q-statistics. According to the report, the Indian capital market is weak and inefficient in a semi-strong state.

3. RESEARCH METHODOLOGY

3.1 Objectives of the Study

Though the primary objective of the study is to investigate the efficiency of Indian Capital Market, the specific objectives are outlined below.

1. To analyze the performance of the sample indices & the firms during the period of study.
2. To test the efficiency of the sample indices and the firms over the period of the study.

3.2 Hypotheses of the Study

The following null & alternative hypotheses are framed for the study:

1. To analyse the performance of the sample indices & the firms during the period of study.

$H0_1$: Return data of the selected indices and firms are not normally distributed.

Ha_1: Return data of the selected indices and firms are normally distributed

2. To test the efficiency of the sample indices and the firms over the period of the study.

$H0_2$: The selected indices & firms are not a weak form of Market Efficiency.

Ha_2: The selected indices & firms are a weak form of Market Efficiency.

3.3 Sample, Data & Period of the study

The stocks selected for this analysis are those which are listed on the S&P CNX Nifty of NSE (National Stock Exchange) which is an index of well–diversified 50 different stocks index accounting for 22 sectors of the economy. Price data collected for this study period (from 1st April 2008 to 31st March 2018) for the 50 constituent companies of CNX nifty has been found that these 15 firms were listed continuously throughout the study period of ten years.

Fifteen firms have been selected from 7 selected sectors according to the availability of data and 7 sectoral indices. In the case of 15 firms, 2 firms of consumer goods (ITC Ltd., HINDUNILVR Ltd.), 2 firms of IT sector (Tata Consultancy Services Ltd., Infosys Ltd.), 3 firms of petroleum (oil) and gas sector (Reliance Industries Ltd., GAIL (India) Ltd. and Bharat Petroleum Corporation Ltd.), 1 company in the telecom sector (Bharti Airtel Ltd.), 2 firm in the construction material (Larsen & Toubro Ltd., DLF), 3 of Bank and Finance sector (HDFC Bank Ltd., State Bank of India, ICICI Bank Ltd.) and 2 firms of automobile sector (Tata Motors Ltd., Maruti Suzuki India Ltd.).

Seven indices have been selected from 22 industrial sectors of the economy. In this study, Nifty Auto, Nifty Bank, Nifty FMCG, Nifty IT, Nifty Metal, Nifty Pharma and Nifty Realty have been selected with the period of 10 years (From 1st April 2008 to 31st March 2018).

Table 1 & 2 below gives a vivid description of the sample indices and the firms selected for the study.

Table 1

Sample Indices selected for the study

Sl No	Indices Name
1	Nifty Auto
2	Nifty Bank
3	Nifty FMCG
4	Nifty IT
5	Nifty Metal
6	Nifty Pharma
7	Nifty Realty

Table 2

Sample firms selected for the study

The following 15 firms are selected from their respective sectors as a sample for the study.

SL No	Sectors	Firms	Total
1	Consumer goods	ITC, HUL	2
2	IT	TCS, INFOSYS	2
3	Telecom	Bharti Airtel Ltd	1
4	Construction	Larsen & Toubro, DLF	2
5	Petroleum/oil and gas	RIL, GAIL, BPCL	3
6	Bank & finance	ICICI bank, HDFC bank, SBI	3
7	Automobile	Maruti Suzuki India Ltd, Tata Motors	2
Total			15 companies

The present study uses the adjusted closing price data of all the selected samples indices and firms for calculating the return data for further analysis by using the following formula comprising a total number 2450 observation:

R = Ln (Pt / Pt- 1)Where R = Daily return,

Ln = Natural Log, Pt= Price at time t Pt 1= Price at time t-1.

Statistical Techniques

The following are the statistical techniques which are used to achieve the objective of this study:

1. Descriptive Statistics
2. Kolmogorov Smirnov Test
3. Unit Root test (ADF)
4. Run Test

4. RESULT AND ANALYSIS

All of the sample companies and sectoral indices that make up the CNX Nifty have negligible Skewness, Kurtosis, and Jarque-Bera, according to the result summaries of descriptive statistics. The following are the weak form statistical test result summaries in this study, as shown in Table 3:

Table 3

Result Summaries of descriptive Tests

NAME	SKEWNESS#					KURTOSIS##			JARQUE-BERA###		
	>0	=0	<0	Total	>3	=3	<3	Total	JB < p–value	JB > p–value	Total
Firms	14	0	1	15	15	0	0	15	0	15	15
Sectors	5	0	2	7	6	0	1	7	0	7	7

Notes: #: Skewness = 0, distribution is normal; Skewness > 0, distribution have right tail; Skewness < 0, distribution have left tail. ##: Kurtosis = 3, distribution is normal distribution; Kurtosis > 3, distribution is Leptokurtic; Kurtosis < 3 distribution is Mesokurtic. ###: Jarque– Bera

Descriptive statistics result summaries are shown in Table 3. It is discovered that the Skewness and Kurtosis values for each of the Nifty component sample companies over the financial time period of the research are inconsequential. Similar to this, all sectors' Skewness and kurtosis values for the sectoral indexes of the CNX NSE are statistically insignificant. According to the general findings of the empirical research, the under examination Indian stock markets have low levels of efficiency. The Jarque-Bera test is used to determine if the gathered data have a normal distribution. The Jarque-Bera test's results show that the market does not have a normal distribution. Descriptive statistics' findings so largely confirm the poor shape of the Indian stock market's inefficiency. On the whole, the empirical descriptive statistics of the share return series on the NSE Nifty and sectoral indices be similar to those as found in other markets. Hence, the researcher has gone for more advanced tests.

Table 4

Result Summaries of Kolmogorov–Smirnov Test

NAME	Z values#			Shapiro-Wilk##		
	Sign < 0.05	Sign >0.05	Total	Sign < 0.05	Sign >0.05	Total
Firms	15	0	15	15	0	15
Sectors	5	0	7	7	0	7

Note: **##:** P–value less than 0.05 at the 1%, 5% indicated fit normal distribution.

In the Kolmogorov-Smirnov Goodness of Fit Test (KS), all companies of sectors and sectoral indices have a P-value less than 0.05 at the 1%, 5%, and 10% levels of significance, as shown in Table 4. The results therefore show unequivocally that a normal distribution is not suited by the frequency distribution of the daily values of the markets under examination. Overall, the researcher may thus draw the conclusion that no sample of NSE under consideration has share price data that adheres to a random walk model, negating the presence of weak form efficiency. The empirical distributions of the share return series are generally similar to those observed in other markets.

Table 5

Result Summaries of Unit Root Test

Name	**Augmented Dicky–Fuller**			
	Sign < 0.05	**Sign > 0.05**	**Tau critical < Tau observed**	**Tau critical > Tau observed**
Firms	15	0	15	0
Sectors	7	0	7	0

NOTE -ADF: Implies Augmented Dicky–Fuller Test with regression equation having lagged difference terms of the dependent term as the explanatory variables$\Delta yt = \beta 1+\beta 2t+\sigma yt-1 +\alpha 1\Delta yt-1+\alpha 1\Delta yt-2+ ut$. *: 1% and 5% level of significance of a different kind of ADF.

Using the expected outcomes from the unit root testing, The null hypothesis H0 is rejected and the alternative hypothesis Ha is accepted since the estimated p-value is less than the significance threshold alpha=0.05. It claims that the series doesn't have any unit roots. The series is hence constant. As is common knowledge, a stationary time series is one in which the mean, variance, autocorrelation, and other statistical features are all constant. As a result, it becomes relatively simple to predict a stationary series. As a result, both the sectoral indexes and all of the Nifty component sample stocks display random walk.

Table 6

Result Summaries of Runs Test

NAME	Z values#			Asymp. Sig##		
	≥ ±1.96	< ±1.96	Total	>0.05	<0.05	Total
Firms	11	4	15	11	4	15
Sectors	2	7	7	2	5	7

Four out of the fifteen Nifty constituent sample businesses and sectoral indices had a considerably low number of runs relative to the total number of observations, according to Table 6's summary of the Runs Test's results. Thus, it suggests that the EMH is disproven. Instead of taking into account both samples, it is discovered that two sectors of sectoral indices (FMCG and IT) and four individual enterprises (belonging to the consumer goods, telecom, financial service, and car industries) have a significant number of Runs. .Thereby it not establishes the existence of a random walk model. In runs test for 15 firms of Automobile sector (2 firms), Banks and Financial Service (3), Construction (1), Energy (2), IT (2), Consumer Goods (1) and in sectoral indices auto, Finance, Energy, IT, PHARMA, it is revealed that these sectors are following RWH; therefore they are efficient sectors. Therefore, the runs test results on EMH are mixed.

5. CONCLUSION

Two key findings are made from the analysed data from the analysis indicated above. The first is that the businesses' share price distribution over time is not typical, and the second is that most of the firms' daily returns do not closely track RWH. The run test and the autocorrelation test are used to confirm the randomness of the Indian market walk. The analysis of the run test reveals that most days have a random walk-like tendency to them. The autocorrelation test results and the run test results both support this. The absence of the unit root in the series has also been demonstrated using the ADF test of the unit root. Because of this, the series is stationary, which increases predictability. These three prerequisites are necessary for the weak type of efficiency. The findings of the serial correlation tests definitively rule out the existence of random walks in the daily returns of market indexes. The unit root tests also come to the conclusion that a large portion of the return series do not include unit roots, which are a required presumption for a random walk. Furthermore, it has been deduced from the above that even if these anomalies continue to exist in the market, an investor may still aim to make abnormal profits from their investments in the short term alone. Demand and supply are ultimately impacted by the market's flexibility. In exchange, these forces take advantage of the extra return, which further limits the possibility of seasonal anomalies and makes the market more effective. The findings lead to the conclusion that the Indian Stock

Index is weakly form efficient since historical rates of return and other market data shouldn't have any bearing on future rates of return.

According to the theoretical underpinnings of the weak-form efficient market hypothesis, previous stock prices lack the analytical substance necessary to predict future stock prices when they are independently and uniformly distributed through time. Regarding the theoretical literature, empirical studies regarding the weak-form EMH in the rising market have been well explored, especially in recent years. Most significantly, it is thought that the definition of efficiency has to be changed. It has generated debate to see efficiency as an absolute and binary condition of the financial markets.

But it has been noted that early literature on the Indian Stock Market was of a weak and semi-strong kind. Thus, it may be inferred that the market has changed and grown, and other micro and macro variables both domestically and globally are to blame. Over the last ten years, the Indian economy as a whole has expanded astronomically. More so than ever, the world's economies are interconnected. An occurrence in one nation has both short-term and long-term effects elsewhere. Therefore, it is essential to analyse the movement of the Indian Capital Market in the context of the modified conditions in order to comprehend, reflect upon, and foresee.

There is a probability that stocks are undervalued or overpriced at any given time, and the fact that the departures from actual value are not random suggests that these deviations are not entirely random. Because it has been established that the Indian stock market does not entirely adhere to the RWH, investors sometimes behave irrationally. An investor must act sensibly. Investor behaviour frequently deviates from logic and reason, and investors exhibit a variety of behavioural biases that affect how they decide which investments to make. Investment decisions are made more difficult by emotional processes, mental errors, and unique personality peculiarities.. Behaving irrationally leads to the unwanted fluctuation of securities prices in a capital market, which makes the market inefficient in terms of their actual value with the market value. Behaving irrationally leads to the unwanted fluctuation of securities prices in a capital market, which makes the market inefficient in terms of their actual value with the market value.

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