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**ANALYZING THE WEAK FORM MARKET EFFICIENCY AND PERFORMANCE OF SELECTED INDIAN IT STOCKS**

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**ABSTRACT**

*The forms of market efficiency occupy a pivotal role in measuring efficiency of Indian capital market. The present paper aims to analyze the weak form efficiency of efficient market hypothesis of 8 IT companies selected from index of IT sector companies listed under NSE covering a period of one quarter i.e. from 21<sup>st</sup> Nov. 2011-17 Feb. 2012. For analyzing the weak form of market efficiency and evaluating the performance of selected stocks of IT sector on the basis of risk and return, the run test, treynor and sharpe ratio, beta and standard deviation have been used as statistical tools. The findings of the study highlight that Indian IT market was an inefficient form of market and rejected the efficient market hypothesis. The results of run test at 5% level of significance were rejected which highlighted that price movement in Indian IT sector was not random and stock prices move in a definite pattern. The empirical results of the sharpe and treynor ratio showed that Mphasis Ltd. was the best option among these 8 IT companies for investment by an investor to achieve the objective of minimizing risk and maximizing the returns.*

**KEYWORDS**

efficient market hypothesis, market efficiency, random, sharpe ratio, treynor ratio.

**INTRODUCTION**

**E**fficient Market Hypothesis is a debatable issue in finance literature in Indian capital market. The efficiency of stocks plays a pivotal role in the functioning of an economy. The efficient market is one which processes all available information quickly and efficiently. The weak, Strong and semi- strong are the three forms of market efficiency. The market efficiency tells us the extent to which stock prices reflect relevant and available information in a right and proper manner. The theory of efficient market hypothesis has been supported by facts proposed by Samuelson (1965) and Fama (1970) that the share prices adjust rapidly to the appearance of new information and current prices fully reflect all available information. It has also been analyzed by Samuelson (1965) that anticipated price of an asset fluctuates randomly around its expected value. Fama supported this fact in his revised paper based on further developments (Fama, 1991) Market efficiency plays an important role in investment decision of investors. In an efficient market, prices of assets reflect market's best estimate for risk and expected return of asset. There has been no undervalued asset with an expectation of higher than expected risk adjusted return or overvalued assets offering lower than the expected return. In an efficient market, the risk and return characteristics of the asset determine the optimal investment decision. EMH achieves the dual role of a theoretical model as well as an instrument to motivate the investor to invest their savings in stock market (Will, 2006).

The Indian economy, being acclaimed as one of the insulated and vibrant economies of the globe, needs funds to be invested in corporate sector either in the form of debt or equity which forms part of capital market. So, it has been the need of the hour to judge the level of efficiency of stocks of Indian markets in order to enter the trajectory of BRICS nation. The studies on market efficiency of Indian IT stocks are very rare. The main objective of this study has been to examine the weak form efficiency of Efficient Market Hypothesis (EMH) in the selected stocks of IT sector in Indian capital market. The EMH uses past actual prices or returns for tests (Gupta & Yang, 2011). One of the motivators for this research are Kumarasamy & Chellasamy (2011) who analyzed the weak form efficiency on returns from Indian IT stocks. It has been found from their study that with the recent developments in global markets especially in emerging markets, there is need to revise the notion of market efficiency in Indian IT stocks.

The paper has been organized as follows. In Section II the studies relating to market efficiency has been reviewed. Section III highlights the significance and objectives of the study. Section IV sets out the research methodology covering sample size, sources of data collection and statistical tools as well. Section V explores the empirical results and findings of the study and section VI concludes the paper.

**REVIEW OF LITERATURE**

There has been a lot of literature available on testing the weak form market efficiency of stock markets. Barnes (1986) showed high degree of efficiency in Kuala Lumpur market. Groenewold and Kang (1993) observed in Australian market semi- strong form efficiency. Barua (1987), Chan, Gup and Pan (1997) found weak form inefficiency of Asian markets. Dickinson and Murago (1994) also found weak form inefficiency of Nairobi stock market. Poshakwale (1996) analyzed that Indian stock market was weak form inefficient by using daily BSE index data from 1987-1994. Gupta and Basu (2007) observed mixed results for weak form efficiency from period 1997-2006. Gupta & Yang (2011) analyzed the weak form efficiency for two major equity markets i.e. BSE and NSE in India from 1997-2011 by using ADF, PP and KPSS tests. The results of the tests supported the weak form efficiency for 2007-2011 but there was a slight conflict for 1997- 2007. Khan, Ikram & Mehtab (2011) in their paper analyzed the market efficiency of Indian capital market in its weak form based on the indices of BSE & NSE by using daily closing prices of indices of NSE & BSE over a period of 1<sup>st</sup> April 2000 to 31<sup>st</sup> March 2010 by using run test. It was found that Indian capital market neither follows random walk model nor is weak form efficient.

It was observed by Mobarek, Asma & Keavin (2000) in their study on Dhaka stock market that share returns do not follow random walk model and significant auto correlation co-efficient at different lags rejects the null hypothesis of weak form efficiency. Gimba & Victor also analyzed the weak form efficient market hypothesis of NSE by using normal distribution and random walk of return series. It was concluded that the market was inefficient in weak form. Kumarasamy, Umanath & Chellasamy (2013) analyzed the weak form efficiency of Indian IT stocks from 1<sup>st</sup> August 2006 to 31<sup>st</sup> July 2012 for 1491 days. Kolmogorov Smirnov test, unit root test and run test were applied on major Indian IT stock indices CNXIT (NSE). It was found that Indian IT stock market was efficient and does not follow random walk model.

**SIGNIFICANCE & OBJECTIVES OF THE STUDY**

Over the last decade, the Indian capital market has been growing by leaps and bounds. India has the largest number of listed companies in the world today. Incredible performance of stock market in the recent past has attracted many investors to try their luck in the investment of equity, which has made the stocks the hottest investment option.

In this context, the present study entitled, "Analyzing the weak form efficiency and performance of selected stocks of IT sector" helps the investors in knowing the performance of securities, whether they have performed well or not with respect to the benchmark and the randomness appearing in their returns. Further, the study is also useful for the readers in understanding the various aspects of performance evaluation of equity. None of the studies were conducted on the test of efficiency of IT sector companies of Indian Stock Market. To fill this gap this research has been undertaken. The study thus has been helpful in determining which IT company had given a beneficial investment and higher returns. The objectives of the study have been as follows:

- To analyze the weak form efficiency of selected stocks of IT sector.
- To evaluate the performance of selected stocks of IT sector on the basis of risk and return.
- To make a categorization of selected stocks of IT sector based on their performance.



**RESEARCH METHODOLOGY****COVERAGE OF THE STUDY**

The universe of the present study is indices of stocks of IT sector companies with special reference to CNX IT index. The CNX IT index are considered as the representative of Indian IT stock market as these are the popular indices of Indian Stock Market.

**DATA COLLECTION**

The study has been based on indices of selected stocks of 8 IT sector companies from the website of NSE (National Stock Exchange) covering a period of 1quarter (21<sup>st</sup> Nov, 2011 to 17<sup>th</sup> Feb, 2012). The CNX IT index has been computed using free float market capitalization method with a base date of Jan 1, 1996 indexed to a base value of 1000 wherein the level of the index reflects total free float market value of all the stocks in the index relative to a particular base market capitalization value. The base value of the index was revised from 1000 to 100 with effect from May 28, 2004. The companies we have considered for our research regarding the weak form efficiency and the performance of IT sector were HCL Technologies Ltd, Infosys Ltd, Mphasis Ltd, Oracle Financial Services Software Ltd, Patni Computer Systems Ltd, Tata Consultancy Services Ltd, Tech Mahindra Ltd, Wipro Ltd.

**TOOLS & TECHNIQUES**

For the purpose of research, Convenience sampling has been used as the Index from domestic market was taken as sample and thus the closing prices were easily available on daily basis. Sharpe ratio and Treynor ratio have been used as the statistical tools to evaluate the performance of equity to achieve the objective of maximum return and minimum risk. The run test has been used to test the weak form of market efficiency.

**RUN TEST**

"Run Test" has been used to test weak form of market efficiency.

Runs Test,  $Z = \frac{R - \mu}{\sigma}$

$\sigma$

Mean,  $\mu = \frac{2n_1 n_2 + 1}{n_1 + n_2}$

Standard error,  $\sigma^2 = \frac{2n_1 n_2 (2n_1 n_2 - n_1 - n_2)}{(n_1 + n_2)^2 (n_1 + n_2 - 1)}$

$n_1 + n_2$  = number of observations in each category

$\sigma$  = Standard deviation

Z = Standard normal variate

**TREYNOR RATIO**

It has been used to analyse the performance of IT sector under NSE.

$T_n = \frac{R_p - R_f}{\text{Beta}}$

Here  $T_n$  = Treynor Index

$R_p$  = portfolio Average Return

$R_f$  = Risk Free Rate of Interest

Beta = Beta Co- efficient of portfolio

**Sharpe Ratio**

$S_t = \frac{R_p - R_f}{S.D.}$

Here  $S_t$  = Sharpe Index

$R_p$  = portfolio Average Return

$R_f$  = Risk Free Rate of Interest

S.D. = Standard Deviation of portfolio return

**Standard Deviation**

$$\sigma^2 = \frac{\sum (X - \mu)^2}{N}$$

where  $\sigma^2$  is the Variance,

$\mu$  is the mean,

N is the number of scores.

**DATA ANALYSIS AND FINDINGS**

The closing prices and the daily return values have been calculated for a quarterly period from 21<sup>st</sup> Nov, 2011 to 17<sup>th</sup> Feb, 2012 in order to analyze the weak form efficiency and performance of IT sector companies listed under NSE. The hypothesis of the study has been to check the weak for market efficiency of selected IT stocks. The tables given in appendix depict the closing prices, daily return values and runs for all the selected companies. Based on the tabular values of the selected stocks of IT Sector companies under NSE, runs test has been performed by calculating the standard error in the closing price values and based on this the normal distribution i.e. the p-value has been calculated in order to determine whether the hypothesis set by us is valid or not. Further the average daily return, beta values and standard deviation of the returns along with the risk free rate has been used in order to calculate the Sharpe and Treynor ratio to categorize the selected stocks on the basis of their risk return profile.

**ANALYSIS ON THE BASIS OF RUNS TEST****TABLE 1: VALUES OF VARIABLES RELATED TO RUNS TEST**

Variables	HCL Tech. Ltd.	Infosys Ltd.	Mphasis Ltd.	OFSS Ltd.	Patni Computer Systems	TCS Ltd.	Tech Mahindra Ltd.	Wipro Ltd.
Mean of closing prices	418.516	2730.7	337.19	2000.7	456.88	1150.0	600.77	407.5
(no. of runs) R	8	12	4	6	4	6	10	10
(no. of binary zero's) n0	42	32	37	36	31	28	37	36
(no. of binary one's) n1	22	32	27	28	33	36	27	28
(no of observations) n	64	64	64	64	64	64	64	64
(expected value) E <sup>o</sup>	29.875	33	32.219	32.5	32.969	32.5	32.219	32.5
(variance) Var <sup>o</sup>	12.776	15.746	14.974	15.25	15.715	15.25	14.974	15.25
(standard deviation) StDev <sup>o</sup>	3.574	3.968	3.87	3.905	3.964	3.905	3.87	3.905
Z	-6.12	-5.292	-7.292	-6.786	-7.308	-6.786	-5.742	-5.762
(normal distribution) P-value	0	0	0	0	0	0	0	0

As the values in the row labeled "Z" are less than -1.96, so the closing prices of the selected stocks of IT sector are statistically significant at the 5% level. The runs test does indicate some non-randomness. Since the p-value is less than the 5% significance level so we reject the hypothesis and thus the difference is statistically significant. The runs test reports a low P value, thus concluding that the data doesn't follow a straight line, and uses nonlinear regression to fit a curve. This means that the selected stocks of IT sector doesn't exhibit the weak form of market efficiency. The prices followed the non random pattern in the market and the change in price could be predicted from the earlier price changes. The investors could earn more than normal profits because the prices in the market absorb the information after a time gap.

Results of the study suggested that the Indian market was an Inefficient form of market, and rejected the Efficient Market Hypothesis. The test had been conducted for a period of 1 quarter and it was interpreted that the price followed a non-random pattern in the IT sector Market. The result was further tested at 5% significance level, where the result was rejected and it had been interpreted that the price changes in this market could be predicted from earlier changes in price. It depicted that the price movement in the Indian IT sector market was not random and they move in a definite pattern. The notion of the market Inefficiency showed that the prices in the market absorb the new information after a time gap. And the investors could beat the market by getting advantage of this. The present price was affected by the past changes. So it was interpreted that the Indian IT sector market rejected the Efficient Market Hypothesis and there was an evidence of Inefficiency in the Indian IT sector Market.

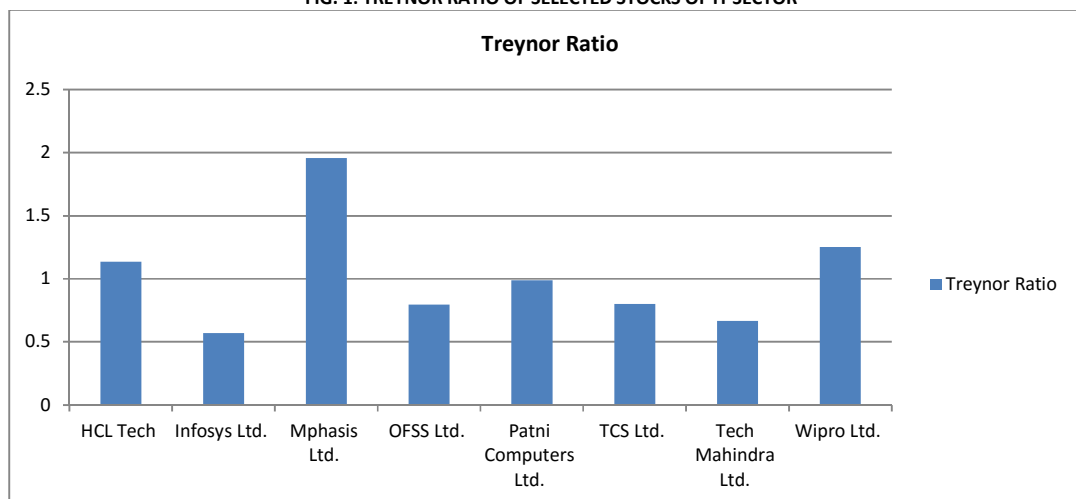
#### ANALYSIS ON THE BASIS OF TREYNOR AND SHARPE RATIO

##### TREYNOR RATIO

TABLE 2: TREYNOR RATIO

Companies	Beta values	Risk Free Rate of Return	Average Rate of Return	Treynor Ratio
HCL Tech. Ltd.	1.12	0.08	1.352	1.136
Infosys Ltd.	0.959	0.08	0.627	0.57
Mphasis Ltd.	0.83	0.08	1.705	1.958
OFSS Ltd.	0.65	0.08	0.597	0.795
Patni Computer System Ltd.	0.52	0.08	0.593	0.987
TCS Ltd.	0.97	0.08	0.858	0.802
Tech Mahindra Ltd.	1.08	0.08	0.798	0.665
Wipro Ltd.	0.87	0.08	1.171	1.254

FIG. 1: TREYNOR RATIO OF SELECTED STOCKS OF IT SECTOR



The above drawn table has been showing the beta values, risk less return, average rate of return and Treynor ratio of the different securities. This graph is a graphical representation of Treynor ratio showing the excess returns of selected securities of IT sector companies over the riskless returns. According to this, Mphasis Ltd. is at number one in delivering the excess returns over risk. This graph is a depiction of the earnings made while facing the risk. This indicates that the IT sector companies taken under consideration have a Treynor ratio ranging between 0.57 to 1.975 with Mphasis Ltd. offering the highest returns and Infosys Ltd. offering the lowest returns.

##### RANKING OF THE COMPANIES ON THE BASIS OF TREYNOR

TABLE 3: RANKING ON THE BASIS OF TREYNOR RATIO

COMPANIES	RANK
Mphasis Ltd.	1
Wipro Ltd.	2
HCL Ltd.	3
Patni computers Ltd.	4
TCS Ltd.	5
OFSS Ltd.	6
Tech Mahindra Ltd.	7
Infosys Ltd.	8

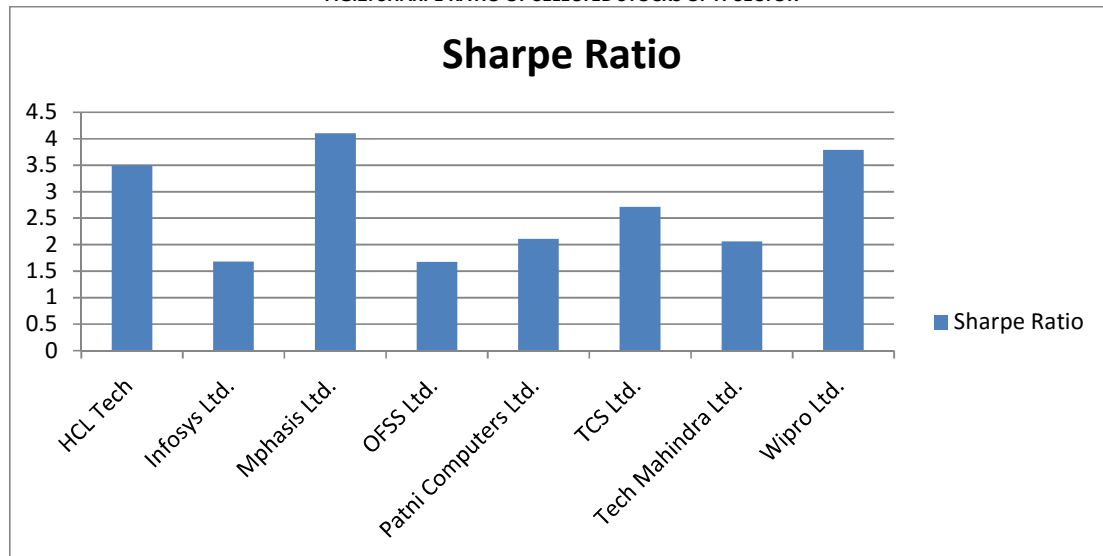
The above table shows the tabular presentation of the securities in the decreasing order of their Treynor ratio. If we compare the returns and Treynor ratio of the securities, then the following companies were at the top 3 positions. The company which was having rank 1 was the maximum return providing company and risk was also very less. Ranking was given in descending order of their Treynor Ratio. The investors were recommended to prefer investing in these top ranking companies rather than going for the companies having lower rank than them.

## SHARPE RATIO

TABLE 4: SHARPE RATIO

Companies	Standard Deviation	Risk Free Rate of Return	Average Rate of Return	Sharpe Ratio
HCL Tech. Ltd.	0.364	0.08	1.352	3.494
Infosys Ltd.	0.325	0.08	0.627	1.685
Mphasis Ltd.	0.396	0.08	1.705	4.099
OFSS Ltd.	0.308	0.08	0.597	1.679
Patni Computer System Ltd.	0.243	0.08	0.593	2.112
TCS Ltd.	0.287	0.08	0.858	2.711
Tech Mahindra Ltd.	0.348	0.08	0.798	2.063
Wipro Ltd.	0.288	0.08	1.171	3.787

FIG.2: SHARPE RATIO OF SELECTED STOCKS OF IT SECTOR



The above drawn table has been showing the standard deviation, risk less return, average rate of return and Sharpe ratio of the different securities. This graph has been the graphical presentation of Sharpe ratio which shows that Mphasis Ltd. has been the company which was providing the maximum returns as compared to others and in this way it was compensating better than others. In the given set of securities the range of Sharpe Ratio lies between 1.679 to 4.099 with Mphasis Ltd. giving maximum returns and OFSS offering the lowest return.

## RANKING OF COMPANIES ON THE BASIS OF SHARPE RATIO

TABLE 5: RANKING ON THE BASIS OF SHARPE RATIO

COMPANIES	RANKING
Mphasis Ltd.	1
Wipro Ltd.	2
HCL Ltd	3
TCS Ltd.	4
Patni computers Ltd.	5
Tech Mahindra Ltd.	6
Infosys Ltd.	7
OFSS Ltd.	8

The above table shows the tabular presentation of the securities of selected stocks of IT sector companies as per their Sharpe index. The above given ranking shows that if an investor wants to choose the security by using Sharpe tool then he should go for Mphasis first and then for others like Wipro, HCL etc. The investors have been advised to go for the security having higher Sharpe ratio than going with the one having a low Sharpe ratio. By using this ratio one can have a better portfolio providing higher returns and thus according to the study conducted it is more beneficial to invest in Mphasis Ltd. rather than going for OFSS Ltd. or Infosys Ltd. as their returns would be less than the higher ranked securities.

## COMPARISON OF SECURITIES ON THE BASIS OF SHARPE AND TREYNOR RATIO

TABLE 6: COMPARISON BETWEEN THE RANKS ON THE BASIS OF TREYNOR RATIO AND SHARPE RATIO

RANKING	Ranking on the basis of Treynor Ratio	Ranking on the basis of Sharpe Ratio
1	Mphasis Ltd.	Mphasis Ltd.
2	Wipro Ltd.	Wipro Ltd.
3	HCL Ltd	HCL Ltd
4	Patni computers Ltd.	TCS Ltd.
5	TCS Ltd.	Patni computers Ltd.
6	OFSS Ltd.	Tech Mahindra Ltd.
7	Tech Mahindra Ltd.	Infosys Ltd.
8	Infosys Ltd.	OFSS Ltd.

The above done comparison of both Sharpe and Treynor ratio has depicted that the same security can be ranked differently according to the two ratios. The difference lies only on the part of tool used. So the investor while doing analysis, first of all must select what sort of technique he was using because same securities show different results when its performance was evaluated by using different tools. Based on the study performed it was clear that Mphasis Ltd. was a safe option

to invest in as it was ranked 1 according to both Sharpe and Treynor Ratio. The same companies were appearing in the top 3 ranks according to both the ratios indicating that these securities were definitely a better investment option as compared to the others.

## CONCLUSION AND RECOMMENDATIONS OF THE STUDY

It has been found from the study that the selected stocks of Indian IT sector are inefficient. The behavior of the stock prices does not confirm the applicability of the random walk model in the IT sector. There are undervalued securities in the market and investors can always earn excess returns by correctly picking them. It has been found from the run test that the series follow a significant trend and does not follow random walk. On the basis of analysis of both Sharpe and Treynor ratio, it has been found that Mphasis Ltd. was the best option among these 8 IT sector companies to invest in. As per the Treynor ratio, Mphasis Ltd. was offering the highest returns and Infosys Ltd. was offering the lowest returns. As per the Sharpe ratio, it was more beneficial to invest in Mphasis Ltd. rather than going for Infosys Ltd. as their returns would be less than the higher ranked securities.

The investors were recommended that they could earn superior returns in an inefficient market by efficiently picking up the stocks in the IT sector market. They should follow an active investment strategy which could beat the market and should not stick to a particular evaluation method as there is no ideal one. In case of short term investment, the investor should pick the stock having volatility in contrast to the market volatility by using Treynor Ratio. Investor interested in long term investment should compare the stock present performance with the past one by using Sharpe Ratio. Investors should track the past trends followed by the securities in terms of their risk-return profile in order to get higher profits at low risk level by investing in a company having beneficial investment opportunity.

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