

## **Evaluation of Weak form of Market Efficiency Theory for Selected five Companies From Nifty**

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**Abstract:** *Since the introduction of "Efficient Market Hypothesis" (EMH) or Market efficiency theory by Professor Eugene Fama there has been a lot of research supporting and contracting the theory. There are three variants to the theory "weak", "semi-strong", and "strong" form. The weak form of the EMH claims that prices of traded assets (e.g., stocks, bonds or commodity) already reflect all the past price and volume information about the asset. The semi-strong form of the EMH claims that prices reflect all publicly available information including past price and volume data and that prices instantly change to reflect new public information. The strong form of the EMH additionally claims that prices instantly reflect even hidden "insider" information. The research paper tries to review "weak" form of market efficiency for selected five companies. Five different companies from five different sectors are being considered viz. Infosys Limited, Hindustan Unilever Limited, Larsen & Toubro Limited, Mahindra and Mahindra Limited and Sun Pharmaceutical Industries Limited. These companies represent various sectors in the economy viz. Information Technology (IT), Fast Moving Consumer Goods (FMCG), Capital goods (CG), Automobiles (Auto) and Pharmaceuticals (Pharma). To test the "weak" form of market efficiency monthly data from 1st April 2004 to 31st March 2016 would be considered. Statistical tests such as "Runs Test" and "Autocorrelations" would be used to infer from the data.*

**Keywords:** *Efficient Market Hypothesis(EMH), weak form of EMH, Runs Test, Autocorrelations*

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### **I. Introduction**

Capital Market is a place where equity and debt instruments are traded. There are buyers and sellers of these securities. The efficiency in the capital market should lead to fair pricing of these securities. This implies all the fund raising by the companies should happen at a rational price. The logic behind concept of efficiency is that there is competition amongst market participant so any information gets incorporated quickly into stock prices. If at all if there is any unfair pricing as per market efficiency concept it should adjust itself instantaneously. Technical Analysis and Fundamental analysis are the two dominant techniques which are used by investment analyst to identify the investment opportunity. Technical Analysis are predominantly based on past price and volume data whereas Fundamental analysis is based mainly on financial statement analysis. Weak form of market efficiency contradicts the importance of technical analysis by saying that prices of traded assets already reflect all the past price and volume data which are the backbones of technical analysis. Nevertheless, as per weak form of market efficiency other publically available information mainly financial statements or events such as stock split, bonus issues, or acquisition announcement could lead to returns which are significantly different from expected risk adjusted returns. Expected risk adjusted returns could be calculated based on Capital Asset Pricing Model or Arbitrage Pricing theory. However, Semi strong form of market efficiency says all these publically available information is already reflected in the stock price and any new announcement is said to be adjusted by the shares instantly. Semi strong form of efficiency further says only private or insider information could give investors returns better than risk adjusted returns. Strong form of efficiency says even private information cannot give returns better than risk adjusted returns.

So in a nutshell, Weak form of efficiency says technical analysis are not effective for predicting future price movements however fundamental analysis and inside information could be used for predicting future price patterns. Semi strong form of efficiency says both technical analysis and fundamental analysis are not effective for predicting future price movements however inside information could be used for predicting future price patterns. Strong form of efficiency says technical analysis, fundamental analysis and inside information are not effective for predicting future price movements and future price movement is completely random.

### **II. Review of Literature**

The relevant review of literature on the topic was done.

#### **Research work done abroad**

Internationally, Eugene Fama (1970) carried out a study on market efficiency and asset price predictability. He classified market in three forms of market efficiency 1) Weak Form 2) Semi strong form 3)

Strong Form. Weak form makes technical analysis i.e. past patterns of price & volume irrelevant but said fundamental analyses of financials were relevant. Semi strong form said both technical & fundamental analyses were useless but insider information was helpful. Strong form said all three were irrelevant and price movement was purely random in nature. Fama called it a random walk theory. Since then there has been lot of research supporting it & contradicting it. Cootner (1964), Lo and MacKinlay (1999) and Lo, Mamaysky and Wang (2000) did the work in the same area. Their work suggested that in the short run there are too many price moves in the same direction making technical analysis useful with some predicting power. Malkiel (2003) suggested one should be careful in drawing conclusions regarding efficiency or otherwise of the stock market from such evidence on predictability of stock returns. It was argued that pricing irregularities and even predictable pattern that appear over time were, in effect, temporary in nature, and hence these might not be able to counter the hypothesis that the stock market was efficient. Lim et al (2009) carried out the test for market efficiency based on trading volume, market return volatility, trade openness and financial openness. They studied these variables for 23 countries for the period from 1992-2006. They concluded that higher was the trading volume lower was the autocorrelation. (i.e. more efficiency). They also found higher level of market return volatility was associated with greater return autocorrelations and hence a lower degree of informational efficiency. The level of trade openness was associated with high degree of trade efficiency. They did not find any significant association between the extent of financial openness and the degree of informational efficiency.

Khan (2013) examined market efficiency in four emerging stock markets from the South Asian region which were Bangladesh, India, Pakistan and Sri Lanka over the 1993 to 2010-time period. The results indicated that there was a relationship between the equity price changes of the four markets being studied. Their returns were co-integrated (reverted to mean values) over a medium term. These markets cooperated with each other through various membership bodies. Benjamin Graham (1949) in the book "Intelligent Investor" suggested value investing for common people rather than getting caught in market extremity. The book was also admired by legendary investor Warren Buffet. The book was fundamentally about the difference between investment and speculation, between quoted stock prices and the underlying or real value of the companies behind them. According to Graham investing was about long term & investor has to tolerate the noise of extreme price movement that would occur in the interim. Schwager (1988) for his book "The Market Wizards" interviews some great traders who have ridiculed the concept of fundamentals. Famous quote from Edward Seykota in that book was "Fundamentals that people read about were typically useless as the market has already discounted the price, and according to him they were "funny-mentals". However, if one could catch on early, before others believe, he/she might have valuable "surprise-a-mentals" which was partly consistent with what Benjamin Graham stated. Seykota believed in system trading which were based on certain principles of technical analysis. The supporter of fundamental analysis like Warren Buffet said technical analysis didn't work when He turned the charts upside down and didn't get a different answer making them redundant.

### **Research work done in India**

In India, Poshakwale (1996) carried out first study on efficiency/predictability in the Indian stock market. Based on runs test and tests for serial correlation, he found evidence of violation of weak-form efficiency in Bombay Stock Exchange over the period 1987- 1994. Consequent study by Gupta and Gupta (1997) gave similar results for the period July 1988 to January 1996. Essentially that implied both fundamental & technical analysis were relevant in those days. Part of that was before NSE came into picture back in 1992 and replacing floor based trading with nationwide screen based electronic trading. This meant more transparent system & hence more efficient system. However major studies carried out by various researchers till 2002 showed lack of efficiency in markets. There were seasonal effects such as the "day-of-the week" and "the month of the year" effect in the returns on Indian stock indices. Debabrata Mukhopadhyay (2007) inferred macroeconomic & financial variables such as consumer price index, nominal exchange rate, NASDAQ composite return, foreign direct investment, long-term interest rate and fiscal deficit of the central government had predictability power for CNX Nifty returns. Mukhopadhyay also explored the concept of "rational bubble" which was a situation where asset prices increased far higher than could be explained by fundamental parameters of the assets. Here the investors anticipated that other investors would drive prices even higher in future. Now, it was perfectly rational for investors to be willing to pay prices that were increasingly divergent from fundamental values as they were to be compensated for this by ever-increasing returns. According to this concept, even though investors recognize that the asset was overvalued, they believe that they would be able to sell it at an even higher price at a later date. Thus, the formation and rapid collapse of speculative bubbles did not require investor irrationality. Something similar to greater fool theory in which investment was made not because investor believed that it was worth the price, but rather because investor believed that he/she would be able to sell it to someone else at an even higher price.

Dr. Nishi Sharma (2013) tested the weak form of EMH to 13 sector specific indices at Bombay stock exchange of India (BSE) from 2006-2012 and concluded sector indices for Automobile, Fast Moving Consumer Goods, Information Technology, Health Care, Oil Gas & tech sector are efficient but above normal returns could be made in Bankex, Consumer Durables, Capital Goods, Metals, Power, Public Sector Undertakings and realty sector. Her analysis was based on Autocorrelation, Jarque-Bera (JB) test. Dr. Phatak & Dr. Tiwari studied market efficiency of 30 random stocks out of 50 stocks from S&P CNX Nifty index from 1st May, 2007 to 30th April, 2008. Using run test method they concluded that the market prices follow a random pattern and hence the markets are weak form efficient. Only Dabur, Ranbaxy, Zee Tele films and Grasim out of the 30 selected were inefficient in their price movement as per them. Das and Mishra (2013) did run test analysis on eight selected Nifty companies from 1st January 2009 to 30th November, 2012. They concluded there was weak form market efficiency in all these 8 stocks. However according to them the inadequate information flow into the stock market, the inefficient communication system, the inadequate understanding of financial information by local investors, the inadequate skills among some stockbrokers, the low level of automation and the interference of regulatory authorities in the determination of assets' prices were the factors which prevented markets from being efficient. Haritika Arora (2013) tested S&P CNX Nifty from 1 January 2000 to 31 Dec 2011 & concluded Indian Stock market did not show evidence of weak form of market efficiency. Statistical analysis were done with help of Augmented Dickey and Fuller (ADF) test, Auto-correlation test (Breusch-Godfrey Serial Correlation LM Test), Ljung-Box Q test, Auto-regression, ARIMA model, portmanteau BDS test and GARCH(1,1) model. Dr. A. Patrick & Mrs.R.Sushama (2011) conducted weak form of efficiency study between NSE & New York Stock Exchange (NYSE) based on Auto correlation & run test from June 2000 to June 2004 and concluded that there were undervalued securities in the NYSE and the investors could make excess returns by correctly picking them.

Rahul Subash (2012) explored Behavioural Finance angel for Indian Markets. He concluded volatility has dominated the world of financial stock markets since 2008. An extreme movement in global indices and stock prices because of fear and anticipation has made life tough for a rational investor. He observed Market sentiments swayed wildly from positive to negative and back, in the shortest timeframes like weeks, days and hours. In this context, understanding irrational investor behaviour deserves more importance that it has ever had & that can be done by a science of behavioural finance. The science did not try to label traditional financial theories as obsolete, but seeks to supplement the theories by relaxing on its assumptions on rationality and taking into consideration the premise that human behaviour could be understood better if the effects of cognitive and psychological biases could be studied in context where decisions were made. Bapusaheb (2012) carried out a study to test weak form of market efficiency base on daily & weekly data for BSE 200 from the period of 1st April 2000 to 31st March 2010. Study was based on Normality Tests, Unit Root Tests, Serial correlation Tests, Randomness Tests, Trading Rules Tests, Momentum Strategy Tests, Model Comparison Tests. He found that stocks' and indices' returns were predictable to some extent may offer exploitable opportunities to investors. Parikh (2013) explored EMF based on data from January 1, 2004 to December 31, 2011. He took Nifty 50 index, The Nifty Midcap 50 Index and The CNX Small cap Index. Statistical test such as Filter Test, One sample t-test, ANOVA Test were used. According to his study large companies showed weak form of market efficiency. However small and mid-cap stocks did not display weak form of market efficiency. Size of the firm played a vital part in efficiency. M.Bharath (2013) carried out event studies based on events such as Bonus Issue, Rights Issue, and Stock Split. Study showed that capital markets displayed semi strong form of market efficiency. The Average Abnormal Return (AAR) and the Cumulative Average Abnormal Return (CAAR) was used for analysis. Statistical tools such as t-test and p-value were used to infer the results.

#### **Research Gap**

- The research reviewed did not take into consideration the same five companies.
- Time frame considered from 1st April 2004 to 31st March 2016 is different.

### **III. Aims & Objectives**

#### **Need for study**

India being a developing economy it has given very good investment opportunities in the past. However, the benefit of the same has not been taken by Indian investors. As per [www.valuereasononline.com](http://www.valuereasononline.com) as on 31st March 2015, the highest ownership of the marketable portion of the equity, which is also known as free float, was by the foreign institutional investors (FIIs). FIIs dominate the Indian market by holding 40 per cent of the free float, thus impacting the market movement with their flows of funds. Retail investors or small investors own one-third of the free float, which was far less than retail holding in developed economies and many developing economies as well. This paper will be an honest attempt towards developing simple principles which could be followed by common man to enter and exist good quality stocks. Current study considers sample of five large companies listed on NSE which are relatively safer for investors to start investing.

### **Objective**

To find whether all the past information reflected in current share price.

### **Hypothesis Testing**

For Monthly Data of selected five companies

Null Hypothesis (Ho): Monthly stock returns are random.

Alternate Hypothesis (Ha): Monthly stock returns are not random

“Runs Test” was used to test the above hypothesis. Based on difference between “Expected number of runs” and “Actual Number of runs” Z-value was calculated. Positive Z indicates that there are too many runs in the sample, negative value of Z indicates that there were less runs than one would expect if the changes were random. The p-value (2-tailed) was used to infer the randomness. If this value was sufficiently small, less than .05, null hypothesis of no randomness was rejected and it was concluded that the series does not alternate enough (too few runs) or alternates too much (too many runs). Autocorrelation Tests would also be used to test the data

## **IV. Research Methodology**

### **Population**

All the stocks which have given more than market returns over the period from 2004 to 16.

### **Sample Size Considered**

5 stocks. Non-probability convenience Sampling was used to choose the sample. Data was taken from 1st April 2004 to 31st March 2016.

There were 143 observations each for each of five companies for the monthly data.

Stock Returns can be negative but stock Prices cannot be negative hence log normal distribution is used to calculate monthly returns of various stocks.

### **Method of calculation for calculating returns**

In a log-normal distribution S (Daily Closing Prices), the parameters denoted  $\mu$  and  $\sigma$  are, respectively, the mean and standard deviation of the variable's natural logarithm (by definition, the variable's logarithm is normally distributed), which means

$$S = e^{\mu + \sigma Z}$$

Stock returns would be  $r = \ln(S_t) - \ln(S_0)$

Where,

$S_t$  = Stock Price close at t days.

$S_0$  = Stock Price close at the beginning of the period

Ln stands for natural logarithm function.

For Monthly returns,

$S_M$  = Stock Price close as on the end of  $M^{\text{th}}$  month.

$S_{M-1}$  = Stock Price close as on the end of  $(M-1)^{\text{th}}$  month.

### **Statistical Tools Applied/Used**

Runs test would be used to see if stock prices follow a particular trend in terms of successive upward or downward price movement. Runs test is a non-parametric test. It depends only on the sign of the price changes but not on the magnitude of the price. It does not require the specification of the probability distribution. It depends only on the sign of the price. They are essentially concerned with the direction of changes in the time series. The main drawback of using Runs Test that it could not detect the amount of change from mean because it only looks at the number of positive or negative changes. By comparing the total number of runs in the data with the expected number of runs under random walk hypothesis, the test of the random walk hypothesis may be constructed. Positive Z indicates that there are too many runs in the sample, negative value of Z indicates that there are less runs than one would expect if the changes were random. The important advantages of this test are its simplicity and independence of extreme values in the sample. In order to compare the observed number of runs in the series, the expected number of runs is calculated according to the formula. The standardized Z is defined as:

$$\text{Runs Test } Z = (R - X) / \sigma$$

R= number of runs

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

$$n_1 + n_2$$

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

Where,

R is the real number of runs (i.e. A run is defined as a succession of similar events preceded and followed by a different event.)

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

$\sigma$  = standard deviation

Z = Standard normal variant

The p-value would be the normal distribution of Z values which states the likelihood of happening will also be calculated.

#### **Autocorrelation or Serial Correlation Tests**

In this test price change on monthly basis would be considered over different time lags and time periods would be considered. If the coefficient of correlation is positive and close to 1 for a specific level of significance it could be concluded that data is positively or negatively correlated.

### **V. Data Collection And Analysis**

#### **Data Collection**

Secondary data was used for this research. It was collected from Capitaline database. The data was authenticated financial websites of the exchanges viz. as Bombay Stock Exchange (BSE), National Stock Exchange (NSE). Capitaline database provides monthly data for period under consideration. Period of consideration of sample was from 1st April 2004 to 31st March 2016.

#### **Findings based on Runs Test Analysis for Monthly Data**

Run Test results based on Monthly lognormal returns for Infosys Limited.

Number of observations	143
Number above cutoff	80
Number below cutoff	63
Number of runs	82
E(R)	71
Stdev(R)	5.87
Z-value	1.79
p-value (2-tailed)	0.07

Run Test results based on Monthly lognormal returns for Hindustan Unilever Limited

Number of observations	143
Number above cutoff	67
Number below cutoff	76
Number of runs	74
E(R)	72
Stdev(R)	5.93
Z-value	0.30
p-value (2-tailed)	0.76

Run Test results based on Monthly lognormal returns for Larsen & Toubro Limited

Number of observations	143
Number above cutoff	68
Number below cutoff	75
Number of runs	60
E(R)	72
Stdev(R)	5.94
Z-value	-2.07
p-value (2-tailed)	0.04

Run Test results based on Monthly lognormal returns for Mahindra and Mahindra Limited

Number of observations	143
Number above cutoff	75
Number below cutoff	68
Number of runs	59
E(R)	72
Stdev(R)	5.94
Z-value	-2.24
p-value (2-tailed)	0.02

Run Test results based on Monthly lognormal returns for Sun Pharmaceutical Industries Limited.

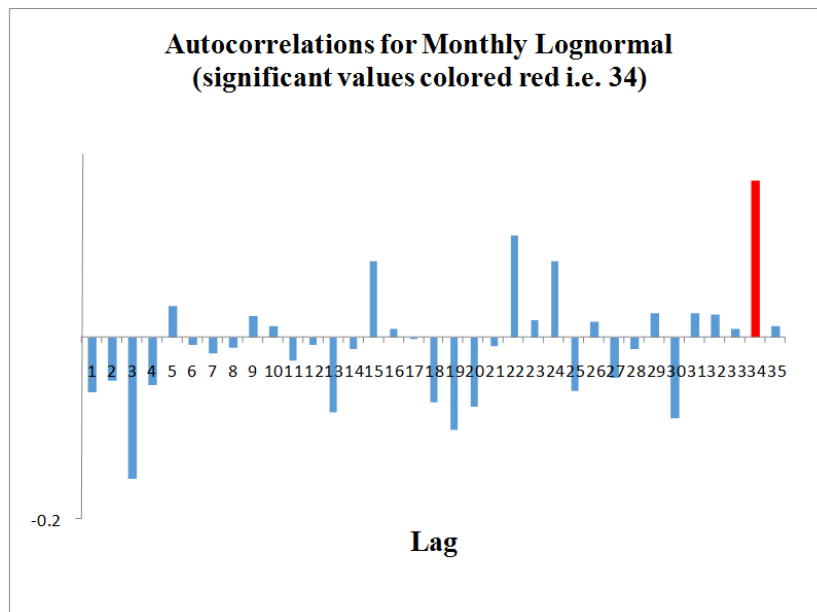
Number of observations	143
Number above cutoff	78
Number below cutoff	65
Number of runs	82
E(R)	72
Stdev(R)	5.91
Z-value	1.71
p-value (2-tailed)	0.09

**Findings based on Autocorrelation**

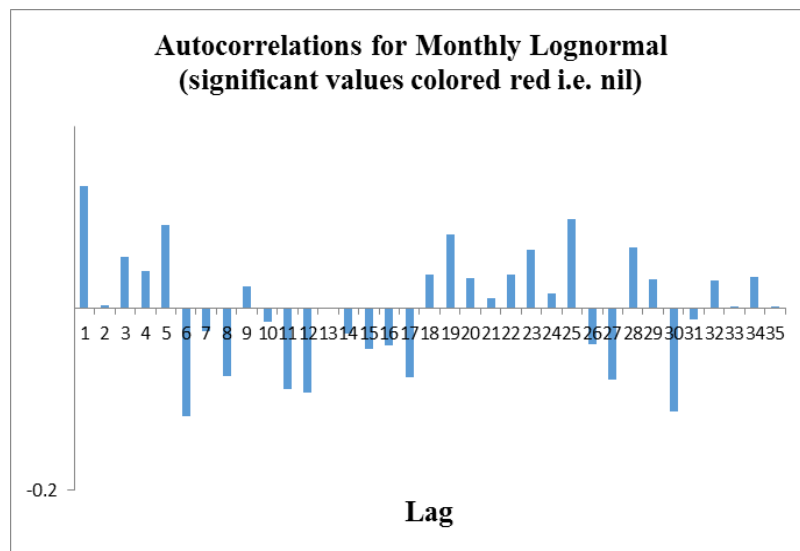
Analysis for Monthly Data

Autocorrelation Graph based on Monthly lognormal returns for Infosys Limited with 1 to 35-Month lag

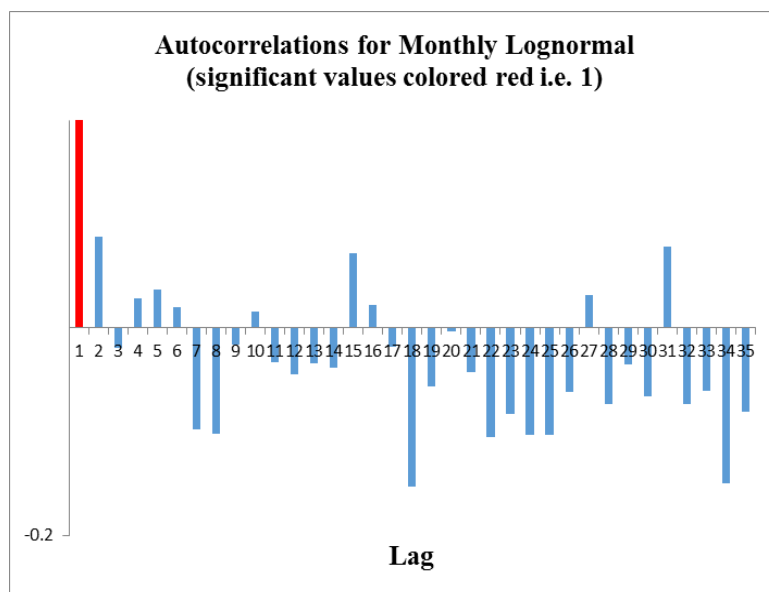
E Autocorrelation Graph based on Monthly lognormal returns for Hindustan Unilever Limited with 1 to 35-Month lag



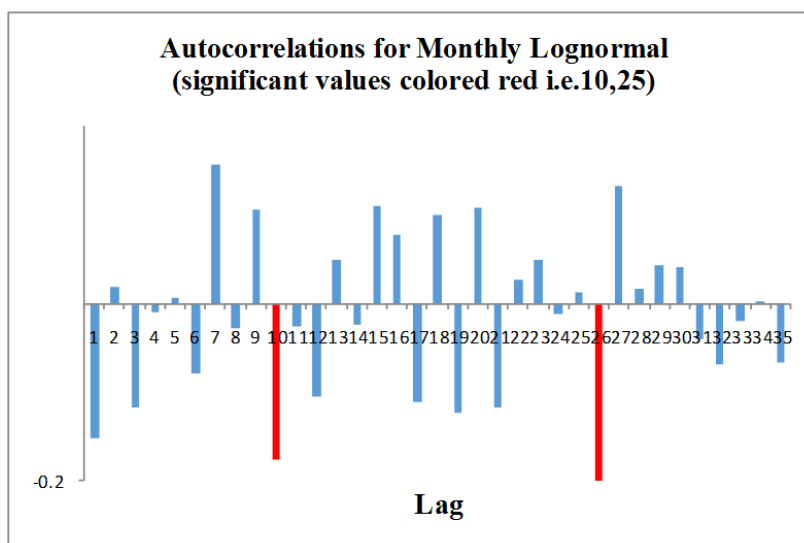
Autocorrelation Graph based on Monthly lognormal returns for Larsen & Toubro Limited with 1 to 35-Month lag



Autocorrelation Graph based on Monthly lognormal returns for Mahindra and Mahindra Limited with 1 to 35-Month lag



Autocorrelation Graph based on Monthly lognormal returns for Sun Pharmaceutical Industries Limited with 1 to 35-Month lag



Interpretation based Runs Test for Monthly Data

- p- value is less than 0.05 in case Mahindra and Mahindra Limited and Larsen & Toubro Limited indicating monthly stock returns are not random. (Null Hypothesis is rejected.)
- The above fact is substantiated since actual number of runs are significantly different from expected number of runs.
- p- value is greater than 0.05 in case Hindustan Unilever Limited, Infosys Limited and Sun Pharmaceutical Industries Limited indicating monthly stock returns are random. (Null Hypothesis is rejected.)
- The above fact is substantiated since actual number of runs are very close to expected number of runs.
- However, p-value for Infosys Limited and Sun Pharmaceutical Industries Limited are less than 0.10 indicating at 90% confidence Null Hypothesis is rejected meaning stock returns are not completely random

#### Interpretation based Autocorrelation Test for Monthly Data

- Mahindra and Mahindra Limited positive correlation for 1-month lag.
- All five stocks show many negative correlations within 36-month lag (i.e. 3-year period) indicating stocks do give investment opportunities for a long term investor.
- All the correlation numbers vary between -0.2 to 0.2 indicating even though they might be significant they are not very strong. Since correlation can take values between -1 to +1.

### **VI. Limitations And Future Scope For Further Study**

#### Limitations of the study

- Study is based on the data of five companies over the period of 12 years
- Study is based on data of large cap companies mid cap and small cap companies might show different results.
- One company per sector is used as an indicator towards that sector which might not be perfect indicator.
- In technical analysis volume is also used to complement price patterns but this paper focuses on test which are just based on price.

#### Future scope for further study

- Study could be extended to more companies across market cap.
- Statistical techniques other than the two used in this paper could also be used.

### **VII. Conclusion & Suggestions**

#### **Conclusion**

Based on the companies under study, the following conclusions can be drawn:

- Stock returns are not efficient in extreme short term. However, they could be efficient in medium to long term period of more than a month.
- Stock price movement is not random in extreme short term particularly for companies like Larsen & Toubro Limited and Mahindra and Mahindra Limited. These companies reflect more volatile sectors such as Capital goods and Automobiles as against sectors such as FMCG, IT and Pharma.
- Stock price movements have a tendency to give fair reflation of the nature of the business.
- Sun Pharmaceutical Industries Limited representing pharma sector is the most random in the price movement.
- Irrespective of the sector, stocks do correct (indicated by negative correlation in returns over various time frames) and give long term investors investment opportunities.
- Even though stock prices may move in same direction the magnitude might not be same as the previous movement indicated by weak correlation numbers.

#### **Suggestion**

- Short term traders could focus more on stocks from sectors such Capital goods and Automobiles.
- Extreme short term traders should focus on momentum in the particular direction. They should avoid countertrend trades in short term.
- Even in short term (less than one month) stock prices show some tendency of mean reversion so short term traders and particularly long term investors could wait for correct price point before executing the trade.

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