A STUDY ON WEAK FORM EFFICIENCY OF INDIAN STOCK MARKET

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Abstract
The Indian securities market is among the safest and the most efficient trading platform in the world. It has been a long journey for the Indian Stock market to get organized, integrated, matured and modernized. Now Indian stock market is one of the best in the world in terms of technology and development and it is getting integrated with global markets. Weak form efficiency has been understood as the future prices cannot be predicted by using past price. The year 2008-09 was the worst year, any economy and the stock market have witnessed in their history. The Indian investors have lost their confidence because unpredictable trends and volatility in the market after the crash in early 2008. So here is an attempt to find an empirical evidence of momentum and contrarian strategy in the Indian stock markets for the period after 2009. The test used to study the weak form market efficiency was Descriptive statistics, Augmented Dickey Filler and Autocorrelation. The results revealed that although the correlation coefficients are not too alarming to make a market too predictable but most of such coefficients show significant values other than zero.

Key Words: Autocorrelation, Indian Stock Market, Market Efficiency, National Stock Exchange and Stock Returns,
JEL Classification: G14.

Introduction
The Indian securities market is among the safest and the most efficient trading platform in the world. The history of the Indian Capital market can be traced back to 1861. The Indian stock market is one of the oldest stock market in Asia and it holds a predominant place not only in Asia, but also in the global level, with Bombay Stock Exchange one of the oldest exchanges across the world and National Stock Exchange which is best in terms of sophistication and advancement of technology.

It has been a long journey for the Indian Stock market to get organized, integrated, matured and modernized. Now Indian stock market is one of the best in the world in terms of technology and development and it is getting integrated with global markets. Eugene Fama (1960) had introduced three forms of efficiency; they are weak, semi-strong and strong form of market efficiency. Weak form efficiency has been understood as the future prices cannot be predicted by using past price.

Statement of the Problem
Though stock market is a volatile place to invest money, the percentage of people who invest their money with stock market has increased considerably over the last few years. Considering country's current growth rate and the economic scenario, it is very evident that the number of people who are involved in stock market operations will only increase in near future.

The year 2008-09 was the worst year, any economy and the stock market have witnessed in their history. The Indian investors have lost their confidence because unpredictable trends and volatility in the market after the crash in early 2008. The world stock markets have witnessed the turbulence due to the subprime crisis that took place in United States and European markets. Investment in securities is faced with the greatest problem of choosing from among a large number of securities. Decision always depends on the risk-return characteristics of securities. So here is an attempt to find the efficiency of the Indian stock markets for the period after 2009.

Review of Literature

P. Srinivasan (2010) tested the weak form efficiency of Indian Stock Markets. The study observed 13 year data (3244 observations) taken from two major indices of India i.e. SENSEX and CNX NIFTY. Based on two unit root tests i.e. Augmented Dickey Fuller test and Phillips Perron (1988), the null hypothesis of Indian Stock Markets being in line with the theory of random walk was rejected.

Kian Ping Lim (2009) in his thesis titled, "An empirical analysis of the weak-form efficiency of stock markets", analysed the market efficiency of stock markets in 23 developing countries over the sample period of 1992-2006, he found that a greater level of *de facto* trade openness is associated with a higher degree of informational efficiency in these emerging stock markets, even after controlling for trading volume and market return volatility. Further analyses found no significant association between the extent of financial openness and the degree of informational efficiency.

Objectives

The following are the objectives of the study
1. To analyse the returns in Indian Stock market.
2. To examine the efficiency of Indian Stock market in weak form.

Hypothesis for the Study

The below hypothesis is framed and tested for the study:

H_0: The Indian stock market is efficient in weak form.

Research Methodology

Sampling Design

The study was confined only to NSE S&P CNX NIFTY, because this index is a vital indicator of Indian stock market. The study comprises of daily closing prices of NSE S&P CNX Nifty Index and its 50 stocks. The researcher had taken 49 out of 50 stocks and left out one stock i.e., COALINDIA as it got listed only from November 2011. The study is purely based on secondary data and was performed using Five and a half years data and from Jan 2009 to June 2014.

Tools used for Analysis

The following were the tools which were useful in finding solutions to the problem:

- **Daily Return**

The return series for the indices selected for this study is first measured by the first difference of logarithm of respective indices. The return of any stock price at time is calculated as:

R = Ln (Pt / Pt- 1)

Where R = Daily return; Ln = Natural Log; Pt= Price at time t; Pt- 1= Price at time t-1**.**

The daily natural log returns were calculated using Microsoft Excel

- **Unit Root Test**

Augmented Dickey Fuller Test and Phillips-Perron Test are the two widely used Unit Root Tests. These two tests are primarily used to check whether a given series is stationary or non -stationary. It was Hassan *et al* who explained the use of Unit Root Tests in testing the weak form efficiency of capital markets.

The ADF test is based on estimating the test regression:-

$$ADF_l = t_{\phi-1} = \frac{\hat{\phi} - 1}{SE(\phi)}$$

$$ADF_n = \frac{T(\hat{\phi} - 1)}{1 - \hat{\psi}_1 - \cdots - \hat{\psi}_p}$$

- **Autocorrelation**

This kind of parametric test is used to identify the correlation among the observations of a single time series data. It is defined as the correlation between members of a series of observations ordered in time. It is sometimes called serial correlation or lagged correlation, which refers to the correlation between members of a series of numbers arranged in time.

$$r = \frac{\sum (x_i - \bar{x})(y_i - \bar{y})}{\left[\sum (x_i - \bar{x})^2\right]^{1/2}\left[\sum (y_i - \bar{y})^2\right]^{1/2}}$$

Summary of Statistics for Analyzing NSE S&P CNX NIFTY Stocks for the Period from Jan 2009 to June 2014

Descriptive statistics is used to explain the basic characteristics of the data in the study with the help of Mean, Standard Deviation, skewness and Kurtosis. The descriptive statistics of the returns for 49 companies taken for the study are given in table 4.1. The summary statistics includes Mean returns, Standard deviation, Skewness, Kurtosis and Number of observations for each stock.

Table – 1,   Descriptive Statistics for NSE S&P CNX Nifty stocks (Jan 2009 - June 2014)

Company	Mean	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis	Observations
ACC	0.000819	0.126885	-0.091776	0.018648	0.329974	6.135171	1366
AMBUJACEM	0.00084	0.138617	-0.111656	0.02172	0.376884	5.626924	1366
ASIANPAINT	-0.0003	0.092202	-2.304678	0.06462	-33.23205	1185.631	1366
AXISBANK	0.000978	0.165607	-0.098979	0.02556	0.26321	5.737409	1366
BAJAJ-AUTO	0.001302	0.115068	-0.705298	0.027087	-12.89998	340.9194	1366
BANKBARODA	0.000835	0.151031	-0.089269	0.023206	0.327823	6.085715	1366
BHARTIARTL	-0.000551	0.226526	-0.671518	0.029222	-8.566189	207.9157	1366
BHEL	-0.00124	0.166012	-1.63423	0.050295	-25.08776	815.3422	1366
BPCL	0.000342	0.140819	-0.708996	0.029198	-10.25806	257.3214	1366
CAIRN	0.000551	0.116896	-0.098515	0.020047	0.21777	5.856767	1366
CIPLA	0.000625	0.087047	-0.103862	0.016495	0.040373	6.173744	1366
DLF	-0.000199	0.223415	-0.174738	0.032665	0.078666	6.637762	1366
DRREDDY	0.001261	0.101481	-0.06695	0.016787	0.178076	5.241453	1366
GAIL	0.000592	0.123898	-0.078327	0.018341	0.331121	5.373176	1366
GRASIM	0.000757	0.154394	-0.232023	0.019068	-0.632122	23.32931	1366
HCLTECH	0.001878	0.172195	-0.169006	0.023829	0.225394	9.060757	1366

HDFC	-0.000296	0.20272	-1.577693	0.047541	-26.69314	888.9627	1366
HDFCBANK	-0.000143	0.151005	-1.605457	0.046784	-29.57276	1016.517	1366
HEROMOTOCO	0.000869	0.196555	-0.104218	0.019976	0.965531	13.91262	1366
HINDALCO	0.00085	0.13388	-0.111443	0.028161	0.247789	4.22177	1366
HINDUNILVR	0.000664	0.160264	-0.079862	0.016593	1.002496	11.38349	1366
ICICIBANK	0.000843	0.207324	-0.130421	0.025109	0.422457	7.851721	1366
IDFC	0.000516	0.192894	-0.175058	0.028365	0.224583	6.625772	1366
INDUSINDBK	0.001993	0.15963	-0.134843	0.026723	0.28202	5.853616	1366
INFY	0.000784	0.15619	-0.239918	0.018678	-1.489236	30.66698	1366
ITC	0.000467	0.105495	-0.706017	0.025245	-15.9947	450.8665	1366
JINDALSTEL	-0.00076	0.192622	-1.768698	0.054521	-24.9485	811.0092	1366
KOTAKBANK	0.000662	0.175116	-0.642629	0.029518	-7.37813	168.4294	1366
LT	0.000577	0.219416	-0.381993	0.024744	-2.184746	48.98774	1366
LUPIN	0.000387	0.100336	-1.610804	0.0471	-29.32236	1004	1366
M&M	0.001047	0.213967	-0.669107	0.028988	-8.643281	212.9895	1366
MARUTI	0.001131	0.100847	-0.130989	0.020153	0.088956	6.004998	1366
MCDOWELL-N	0.000729	0.298074	-0.259212	0.031736	0.235053	14.2773	1366
NMDC	0.000000	0.182521	-0.142351	0.025956	1.192493	11.62941	1366
NTPC	-0.000106	0.101096	-0.124886	0.017133	-0.098229	9.015289	1366
ONGC	-0.00033	0.152595	-1.44344	0.043914	-25.91812	855.3025	1366
PNB	0.000464	0.13489	-0.104133	0.022815	0.076853	5.719877	1366
POWERGRID	0.000377	0.147976	-0.118573	0.01662	0.282949	12.19002	1366
RELIANCE	-0.000142	0.193667	-0.724245	0.028097	-12.32959	326.3114	1366
SBIN	0.000538	0.182544	-0.095057	0.022328	0.442552	7.488903	1366
SSLT	0.001308	0.554904	-0.132819	0.032438	3.985074	66.03689	1366
SUNPHARMA	-0.000319	0.199518	-1.610913	0.050883	-24.91556	758.8484	1366
TATAMOTORS	0.000727	0.172487	-1.653744	0.05289	-22.36884	702.4996	1366
TATAPOWER	-0.001419	0.139532	-2.324732	0.066319	-31.49884	1104.294	1366
TATASTEEL	0.000651	0.157035	-0.128169	0.027225	0.139451	5.302245	1366
TCS	0.001189	0.144063	-0.692762	0.027167	-11.95189	314.6176	1366
TECHM	0.001583	0.228028	-0.155171	0.025146	0.940617	12.48939	1366
ULTRACEMCO	0.001395	0.136643	-0.069434	0.018975	0.486496	6.815001	1366
WIPRO	0.000623	0.107351	-0.50177	0.02392	-6.826707	145.9765	1366

Source: Computed from data source.

The above table represents the summary statistics of NSE S&P CNX Nifty stocks for the period from January 2009 to June 2014. The descriptive statistics is calculated based on the daily returns of 49 stocks. The mean value for most of the companies are positive, except for ASIANPAINT, BHARTIARTL, BHEL, DLF, HDFC, HDFCBANK, JINDALSTEL, NTPC, ONGC, RELIANCE, SUNPHARMA, TATAPOWER. The mean value is high for INDUSINDBK and low for BHARTIARTL. SSLT had given the highest return, whereas TATAPOWER had given the lowest return among the selected stocks. The standard deviation result shows that JINDALSTEL, SUNPHARMA, TATAMOTORS, TATAPOWER are highly deviated and ACC, CIPLA, DRREDDEY, GAIL, HINDUNILVR, INFY, NTPC, POWERGRID and ULTRACEMCO were less deviated. ASIANPAINT, BAJAJ-

AUTO, BHARTIARTL, BHEL, BPCL, GRASIM, HDFC, HDFCBANK, INFY, ITC, JINDALSTEL, KOTAKBANK, LT, LUPIN, M&M, NTPC, ONGC, RELIANCE, SUNPHARMA, TATAMOTORS, TATAPOWER, TCS and WIPRO were negatively skewed and all the other stocks were positively skewed. The kurtosis results shows that all the companies are leptokurtic in nature, as all the values are more than 3.

Test to Measure the Stationarity
To test whether the data series is in stationary, Augmented Dickey Fuller test is used. The table 4.2 depicts the result of Augmented Dickey Filler test for all the companies taken for the study period.

Table – 2,Augmented Dickey Filler Test for NSE S&P CNX Nifty stock returns for the period from Jan 2009 to June 2014

Company	t statistics (level)	Probability
ACC	-35.86194	0.0000
AMBUJACEM	-39.51392	0.0000
ASIANPAINT	-36.7742	0.0000
AXISBANK	-34.03203	0.0000
BAJAJAUTO	-34.8781	0.0000
BANKBARODA	-35.17406	0.0000
BHARTIARTL	-37.58186	0.0000
BHEL	-35.71833	0.0000
BPCL	-37.4107	0.0000
CAIRN	-28.56971	0.0000
CIPLA	-39.73723	0.0000
DLF	-33.40681	0.0000
DRREDDY	-37.38174	0.0000
GAIL	-38.52009	0.0000
GRASIM	-35.24331	0.0000
HCLTECH	-37.81744	0.0000
HDFC	-37.58371	0.0000
HDFCBANK	-36.99097	0.0000
HEROMOTOCO	-23.92052	0.0000
HINDALCO	-36.61296	0.0000
HINDUNILVR	-36.72042	0.0000
ICICIBANK	-34.01632	0.0000
IDFC	-36.04059	0.0000
INDUSINDBK	-36.25883	0.0000
INFY	-27.86863	0.0000
ITC	-38.34808	0.0000
JINDALSTEL	-37.35775	0.0000
KOTAKBANK	-37.32176	0.0000
LT	-33.98265	0.0000
LUPIN	-36.20891	0.0000

MM	-36.56371	0.0000
MARUTI	-35.42533	0.0000
MCDOWELLN	-36.30325	0.0000
NMDC	-33.79288	0.0000
NTPC	-38.07513	0.0000
ONGC	-36.37214	0.0000
PNB	-34.09958	0.0000
POWERGRID	-39.56925	0.0000
RELIANCE	-36.15733	0.0000
SBIN	-32.46138	0.0000
SSLT	-36.54268	0.0000
SUNPHARMA	-36.92223	0.0000
TATAMOTORS	-35.07815	0.0000
TATAPOWER	-37.77359	0.0000
TATASTEEL	-35.43812	0.0000
TCS	-37.43707	0.0000
TECHM	-34.91676	0.0000
ULTRACEMCO	-35.50535	0.0000
WIPRO	-38.93492	0.0000

Source: Computed from data source.

Table 2 shows the ADF results of NSE S&P CNX Nifty stock returns, during the period - Jan 2009 to June 2014. As the probability value for all the companies is less than 0.05 level of significance, the unit root does not exist. The stationary of the variable is proved at the level with the t statistics value. This indicates that there is stationary in the series and the data series best fits the normal distribution.

Test to Measure the Degree of Interdependency in Returns
Parametric tests are more rigorous than the non-parametric test. Auto correlation test, a parametric tool was used to measure the degree of interdependency in returns to test the weak form market efficiency. For the study period, all the NSE S&P CNX Nifty company's daily stock returns were taken for measurement. Auto correlation is the cross correlation of signal with itself. Autocorrelation Function is a measure of the linear relationships between time steps/lags within the same variable. The plots had been used to determine whether the series is random in nature.

The Autocorrelation function for the difference in daily returns of all the stocks during the study period had been calculated. The p-value is less than 5% level of significance and hence the null hypothesis is rejected. The result shows that the stock returns depart from random walk and the Indian stock market is inefficient in weak form. It is inferred that the current returns depend on previous returns, hence will give direction for its future performance. In lag 1 and 2, the correlation in return is higher and fluctuates thereof.

The results revealed that although the correlation coefficients are not too alarming to make a market too predictable but most of such coefficients show significant values other than zero.

Conclusion
The inefficiency of Indian stock market in the weak form also implies financial and institutional imperfections. It also pinpoints towards the fact that country's liberalization, deregulation and privatization policies have generated

some level of instability in the market. Weak-form market inefficiency in India is most likely to be caused by inappropriate policy choices. Regulators have to take in a long term vision while formulating and implementing policies and programmes for Indian capital market. The presence of Autocorrelation in the market return series suggests that there is a relationship between the past return and present return and the Indian stock market movements are predictable in nature. The auto-correlation coefficient clearly depicts that the future returns can be predicted by analyzing the past prices which clearly means that the Indian capital markets are not random and don't follow the theory of random walk. Investors are recommended to make systematic study before going for investments in stock market. They should never let greed control their investment decisions.

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