

Testing Market Efficiency of Indian Stock Market

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Abstract- As long as financial markets are concerned, people tried to forecast the future movement of it. The purpose of forecast is to expect great fortunes. In reality it is an important question that "is it possible to forecast market with the historical data?" If it is possible than excess returns can be made by picking up lottery stock. This situation is called "Inefficient Market". On the other hand if market is efficient, it is waste of time to predict stock market. The main intention of this paper is to study the efficiency level in Indian Stock market and the random walk nature of the stock market by using RUN test for the period from 1st January 2001 to 31st December 2010. In this paper, 6 major indices [BSE 30, BSE 100,200,500, BSE SMALL CAP and BSE MIDCAP] are studied.

Keywords- Market efficiency, Random walk, Run test, ACF.

I. INTRODUCTION

“My interest is in the future because I am going to spend the rest of my life there” - Charles F. Kettering (American engineer, inventor of the electric starter, 1876-1958). This quote explains the investors' attitude when they try to estimate future. The same efforts put by academicians to explore whether there is certain dependence in successive price changes that could profitably be exploited by various kinds of trading techniques.

The Random Walk Hypothesis is concerned with the question of whether one can predict future prices from past prices. It assumed that successive price change is independent from the historical closings. There is no meaning to study past trend or patterns of prices to predict future movement. In its simple form, it states that price changes cannot be predicted from earlier changes in any meaningful manner (Weak form of hypothesis)¹. The main purpose of this paper is to test the weak-form of efficiency of the Indian stock market by using daily data from the 1st January 2001 to 31st December 2010. There are 2 major stock exchanges in India, Bombay Stock Exchange (BSE) and National Stock Exchange (NSE). There are various indices are available but for the study purpose only 6 indices of BSE is considered.

Literature Review:

In support of pattern finding, Lo, Mamaysky and Wang (2000) conclude that human judgment is superior to most computational algorithms. But recent advanced statistical model had successful applications in fingerprint identification, handwriting analysis, and face recognition which can be useful to identify pattern or trend in technical analysis².

In paper titled "Quasi-Maximum Likelihood Estimation and Inference in Dynamic Models with Time Varying Covariance"

Brock, Lakonishok and LeBaron (1992) tested 26 simple technical trading rules on daily data of the Dow-Jones Industrial Average for the period 1897-1986. They conclude that buy signals generates higher returns during buy days compare to sell signals during sell signals³.

The first researcher who linked the random walk process to economic processes was French mathematician Louis Bachelier in his Ph.D. dissertation titled "The Theory of Speculation" who noticed that changes of prices of French government papers are unpredictable what forced him to conclude that "The mathematical expectation of the speculator is zero"⁴.

In against of Random walk theory, Alexander (1961) applies several filters to the DJIA in the period 1897 – 1929 and the S&P Industrials in the period 1929 – 1959. He developed a filter strategy. According to it buy the stock when price increases by x percent from a recent low and sell when price declines by x percent from a recent high. He concludes in support of technical analysis. He concludes that in speculative markets if price of a stock initiate one trend then it is going to persist for long time⁵.

In the paper titled "A Comparative Analysis of Stock Price Behaviour on the Bombay, London and New York Stock Exchanges" Sharma and Kennedy (1977) compared the behavior of stock indices of the Bombay, London and New York Stock Exchanges for the period of 1963-73. He used run test and spectral analysis. He concludes that all 3 stock exchanges follow the random walk movement⁶.

MadhuriMalhotra, M. Thenmozhi, G Arun Kumar (2007), in their paper titled "Stock Market Reaction and Liquidity Changes around Bonus Issue Announcement: Evidence from India" by (2007), examines share price reaction to the announcement of bonus issue for a sample of Indian companies. Standard event study methodology has been used for the purpose of studying the Bonus issue announcement reaction. Bonus issue announcement yields negative abnormal returns around the announcement date. There is a negative reaction after the bonus issue announcement conveying that the market under reacts after the announcement. It is also observed that there is no information leakage prior to the announcement¹⁹.

II. OBJECTIVES OF THE STUDY

The purpose of this study is to test the random walk theory in Bombay Stock Exchange (6 Indices). The 10 years daily closing data for 4 indices and 8 years data for Small-Cap and Midcap index is used to know whether past stock price movements follow a trend or not, so they can or cannot be used to predict their future movement. The results of the study are aimed to validate or not to validate the perceptions that stock prices in BSE do follow the random walk theory.

Hypothesis:

1. Ho: BSE 30 Follows Random pattern.
2. Ho: BSE 100 follows Random pattern.
3. Ho: BSE 200 follows Random pattern.
4. Ho: BSE 500 follows Random pattern.
5. Ho: BSE Mid-Cap follows Random pattern.
6. Ho: BSE Small-Cap follows Random pattern.

III. METHODOLOGY

For testing random walk of BSE indices, daily closing values used for the period of 1st January 2001 to 31st December 2010. The reason for selecting this period is that during this 10 years market seem too volatile. It touched the life time high in 2008 and low in 2010. The total 2498 number of observations for BSE 30, BSE 100, BSE 200 and BSE 500 each and 1938 for BSE Small-cap and Mid-cap each. The data are collected from BSE website only.

Research methodology:

After having 1 lag difference ($t_1 - t_0$), total runs are calculated with the help of Excel. The MINITAB software is used for applying run test.

To check the Randomness among the data Run test is used. Run test is a non-parametric test. "A Run test may be defined as a sequence of price changes of the same sign preceded and followed by price changes of different sign^A." 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 series¹.

In a given time series of stock prices there are three possible types of price changes, namely positive, negative and no change. This gives three types of runs. A positive (negative) run is a sequence of positive (negative) price changes preceded and succeeded by either negative (positive) or zero price change. Similarly, a zero run is sequence of zero price changes preceded and succeeded by either negative or positive price change^B. The assumption of Run test is that the successive price changes are independent and the sample proportion of positive, negative and zero price changes are unbiased estimates of the population proportions

IV. RESULT AND DISCUSSION:-

Table: 1 BSE Indices Run test output for 2001 to 2010						
Indices	Run above & Below K	Observed No. of Run	Expected No. of Run	Observation above K	Observation below K	P Value
BSE 30	0.547676	1149	1237.65	1367	1129	0.000
BSE 100	0.559696	1117	1231.21	1397	1099	0.000
BSE 200	0.570513	1107	1224.18	1424	1072	0.000
BSE 500	0.568510	1101	1225.57	1419	1077	0.000
BSE MIDCAP (2003-10)	0.601240	773	929.314	1164	772	0.000
BSE Small-Cap (2003-10)	0.598657	737	931.313	1159	777	0.000

From the **Table 1** it can be observed that, the resulting p-value of all indices (0.0000) are smaller than the alpha level of 0.05, there is sufficient evidence to conclude that the data are not in random order and market is inefficient. It means with the help of past prices and trend we can predict the market. The above test was run on total observed runs of 10 years. And it can be interpreted that market is not random.

But, if the run test applied on year wise data of BSE 30 and BSE 100, the result is different than the above.

Table 2:- BSE 30 Run test output for 2001 to 2010						
BSE 30	Run above & Below K	Observed No. of Run	Expected No. of Run	Observation above K	Observation below K	P Value
2001	0.506073	105	124.482	125	122	0.013
2002	0.517928	112	126.339	130	121	0.069*
2003	0.588933	105	123.498	149	104	0.016
2004	0.562992	125	125.984	143	111	0.900*
2005	0.573705	107	123.773	144	107	0.030
2006	0.6	113	121	150	100	0.291*
2007	0.574297	117	122.751	143	106	0.455*
2008	0.451220	114	122.829	111	135	0.255*
2009	0.555556	125	121	135	108	0.603*
2010	0.543651	131	126.040	137	115	0.528*

In **table 2**, it can be observed that in the year 2001, 2003 and 2005 the P value is smaller than 0.05. It means market is non random. But in the year 2002, 2004, 2006, 2007, 2008, 2009 and 2010 the P value is greater than alpha value. It means in all 7 years, market follows the random pattern.

Table 3:- BSE 100 Run test output for 2001 to 2010						
BSE 100	Run above & Below K	Observed No. of Run	Expected No. of Run	Observation above K	Observation below K	P Value
2001	0.477733	105	124.255	118	129	0.014
2002	0.521912	112	126.259	131	120	0.071*
2003	0.616601	99	120.621	156	97	0.004
2004	0.574803	127	125.157	146	108	0.813*
2005	0.581673	101	123.151	146	105	0.004
2006	0.612	109	119.728	153	97	0.152*
2007	0.606426	113	119.859	151	98	0.361*
2008	0.459350	110	123.187	113	133	0.090*
2009	0.588477	117	118.695	143	100	0.822*

2010	0.555556	129	125.444	140	112	0.649*
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In **table 3**, it follows the same pattern of BSE 30. In the year 2001, 2003 and 2005 the P value is smaller than 0.05. It means market is non random. But in the year 2002, 2004, 2006, 2007, 2008, 2009 and 2010 the P value is greater than alpha value. It means in all 7 years, market follow the random pattern.

V. SCOPE OF THE STUDY

The study is limited to 10 years and 6 indices only. The broader study is possible by increasing number of years and indices.

The study is also limited to BSE, It can be expand by including NSE or other Nation's indices to prove randomness of the capital market.

Here autoregression, ARIMA, GARCH tests are not applied. The detailed study is possible by knowing stationarity of the data.

VI. CONCLUSION

The results show the evidence of the inefficient form of the Indian Stock Market in long run but efficient form in short term. So, the findings support the Random-walk hypothesis in short duration but in long term doesn't. All indices of BSE do not support the weak form of market efficiency. The information regarding yesterday's and today's indices can be used to predict tomorrow's indices. The stocks in the index don't absorb the price information effectively. It means investors can identify available undervalued securities in the market make excess returns by correctly picking them.

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