Efficient Market Hypothesis: A Case Study On Bombay Stock Exchange

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INTRODUCTION

An investment theory states that it is impossible to "beat the market" because stock market efficiency causes existing share prices to always incorporate and reflect all relevant information. According to the EMH, this means that stocks always trade at their fair value on stock exchanges, and thus, it is impossible for investors to either purchase undervalued stocks or sell stocks for inflated prices. Thus, the crux of the EMH is that it should be impossible to outperform the overall market through expert stock selection or market timing, and that the only way an investor can possibly obtain higher returns is by purchasing riskier investments.

The term efficiency used in EMH refers to capital market efficiency. In an efficient capital market, prices fully and instantaneously reflect all available information. This means that when stocks are traded, prices are accurate signals for capital allocation.

Market efficiency is described in three forms- weak, semi-strong & strong. Weak form market efficiency says that stock prices have no memory. Yesterday has nothing to do with tomorrow. Weak form of market efficiency is synonymous with random walk model. Stock prices would behave like random walk as per weak form of market efficiency.

While semi-strong form of efficiency deals only with publicly known information, strong form of efficiency deals with all information. The research work was to test the Efficient Market Hypothesis: the study of Bombay stock exchange in the weak form.

Famaetal (1969):

'An "efficient" market, i.e., a market that adjusts rapidly to new information.'

Fama (1970):

'A market in which prices always "fully reflect" available information is called "efficient."'

Jensen (1978):

'A market is efficient with respect to information set $[theta]_t$ if it is impossible to make economic profits by trading on the basis of information set $[theta]_t$.'

Fama (1991):

'I take the market efficiency hypothesis to be the simple statement that security prices fully reflect all available information. A precondition for this strong version of the hypothesis is that information and trading costs, the costs of getting prices to reflect information, are always 0 (Grossman and Stiglitz (1980)). A weaker and economically more sensible version of the efficiency hypothesis says that prices reflect information to the point where the marginal benefits of acting on information (the profits to be made) do not exceed marginal costs (Jensen (1978)).'

Malkiel (1992):

'A capital market is said to be efficient if it fully and correctly reflects all relevant information in determining security prices. Formally, the market is said to be efficient with respect to some information set...if security prices would be unaffected by revealing that information to all participants. Moreover, efficiency with respect to an information set implies that it is impossible to make economic profits by trading on the basis of [that information set].'

Fama(1998):

'Market efficiency (the hypothesis that prices fully reflect available information)...' '...the simple market efficiency story; that is, the expected value of abnormal returns is zero, but chance generates deviations from zero

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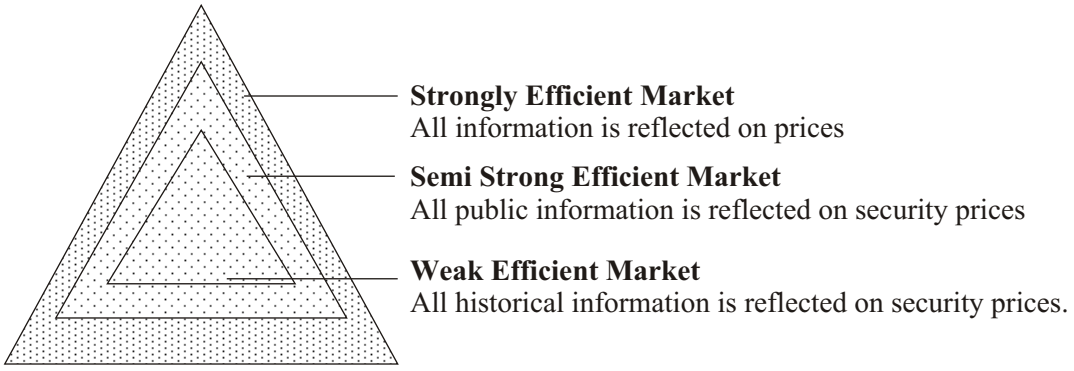
(anomalies) in both directions.'

An "efficient" market is one where there are large numbers of rational, profit-maximizers actively competing with each other and trying to predict future market values of individual securities.

The origins of the Efficient Markets Hypothesis (EMH) can be traced back at least as far as the pioneering theoretical contribution of Bachelier (1900) and the empirical research of Cowles (1933).The hypothesis states that the stock market is a highly efficient pricing mechanism. Efficiency in this context does not refer to the organizational and operational aspects of the market or to the efficient allocation or resources within the economy, but to the capacity of the market to convert information into shares prices. There are three forums of the hypothesis: (a) Weak efficiency: share prices move independently of previous movements. (b) Semi strong efficiency: current prices of stocks not only reflect all informational content of historical prices but also reflect all publicly available knowledge about the corporations being studied. (c) Strong efficiency: not only is publicly available information useless to the investor or analyst, but all information is useless too.



WEAK FORM

The weak form says that the current prices of stocks already fully reflect all the information that is contained in the historical sequence of prices. Therefore, there is no benefit in examining the historical sequence of prices as far as forecasting the future is concerned. This weak form of the efficient market hypothesis is popularly known as the random-walk theory. Clearly, if this weak form of the efficient market hypothesis is true, it is a direct repudiation of technical analysis. If there is no value in studying the past prices and past prices changes, there is no value in technical analysis. The technicians place considerable reliance on the charts of historical prices that they maintain, even though the efficient-market hypothesis refutes this practice.

SEMI STRONG FORM

The semi strong form of the efficient-market hypothesis says that current prices of stocks not only reflect all informational content of historical prices, but also reflect all publicly available knowledge about the corporations being studied. Furthermore, the semi-strong form says that efforts by analysts and investors to acquire and analyze public information will not yield consistently superior returns to the analyst. Examples of the type of public information that will not be of value on a consistent basis to the analyst are corporate reports, corporate announcements, and information relating to corporate dividend policy, forthcoming stock splits, and so forth.

In effect, the semi-strong form of the efficient market hypothesis maintains that as soon as information becomes publicly available, it is absorbed and reflected in stock prices. Even if this adjustment is not the correct one immediately, in a very short time it will be properly analyzed by the market. Thus, the analyst would have great difficulty trying to profit using fundamental analysis. Furthermore, even while the correct adjustment is taking place, the analyst cannot obtain consistent superior returns. Why? Because the incorrect adjustments will not take place consistently; that is, sometimes there will be adjustments and at other times, there will be under adjustments. Therefore, an analyst will not be able to develop a trading strategy based on these quick adjustments to new publicly available information.

STRONG FORM

The strong form of the efficient-market hypothesis maintains that not only is publicly available information useless to the investor or analyst, but all information is useless. Specifically, no information that is available is public or “inside” can be used to earn consistently superior investment returns. For the strong form, as has already been mentioned, says that no type of information is useful. This implies that not even security analysts and

portfolio managers who have access to information more quickly than the general investing public are able to use this information to earn superior returns.

The strict form of the efficient-market hypothesis states that two conditions are met. First, that successive price changes or return changes in return are independent; and second, that these successive price changes or return changes are identically distributed-that is, these distributions will repeat themselves over time. In a practical sense, this seems to imply that in a random-walk world, stock prices will at any time fully reflect all publicly available information, and furthermore, that when new information becomes available, stock prices will instantaneously adjust to reflect it. The random-walk theorist is not interested in price or return levels, but rather in the changes between successive levels.

OBJECTIVES OF THE STUDY

The objective of this research was to understand the Efficient Market Theory and its practical applicability.

To investigate whether prices of Stocks in Bombay Stock Exchange follow a Random Walk process (i.e. weak form efficient) as required by the market efficiency theory.

To open new vistas for further research.

REVIEW OF LITERATURE

Although the concept of the random walk can be traced back to French mathematician Louis Bachelier's doctoral thesis 'the Theory of speculation' in 1990, the EMH really starts with Nobel Laureate Paul Samuelson and his 1965 article, 'Proof that Properly Anticipated Prices Fluctuate Randomly'. But it was Chicago finance professor **Eugene Fama** with his 1970 paper 'Efficient Capital Markets' who coined the term EMH and made it operational with the foundational epithet that in efficient markets, 'Price fully reflect all available information'.

Fama argued that in an active market of large numbers of well-informed and intelligent investors, stocks will be appropriately priced and reflect all available information. In these circumstances, no information or analysis can be expected to result in out performance of an appropriate benchmark. Because of the wide availability of public information, it is nearly impossible to beat the market consistently.

Another professor, **Burton Malkiel of Priceton,** popularized the notion of the random walk implication in his bestseller **A Random Walk down Wall Street.** He suggested that throwing darts (or, more realistically, a towel) at the newspaper stock listings is a good way as any to pick stocks and is likely to beat most professional investment managers. Malkiel does suggest in the later part of his work how those who insist on trying to beat the market might attempt to do so, but he indicates that they are unlikely to be successful.

Two different local studies on the Kuala Lumpur Stock Exchange (KLSE) have been chosen, which each of the studies test on the different form of efficiency of the KLSE. The first study, "Weak Form Efficiency and Mean Reversion in the Malaysian Stock Market" conducted by **Kok Kim Lian and Goh Kim Leng,** addresses the issue of weak form market efficiency in the Malaysian case by examining the random walk behavior of stock prices over the short run in the KLSE using the closing levels of the seven KLSE stock indices: Composite Index, Emas Index and the five sectorial indices. The tests employed are run tests, serial correlation test, Ljung-Box-Pierce Q test and the von Neumann's ratio test, which are based on returns of short horizons.

Kok and Goh used the daily, weekly and monthly closing levels of the seven KLSE stock indices over a period of 9 years, 1984 to 1992. Meanwhile, the results are given for the two equal sub periods 1984- June 1988 and July 1988-1992 in order to determine whether any significant result of the sub periods attributes towards the whole period result and also to make comparisons. Study on the long run random walk behavior in the KLSE is also being given attention by Kok and Goh as the phenomenon of short run random walk behavior may not hold in the long run. This is because they may revert to some mean level over longer horizons and is, thereby, said to be mean reverting. The analysis was done by investing whether indices exhibit mean reversion.

Bhanu Pant And Bishnoi T.R. (2002) conducted a research on Testing Random Walk Hypothesis for Indian Stock Market Indices. The analyses of the behavior of daily & weekly returns of 5 Indian market indices for random walk during April 1996 - June 2001 shows that the Indian stock market indices do not follow random walk. The results were based on the tests of Indian stock market indices for normality, autocorrelation using Q-statistic & Dickey-fuller test and also the analysis of variance ratio using homoscedastic and heteroscedastic test estimates.

Ramasastri, A.S (2001), conducted a study on stock market efficiency spectral analysis. This research studies efficiency of Indian stock market since the beginning of 1996 to 1998 using a powerful technique Spectral Analysis, Correlogram based on Sensex, establishes that Indian stock market has been efficient. Spectral analysis

finds that there is a presence of periodic cycles in the movements of share prices. Yet, confirms market efficiency as power functions flatten at higher frequencies. They have initially calculated that auto correlation have been found to be statistically insignificant. Correlogram falls steeply and hovers around zero for k greater than 0 from correlogram; we can conclude that daily Sensex return series are random.

Well known Dickey Fuller unit root test and Box Pierce Q test are also widely used in literature. **Ramasastri (1999)** tested Indian stock market for random walk during post liberalization period using three Dickey Fuller hypotheses. Contrary to other studies he could not reject the null hypotheses that stock price are random walks. Lo & Mackinlay (1989) have indicated that the variance ratio test is more powerful than the well-known Dickey Fuller unit root or the Box Pierce Q test. According to Ayadi & Pyun (1994), the variance ratio test has more appealing features and hence, it has been used several times in the literature on random walk.

Gupta Pradeep (2000) conducted a study of stock market efficiency in India. This study is principally aimed at enquiring into certain aspect of market efficiency with respect to Indian stock market during 1986 to 1995. The nature of data is secondary and yearly time series data has been used to verify semi strong form of EMH and daily data has been used for weak form of EMH. To analyse the data, various statistical tools have been used: mean, standard deviation, coefficient of variation, skew and kurtosis have been employed to have an idea of general profile of variables to know the extent of correlation among variables, Karl Pearson's coefficient of correlation has been applied. For testing the significance of correlation coefficient, the student's t-test has been used to test the semi strong form; the EMH with selected accounting and macroeconomics variables and multiple regression technique have been employed. To test the weak form of EMH, short term data of dependent variables have been plotted to verify whether share price depict any reversal effect. The findings of this research are dividend and have a powerful and positive impact on market share price. Profitability has a positive influence on market share price. Leverage had no significant effect on market share prices.

Parameswaran (2000), performed variance ratio tests corrected for bid-ask spread and non-synchronous trading on the weekly returns derived from CRSP daily returns file for a period of 23 years. His results show that eight out of ten size sorted portfolios do not follow a random walk. He observed that non-trading is not a source of serial correlation in large sized firms.

Mitra (2000), for long time empirical testing of efficient market hypothesis was based on rejection of forcastability of asset return. Ability of any model to predict future stock price fairly accurately itself proves that the market does not follow random walk. The study based on technical analysis and neural networks disprove random walk hypothesis by proving that future prices can be accurately forecasted. Mitra 2000 developed ANN model based on past stock market price as parameters and showed that network performs very well in forecasting developments in BSE sensitive index, thus rejecting criteria of unforecastability of stock prices in BOMBAY stock exchange. Ming, Nor & Guru study mentioned earlier also tries to disprove random walk by establishing the predictive capability of technical rules like VMA & FMA.

Kim, Nelson & Startz (1991) examined the random walk process of stock prices by using weekly and monthly returns in five Pacific-Basin stock markets. The findings provided evidence that the mean reversion was only a phenomenon of the pre-World War II period, and not a feature of the post-war period. They found that the variance ratio tests produced positive serial correlation.

Studies based on the Lo & Mackinlay's simple volatility based specification test have indicated rejection of random walk in the stock markets of developing countries and newly developed countries as well. **Pan, Chiou, Hocking & Rim (1991)**, applied the variance ratio test on daily and weekly returns for a five-year sample period in five Asian stock markets, namely Hong Kong, Japan, Singapore, South Korea, and Taiwan. They rejected the null hypotheses of randomness for both daily and weekly market returns for Korea and Singapore and accepted the null hypothesis in case of Japan. The null hypotheses for Hong Kong daily returns index and the Taiwan weekly returns index were also rejected. Their results indicated that all the returns based on the five market indices were positively auto correlated except for Japan. **Barman & Madhusoodanan (1993)** used variance ratio test to find out the temporary and permanent components in the stock market. Their study based on industry wise indices concluded that in general, Indian market is mean reverting. **Ayadi & Pyun (1994)** showed that South Korean market does not follow random walk when tested under homoscedastic error term assumption and follows random walk when the test statistic is corrected for heteroscedasticity. In his further study Madhusoodanan (1998) concluded that RWH cannot be accepted for BSE sensitive index and BSE national index and observed that heteroscedasticity does not seem to be playing an important role in the Indian stock market. Ming, Nor & Guru (2000) showed that variance ratio and multiple variance ratio tests reject random walk for KualaLampur stock

exchange. They further show that trading rules like variable length moving average (VMA) and fixed length moving average (FMA) have predictive ability of earning profits over and above the transaction costs.

Darrat & Zhong (2000) examined random walk hypothesis for the two newly created stock exchanges in China. They followed two different approaches-the variance ratio test and comparison of NAÏVE model (based on assumption of random walk) with other models like ARIMA and GARCH. They rejected the random walk in newly created Chinese stock exchanges using both the methodologies. They further suggested artificial neural network (ANN) based models as strong tools for predicting prices in the stock exchanges of developing countries.

Grieb & Reyes (1999) employed variance ratio on weekly stock returns to re-examine the Brazilian and Mexican stock markets. The findings indicated non-random behavior in the Mexican market while the Brazilian market indicated evidence in favor of random walk. **Koh & Goh (1994)** tested the random walk hypothesis by extending the framework of **Cochrane (1988)** on Malaysian stock indices. The results revealed that the Malaysian stock market followed random walk in the long run.

For a long time, the empirical testing of the efficient market hypothesis was based on the rejection of forecastability of asset returns. Ability of any model to predict future stock prices fairly accurately itself proves that the market does not follow random walk. The studies based on technical analysis and neural networks disprove random walk hypothesis by proving that future prices can be accurately forecasted. **Mitra (2000),** developed ANN model based on past stock market prices as parameters and showed that network performs very well in forecasting developments in BSE sensitive index, thus rejecting the criteria of un-forecastability of stock prices in Bombay stock exchange. Ming, Nor & Guru study (mentioned earlier) also tries to disprove random walk by establishing the predictive capability of technical rules like VMA and FMA.

The random walk model was first developed by **Bachelier (1900)** in which he asserted that successive price changes between two periods is independent with zero mean and its variance is proportional to the interval between the two time periods. Accordingly, the variance of weekly changes should be five times the variance of the daily changes (assuming the market remains closed on weekends). This concept is exploited in the variance ratio tests, which has been widely used to test the random walk hypothesis in various markets. The study of rejection of random walk in the share prices due to mean reverting tendency, which is a consequence of persistence of one sided volley in share prices, was first presented by **De Bondt & Thaler (1985)**. The presence of mean reverting tendency and absence of random walk in US stocks was confirmed by the studies of De Bondt & Thaler (1989) and Poterba & Summer (1988).

Lo And Mackinlay, 1988, conducted a study to test the random walk hypothesis, compared 3 variance estimators derived from data at various levels of frequencies for weekly stock market returns in the New York Stock Exchange and American Stock Exchange for a period of over 32 years. They improved the variance ratio statistic by taking overlapping period and corrected the variances used in estimating the statistic for bias. They also proposed a test statistic Z*, which is robust under the heteroscedastic random walk hypothesis, hence can be used for a longer time series analysis. An extensive Monte Carlo simulation was conducted by Lo & MacKinlay (1989) to find out the size and power of these tests in infinite samples. They identified that the variance of random walk increments was linear in all sampling intervals. Their findings provided evidence to reject the random walk model for the entire sample period of 1962-1985 and for all sub-periods for a variety of aggregate returns indexes and size-sorted portfolios. Their results also indicated positive autocorrelation for weekly holding-period returns not only for the entire sample but also for all sub-periods. The rejection of the random walk model by **Lo & MacKinlay (1988)** was mainly due to the behavior of small stocks. But this could not be attributed entirely to the effects of infrequent trading or time-varying volatilities. They used simple specification test based on variance estimators to prove that stock prices did not follow a random walk.

In his survey paper 'Anomalies in Relationships Between Securities' **Yields And Yield-Surrogates', Ball (1978)** examines the evidence contained in 20 previous studies of stock price reaction to earnings announcements. He finds that the post-announcement risk adjusted abnormal returns are systematically non-zero in the period following earnings announcements in a fashion inconsistent with market efficiency. Ball argues that the nonzero abnormal returns are due to inadequacies in the two parameter asset pricing model used in the studies to adjust for risk differentials, and not to inefficiencies in the pricing of shares. He provides methodological suggestions for reducing the estimation bias due to inadequacies in the asset pricing model.

Jensen Watts (1978) in his paper 'Systematic 'Abnormal' Returns After Quarterly Earnings Announcements' finds statistically significant abnormal returns even after taking all the steps suggested by Ball. He then goes on to provide the first explicit test to determine whether those abnormal returns emanate from market inefficiency or

from deficiencies in the asset pricing model. He concludes that the abnormal returns are due to market inefficiencies and not asset pricing model deficiencies. However, the inefficiencies occurred only in the period 1962-1965, and not in the period 1965-1968. Furthermore, after allowance for transactions costs, only a broker could have earned economic profits in the 1962-1965 period.

Thompson (1978) in his study of 'The Information Content of Discounts and Premiums on Closed-End Fund Shares' finds that a relatively simple trading rule (based on discounts for closed-end funds) earned statistically significant abnormal returns of about 4%, per year over the period 1940-1971. In addition, the results are quite uniform throughout the period. Thompson is unable to distinguish, on the basis of the evidence, whether the abnormal returns are due to market inefficiencies or inadequacies of the two parameter asset pricing model. He argues that the abnormal returns are likely to be due to inadequacies of the asset pricing model and not due to market inefficiency, since the data on the closed end fund discounts was widely available over the entire period and was extensively discussed in the professional press.

Galai (1978) in his paper 'Empirical Tests of Boundary Conditions for CBOE Options' tests (1) whether the prices of stocks on the NYSE and the prices of their respective call options on the Chicago Board Options Exchange behave as a single synchronized market, and (2) whether profits could have been made through a trading rule on call options on the CBOE and their respective stocks on the NYSE. He finds that the two markets do not behave as a single synchronized market. In addition, he finds that positive profits (ignoring risk differentials) could have been made from the trading rule (which is based on violations of the lower boundary condition of the option price). Jensen 6 1978. However, the average profit is small relative to the dispersion of the outcomes, and it appears that most of this would be wiped out by transactions costs for non-members of the exchange.

Chiras and Manaster (1978) in their study of 'The Information Content of Option Prices and a Test of Market Efficiency use the Black-Scholes-Merton option pricing model and actual option prices to calculate implied variances of future stock returns. These variances prove to be better predictors of future stock return variances than those obtained from historical stock price data. In addition, a trading strategy that utilizes the information content of the implied variances yields abnormally high returns, and the returns appear to be high enough to allow profits even for non-members of the exchange. Chiras and Manaster conclude that in the period covered by their data, June 1973 to April 1975, the prices of options on the Chicago Board Options Exchange provided the opportunity to earn economic profits and therefore, that the CBOE market was inefficient.

Slutzky (1937) has observed that any series can be created from a series, which is purely random. By suitably weighting and averaging the random series, we can obtain a series with sharp peaks. When we use this spectral analysis for this derived series, we may observe the peaks. Sensex series, which are obtained as weighted average of individual stock series may have this spurious effect. Therefore, it may be necessary to do spectral analysis on individual stock series than on Sensex. This would be an interesting and useful area of future research.

The EMH and **John Maynard Keynes' (1936),** philosophy represents two extreme views of the stock market. EMH is built on the assumptions of investors' rationality. This image is in stark contrast to Keynes' philosophy in which he pictures the stock market as a "casino" guided by "animal spirit". He argues those investors are guided by short run speculation motives. They are not interested in assessing the present value of future dividends and holding an investment for a significant period, but rather in investing estimating the short run price movements. In EMH, investors have long-term perspective and return on investment is determined by rational calculation based on changes in the long run incomes flow. However in the Keynesian analysis, an investor has shorter horizons and returns represent changes in short-run price fluctuations.

RESEARCH METHODOLOGY

THE STUDY

The research was descriptive in nature. For the purpose of statistical analysis of the weak form of efficient market hypothesis, the market prices of thirty companies involved in the formation of index of Bombay Stock Exchange i.e. Sensex for fifty-two weeks have been taken.

SAMPLING DESIGN

Population

The research contained all the companies and firms listed on Bombay Stock Exchange, and closing prices of fifty-two weeks were collected for analysis.

Sampling Frame

The sampling frame consisted of the thirty companies involved in the formation of index of Bombay Stock

Exchange i.e. Sensex.

Sampling Element

Thirty individual companies forming index of Bombay Stock Exchange i.e. Sensex have been analyzed.

Sampling Size

It contained 30 companies involved in the formation of BSE index: Sensex.

Sampling Technique

Judgment sampling technique (non probability sampling technique) has been used.

Tools used for data collection

Secondary sources were used to collect data. Weekly price data was collected from Bombay Stock Exchange site for all firms for the period 1st April 2005 to 31stMarch 2006 and Friday closing prices were considered for analysis.

Tools used for data analysis

Autocorrelation and Run test has been used to check the weak form of efficiency. Autocorrelation has been used to check the correlation (positive or negative) between share prices. Following hypothesis has been formed:

Null Hypothesis (Ho): The price movements in the share prices of Bombay Stock Exchange is not affected by past prices.

Alternate Hypothesis (Ha): The price movements in the share prices of Bombay Stock Exchange is affected by past prices.

Run test has been applied through the following formulae:

$$\text{Run} = \frac{dx_i dy_i - dx_i \; dy_i/n}{\{ d^2x_i/n - (dx_i/n)^2 \}^{1/2} \{ d^2y_i/n - (dy_i/n)^2 \}^{1/2}}$$

$dx_{i=} \; (x_i - A_x)$

$dy_{i=} \; (y_i - A_y)$

$d^2x_{i=} \; (x_i - A_x)^2$

$d^2y_{i=} \; (x_i - A_y)^2$

$dx_i \, dy_{i=} \; (x_i - A_x)(y_i - A_y)$

n=number of pairs of observations of x & y.

$$\text{Mean} = \frac{2n1n2 + 1}{n1+n2}$$

$$\text{Standard deviation } (\;^2) = \frac{2n1n2\,(2n_1n_2 . n_1 - n_2)}{(n_1+n_2)^2\,(n_1+n_2-1)}$$

$n_1+n_{2=}$Number of observation in each category.

$$Z = \frac{\text{run-mean}}{}$$

Z= standard normal variate

RESULTS & DISCUSSION

RESULTS OF RUN TEST

The calculated values of run test (Z) are compared with the critical value at 5% level of significance. Out of the 30 companies, the value of Z of all the companies was less than the critical value of 1.96 at 5% level of significance. So, the null hypothesis that the price movement in the share prices of Bombay Stock Exchange is not affected by past prices is accepted. The result shows that the price movements in share prices of Bombay Stock Exchange are random in behavior. We can't use the historical data for predicting the future prices. This study has proved that the weak form of efficient market hypothesis or the random walk theory is applicable in the Bombay Stock Exchange. See Table 1 for reference.

RESULTS OF AUTOCORRELATION

The serial correlation is calculated for weekly share prices of Sensex for the period 1st April 2005 to 31st March 2006.The correlation is calculated between the share prices of any period 't' & 't+1',between 't'& 't+2',between 't' &

Table 1: Analysis of Run Test

Company Name	Z
ACC	0.763
BAJAJAUTO	1.937
BHARTI	0.551
BHEL	0.280
CIPLA	0.994
DRREDDY	-0.164
GRASIM	-3.356
GUJAMBCEM	0.763
HDFCBANK	0.862
HEROHONDA	1.133
HINDALCO	0.000
HINDLEVER	0.378
HDFC	-1.736
ITC	-1.663
ICICIBANK	-0.035
INFOSYS	-1.407
L&T	-1.071
MARUTI	0.410
NTPC	-0.167
ONGC	0.279
RANBAXY	0.751
RELIANCE	0.177
RELIANCE ER	0.410
SATYAM	0.570
SBIN	-0.593
TATAMOTORS	0.570
TATAPOWER	-0.775
TISCO	0.571
TCS	-0.470
WIPRO	1.003

't+3' &between 't' & 't+4'. To analyze the results, the three limits of correlation coefficient have been taken. These limits are ±0 to ±.25(low correlation), ±.25 to ±.75(moderate correlation) & ±.75 to ±1(high correlation).

From the Table, it is analyzed that out of 30 companies analyzed for correlation between 't' & 't+1', 8 companies have shown moderate correlation and 22 companies have shown high correlation. From the table it is also analyzed that out of 30 companies, for correlation between 't' & 't+2', 12 companies have shown moderate correlation and only 18 companies have shown high correlation. From the table, it is also analyzed that out of 30 companies, for correlation between 't' & 't+3', 1 company has shown low correlation, 14 companies have shown moderate correlation and only 15 companies have shown high correlation. From the table, it is also analyzed that out of 30 companies, for correlation between 't' & 't+4', 3 companies have shown low correlation, 19 companies have shown moderate correlation and only 8 companies have shown high correlation. The number of companies in low and moderate correlation group were increasing after the period of 't+1' and't+2' significantly. The number of companies in high correlation group goes on decreasing for the period from't+1' to 't+4'.

Large number of companies show moderate or low correlation as the time period increases. If there is little correlation between stock prices over time, it shows that it is not useful in predicting the future using historical data. So, after seeing the results of correlation, we can say that the stock prices of companies in Sensex are not related or connected to each other. See Table 2 for reference.

CONCLUSION

The random walk model says that previous price changes or changes in return are useless in predicting the future price or return changes. That is, if we attempt to predict future prices in absolute terms using only historical price-change information, we will not be successful. After applying the statistical test like Run test and Correlation, it can be concluded that the price movements of the shares of the companies in BSE SENSEX are random i.e. nobody can be successful in predicting the future prices on the basis of historical data only. In almost all the

Table 2: Autocorrelation between weekly price changes and lagged price changes of Sensex

Company Name	t+1	t+2	t+3	t+4
ACC	0.582056	0.557776	0.531726	0.515030
BAJAJAUTO	0.991421	0.980834	0.971161	0.961683
BHARTI	0.977884	0.968621	0.960876	0.937841
BHEL	0.583882	0.561558	0.555378	0.561661
CIPLA	0.979301	0.974791	0.963943	0.959559
DRREDDY	0.894490	0.685615	0.678927	0.577866
GRASIM	0.556586	0.545047	0.502351	0.451807
GUJAMBCEM	0.933078	0.662770	0.694490	0.722279
HDFCBANK	0.948520	0.915599	0.886824	0.742182
HEROHONDA	0.679191	0.669908	0.668230	0.656893
HINDALCO	0.949556	0.895452	0.840954	0.740191
HINDLEVER	0.974420	0.555479	0.526529	0.496081
HDFC	0.476172	0.372260	0.260613	0.247291
ITC	0.940065	0.882485	0.830147	0.726369
ICICIBANK	0.655736	0.517685	0.475013	0.539360
INFOSYS	0.965723	0.939330	0.913637	0.885226
L&T	0.991160	0.978784	0.970648	0.969495
MARUTI	0.674024	0.563077	0.354556	0.237561
NTPC	0.982907	0.967241	0.949497	0.936730
ONGC	0.949969	0.911473	0.869075	0.738066
RANBAXY	0.953673	0.912185	0.872738	0.730589
RELIANCE	0.944946	0.773008	0.706614	0.664875
RELIANCE ER	0.865051	0.797055	0.654414	0.490861
SATYAM	0.988835	0.984360	0.980695	0.973562
SBIN	0.768924	0.634347	0.592024	0.456555
TATAMOTORS	0.987356	0.974930	0.963063	0.952099
TATAPOWER	0.955513	0.922427	0.890475	0.714146
TISCO	0.858979	0.763594	0.684130	0.564255
TCS	0.968294	0.921331	0.872198	0.734907
WIPRO	0.611170	0.536648	0.358703	0.245859

companies, Run test has rejected the Ho: The price movements in the share prices of Bombay Stock Exchange are not affected by past prices and accepted (Ha): The price movements in the share prices of Bombay Stock Exchange are affected by past prices. Moreover, results of correlation test also support the weak form efficiency for BSE SENSEX. So, it can be concluded that the price movements of shares on BSE SENSEX are occurring by chance. Before investing in the shares of the company listed on Bombay Stock Exchange, an investor should not rely only on the historical prices of the shares of that company.

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