TESTING WEAK-FORM EFFICIENCY OF INDIAN STOCK MARKETS

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ABSTRACT
This study examines the random walk hypothesis to determine the validity of weak-form efficiency for two major stock markets in India. The study uses daily observation over the span from 1st July 1997 to 31st August 2010, comprising a total of 3244 observations. The random walk hypothesis is examined using unit root tests namely, Augmented Dickey-Fuller (1979) test and the Phillips-Perron (1988) test. The ADF and PP unit root tests clearly reveals that the null hypothesis of unit root is convincingly rejected in the case of stock market returns of two major indices, viz. S&P CNX NIFTY and the SENSEX. This suggests that the Indian stock markets does not show characteristics of random walk and as such are not efficient in the weak form implying that stock prices remain predictable. The empirical results do not support the validity of weak-form efficiency for stock market returns of Indian stock exchanges. This implies that the Indian stock markets are not weak form efficient signifying that there is systematic way to exploit trading opportunities and acquire excess profits. This provides an opportunity to the traders for predicting the future prices and earning abnormal profits. The implication of rejection of weak form efficiency for investors is that they can better predict the stock price movements, by holding a well diversified portfolio while investing in the Indian stock markets.

KEYWORDS: Indian Stock Market, Market Efficiency, Unit root test, Weak-form Efficiency.

1. INTRODUCTION

The term market efficiency in capital market theory is used to explain the degree to which stock prices reflect all available, relevant information. The concept of Efficiency Market Hypothesis (EMH) is based on the arguments put forward by Samuelson (1965) that anticipated price of an asset fluctuate randomly. In finance, the efficient-market hypothesis (EMH) asserts that financial markets are "informationally efficient". That is, one cannot consistently achieve returns in excess of average market returns on a risk-adjusted basis, given the information publicly available at the time the investment is made. According to Fama (1970), there are three major versions of the hypothesis: “weak”, “semi-strong”, and “strong”. Weak EMH claims that prices on traded assets (*e.g.*, stocks, bonds, or property) already reflect all past publicly available information. Semi-strong EMH claims both that prices reflect all publicly available information and that prices instantly change to reflect new public information. Strong EMH additionally claims that prices instantly reflect even hidden or "insider" information. There is evidence for and against the weak and semi-strong EMHs, while there is powerful evidence against strong EMH.

Random walk hypothesis basically measures weak form of market efficiency. In weak-form efficiency, future prices cannot be predicted by analyzing prices from the past. Excess returns

cannot be earned in the long run by using investment strategies based on historical share prices or other historical data. Technical analysis techniques will not be able to consistently produce excess returns, though some forms of fundamental analysis may still provide excess returns. Share prices exhibit no serial dependencies, meaning that there are no "patterns" to asset prices. This implies that future price movements are determined entirely by information not contained in the price series. Hence, prices must follow a random walk. However, if the markets were not efficient, the investors will beat the market and attain maximum profits. Participants in an inefficient market can use various devices such as trading rules and statistical techniques to predict the movement of stock prices.

2. REVIEW OF LITERATURE

Random walk hypothesis have been tested in many stock exchanges of the world. Several researches have been done on this topic on various stock markets of different countries or regions. Empirical studies on weak form efficiency in Asian stock markets have been extensively conducted in recent years. Indeed, in the Chinese stock markets, Mookerjee and Yu (1999) and Groenewold et al. (2003) consistently found that these markets (Shanghai and Shenzhen stock exchanges) are not weak form efficient. Besides, Lima and Tabak (2004) found that the B shares index for both Shanghai and Shenzhen Stock Exchange do not follow the random walk. However, they also report that the hypothesis of weak form efficiency cannot be rejected for A shares indexes of the two exchanges. Moreover, Seddighi and Nian (2004) found that the Shanghai Stock Exchange is weak form efficiency for the period from 4th January 2000 to 31st December 2000. Regarding the Taiwanese stock market, it is proved that the market is efficient in the weak form (Fawson et al., 1996; Alam et al., 1999; and Chang and Ting, 2000). Similarly, the null hypothesis of random walk cannot be rejected for the Hong Kong stock market (Karemera et al., 1999; Alam et al., 1999; Cheung and Coutts, 2001; and Lima and Tabak, 2004). In addition, it is showed that stock market in the ASEAN region (Indonesia, Malaysia, Thailand and Singapore) follow the weak form of EMH (Barnes, 1986; Karemera et al., 1999; Alam et al., 1999). In the Southern part of Asia, Sharma and Kennedy (1977) and Alam et al. (1999) report that the random walk hypothesis cannot be rejected for stock price changes on the Bombay (India) and Dhaka Stock Exchange (Bangladesh) respectively. However, Abeysekera (2001) and Abraham et al., (2002) show evidence to reject the hypothesis of weak form efficiency for stock markets in Sri Lanka, Kuwait, Saudi Arabia and Bahrain. The studies such as Sharma and Kennedy (1977), Barua (1980, 1987), Sharma (1983), Ramachandran (1985), Gupta (1985), Srinivasan (1988), Vaidyanathan and Gali (1994) and Prusty (2007) supports the weak form efficiency of Indian capital market. However, some studies like Kulkarni (1978), Chaudhury (1991), Poshakwale (1996), Pant and Bishnoi (2002), Pandey (2003), Gupta and Basu (2007), Mishra, (2009) and Mishra and Pradhan, (2009) do not support the existence of weak form efficiency in Indian capital market.

In short, the above literature shows that still it cannot said with certainty that whether stock market follow random walk or stock prices are predicable. The quarrel between random walk believers and believers of non random behavior of asset prices has not end yet. Random walk hypothesis are testing in various stock market specially recently behavior of Stocks of emerging markets are of great concern of many researcher. In the Indian context, there has been wide range of studies concerning the efficient market hypothesis in the literature, but seems to provide mixed evidences. The ability of Indian stock market to play the role that is ascribed to them – attracting foreign investment, boosting domestic saving and improving the pricing and availability of capital – depends upon the presence of random walks. A market

following a random walk is consistent with equity being appropriately priced at an equilibrium level, whereas the absence of a random walk infers distortions in the pricing of capital and risk. This has important implications for the allocation of capital within an economy and hence overall economic development. If the Indian stock markets are efficient, the need for government intervention is minimal. On the other hand, an inefficient equity market provides opportunities for profitable transactions. Participants in an inefficient equity market can use various devises such as trading rules and statistical techniques to predict the movement of share prices. Further, the stock market regulators and authorities can determine the best way to influence stock prices, reduce stock market volatility and evaluate the consequences of different economic policies.

In this context, the present study examines the random walk hypothesis to determine the validity of weak-form efficiency for two major stock market indices of Indian stock exchanges, viz. NSE S&P CNX NIFTY and the BSE SENSEX. The remainder of the article is organised as follows: Section-3 describes the methodology and data used for empirical analysis. Section-4 offers empirical results and discussion of the study. Concluding remarks are presented in section-5.

3. METHODOLOGY

Usually time series analysis considers stationary time series in empirical studies. If the series is non-stationary, the relationship between the independent and dependent variables may exhibit misleading inferences leading for spurious regression. A series said to be stationary if the mean and auto covariance of the series does not depends on time. In order to examine whether each variable's time series is integrated and has a unit root, the study has considered two widely used popular unit root tests- Augmented Dickey-Fuller test (1979) test and Phillips-Perron (1988) test. Both the tests use the null hypothesis that the series does contain a unit root (non-stationary variable) against a stationary variable in the alternative hypothesis. If the calculated test statistics is higher than the critical value then one does not reject the null hypothesis and the concerned variable is non-stationary, if not that is stationary. To test the EMH (Efficient Market Hypothesis) of Indian equity market, the tools of stationarity of share prices are tested by using daily market returns.

The equation of unit root test is expressed as:

$$\Delta R_t = \alpha_0 + \alpha_2 t + \sum_{i=1}^{k} \beta_i \Delta R_{t-1} + \varepsilon_t \quad \ldots\ldots\ldots\ldots\ldots (1)$$

where, R_t denotes the daily return of the individual stock at time t and β_i is the coefficient to be estimated, k is the number of lagged terms, t is the trend term, α_2 is the estimated coefficient for the trend, α_0 is the constant, and ε is white noise. MacKinnon's critical values are used in order to determine the significance of the test statistic associated with β_{i0}. The unit root tests the null hypothesis H_0: $\beta_i = 1$ against the one-sided alternative H_1: $\beta_i<1$. The null hypothesis of a unit root is rejected in favour of the stationary alternative in each case if the test statistic is more negative than the critical value. Phillips-Perron (1988) suggests an alternative approach for checking the presence of unit roots in the data. They formulate a nonparametric test to the conventional t-test which is robust to a wide variety of serial correlation and time dependent hetroscedasticity. The Phillips-Perron test incorporates an alternative (nonparametric) method of controlling for serial correlation when testing for a unit root by estimating the non-augmented Dickey-Fuller test equation and modifying the test statistic so that its asymptotic distribution is unaffected by serial correlation.

The data for the study consists of daily closing prices of two major Indian stock market indices, namely S&P CNX Nifty and SENSEX of National Stock Exchange (NSE) and Bombay Stock Exchange (BSE) respectively. The study uses daily observation over the span from 1st July 1997 to 31st August 2010, comprising a total of 3244 observations. All the required data information for the study has been retrieved from the website of www.yahoofinance.com. Throughout this paper, stock market returns are defined as continuously compounded or log returns (hereafter returns) at time t, r_t, calculated as follows:

$$R_t = log (P_t / P_{t-1}) = log P_t - log P_{t-1} \quad \ldots\ldots\ldots\ldots (2)$$

where P_t and P_{t-1} are the daily closing prices of S&P CNX Nifty and SENSEX at days *t* and *t−1*, respectively.

4. EMPIRICAL RESULTS AND DISCUSSIONS

This study examines the random walk hypothesis to determine the validity of weak-form efficiency for two major stock markets in India. The random walk hypothesis is examined using unit root tests namely, the Augmented Dickey-Fuller (1979) test and the Phillips-Perron (1988) test. First, the study performs ADF test with intercept, with intercept and trend, and without an intercept and trend. It further tests the price series using the Phillips-Perron test for a confirmatory data analysis.

Table-1:
Results of Augmented Dickey Fuller Test

Returns	With Intercept	With Intercept & Trend	Without Intercept & Trend	Remarks
S&P CNX NIFTY	-25.448*	-25.462*	-25.401*	*Rejects the Null Hypothesis of Presence of Unit Root*
SENSEX	-27.931*	-27.949*	-27.894*	
Note: * – indicates significance at one per cent level. Optimal lag length is determined by the Schwarz Information Criterion (SIC).				

The results of Augmented Dickey-Fuller test of random walk model was presented in Table-1. The ADF test result reveals that the null hypothesis of unit root (non stationary) of the stock market returns of two major indices, viz. S&P CNX NIFTY and the SENSEX is convincingly rejected, suggesting that the Indian stock markets does not show characteristics of random walk and as such are not efficient in the weak form implying that stock prices remain predictable. The empirical results do not support the validity of weak-form efficiency for stock market returns of Indian stock exchanges. This implies that the Indian stock markets are not weak form efficient signifying that there is systematic way to exploit trading opportunities and acquire excess profits. This provides an opportunity to the traders for predicting the future prices and earning abnormal profits. The implication of rejection of weak form efficiency for investors is that they can better predict the stock price movements, by holding a well diversified portfolio while investing in the Indian stock markets.

Table-2:
Results of Phillips-Perron Test

Returns	With Intercept	With Intercept & Trend	Without Intercept & Trend	Remarks
S&P CNX NIFTY	-53.291*	-53.303*	-53.272*	*Reject the Null Hypothesis of Presence of Unit Root*
SENSEX	-53.046*	-53.049*	-52.970*	
Note: * – indicates significance at one per cent level. Optimal lag length is determined by the Newey-West Criterion.				

The study also conducted Phillip-Perron test for confirmatory data analysis and the results are presented in Table-2. From the table results, it was clear that both the return series rejects the null hypothesis of unit root. This result is consistent with the findings of ADF test, suggesting the Indian stock markets are not weak form efficient.

5. CONCLUSION

The behavior of stock market returns in the financial literature is a central issue to the theory and practice of asset pricing, asset allocation, and risk management. The supporters of the efficient market hypothesis (EMH) claim that stock prices are basically random and as such any speculation based on past information is fruitless. This study examines the random walk hypothesis to determine the validity of weak-form efficiency for two major stock markets in India. The study uses daily observation over the span from 1st July 1997 to 31st August 2010, comprising a total of 3244 observations. The random walk hypothesis is examined using unit root tests namely, Augmented Dickey-Fuller (1979) test and the Phillips-Perron (1988) test. The ADF and PP unit root tests clearly reveals that the null hypothesis of unit root is convincingly rejected in the case of stock market returns of two major indices, viz. S&P CNX NIFTY and the SENSEX. This suggests that the Indian stock markets does not show characteristics of random walk and as such are not efficient in the weak form implying that stock prices remain predictable. The empirical results do not support the validity of weak-form efficiency for stock market returns of Indian stock exchanges. This implies that the Indian stock markets are not weak form efficient signifying that there is systematic way to exploit trading opportunities and acquire excess profits. This provides an opportunity to the traders for predicting the future prices and earning abnormal profits. The implication of rejection of weak form efficiency for investors is that they can better predict the stock price movements, by holding a well diversified portfolio while investing in the Indian stock markets.

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