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REVISITING RANDOM WALK BEHAVIOR OF STOCK MARKET: EVIDENCE FROM INDIAN MARKET

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ABSTRACT

The present study analyses the random walk behaviour of Indian stock market. The study has taken S&P CNX Nifty Fifty return for the purpose of analysis. The period of the study ranges from April, 2006 to March, 2015. The paper has applied the Unit root (on basis of Augmented Dickey- Fuller and Phillips-Perron) and Variance ratio test to study the random walk of stock market. The results of different test provide evidence against random walk of stock market. So the Indian stock market in the select sample period implies weak form of market inefficient. In addition, the study attempts to analyse the volatility clustering and persistence. The results of GARCH (1,1) model shows that there is presence of Volatility clustering and persistence.

Keywords: Efficient Market Hypothesis, Random walk hypothesis, Volatility, Stock Market, CNX Nifty-Fifty

1. Introduction:

'Stock market has been considered as barometer of an economy'. It acts as a mean of fund mobilasation by providing opportunities of investment to many small as well as big investors like financial institutions etc. Since stock market is one of the major avenues of investment, so the investors and many researchers always try to find a way for prediction of future stock prices. If one can predict stock prices, then he will be able to earn abnormal or excess profit. The future

stock prices are the reflections of different information and positive as well as negative news of the market. In this context one of the major evolutions in financial history is Efficient Market hypothesis (EMH). EMH suggests that in an efficient market the current share prices will be already reflecting all the information, so nobody can use the prevailing information to earn excess profit. Sometimes it is also called as Informational efficiency (Fama, 1970) of stock market. The efficient market hypothesis can be of three types such as weak form of efficiency, Semi-strong and strong form of market efficiency (Fama, 1970).

- **Weak form of efficiency:** Weak form of efficiency means the current market price already reflects all past information. So the entire past information and technical analysis such as using charts or graphs will be of no use.
- **Semi-strong form of Efficiency:** Semi-strong form of efficiency implies the past price related information as well as publically available information is of no use, as it is been already reflected in current price.
- **Strong form of Efficiency:** The strong form of market efficiency means the current prices reflect all the past, publicly available as well as private information such as insider trading information.

In a healthy economy the stock market should be efficient. But the literature in this context shows mix evidence. Like Tas and Dursunoglu (2005) tested the random walk hypothesis in case of Istanbul Stock exchange. By applying auto correlation and run test the study found that the Istanbul stock exchange is not weak form of efficient. Poshakwale (1996) found evidence against weak form of efficient in case of Indian stock market. Samanta (2004) found mixed evidence of both efficient and not efficient. In the sample period the market was inefficient till 1996 and after that highly efficient till 1999. Arora (2013) has tested random walk of Indian stock market. The study found that the Indian market does not exhibit weak form of efficiency in the sample period. Chen (2008) rejected random walk in case of Euro exchange rates. In another study Sharma and Seth (2011) studied market efficiency of both BSE and NSE in both pre and post crisis period. They found that both the market does not exhibit weak form of efficiency. Anoruo and Elike (2008) study the random walk of china's non-US equity closed end fund. The study rejects the random walk of closed end fund in the sample period.

As the past literature provides evidence that the market shows a mixed behavior. Many of the studies show evidence for weak form of efficiency, while many studies have also rejected it. The

present study revisits the random walk behavior of Indian stock market. Also the present study assesses volatility of Indian stock market.

2. Data and Methodology:

For the purpose of analysis S&P CNX Nifty-Fifty returns for period from April, 2006 to March, 2015 has been selected. The returns have been calculated by using the formula **(P_t/P_{t-1}),** here P_t stock price at t period and P_{t-1} stock price at t-1 period and Ln natural log. The methodology of the study can explained as follows.

2.1.Unit root Test

In time series analysis unit root test is one of the underlying tests for stationarity of data. A series is said to be stationary, if its mean and variance are time invariant or constant over the time period. In case of stationary data, there will absence of unit root problem. The unit root test also denotes test for random walk of the stock market. The equation of unit root can be written as:

$$SMR_t = \rho SMR_{t-1} + u_t 1 \leq \rho \leq 1 \quad (1)$$

Here SMR_t is stock market return at t period, and SMR_{t-1} stock market return at t-1 period, u_t is a white noise error term. In the above equation stock market return is said to be random walk if present return at t period is equal to past return at t-1 period plus random shock. Here ρ is not equal to 1 then series will be stationary and does not contain unit root.

2.2.Variance Ratio Test:

The study uses the Lo and MacKinlay (1988) variance ratio test. The stochastic process with drift can be written as:

$$SMR_t = \mu + SMR_{t-1} + \varepsilon_t, \quad (2)$$

Here μ is the drift parameter, and expected value of error is zero. The model implies error will grow linearly with time. The following equation (3) shows Variance Ratio VR (q):

$$VR\ (q) = \frac{\sigma^2(q)}{\sigma^2(1)} \quad (3)$$

In above equation $\sigma^2(q)$ is $\frac{1}{q}$ times the variance of $(\boldsymbol{E_t}\text{-}\boldsymbol{E_{t-q}})$ and $\sigma^2(1)$ is the variance of $(\boldsymbol{E_t - E_{t-1}})$.

2.3.**Volatility clustering and Spillover:**

The present study uses GARCH (1,1) Bollerslev (1986) model to analyse the volatility clustering and persistence. Generally standard deviation is used one of crude measure to assess unconditional variance. But the GARCH is estimated to measure conditional variance. The equation of GARCH model will be as follows assuming Exchange rate can be represented by AR(1) process.

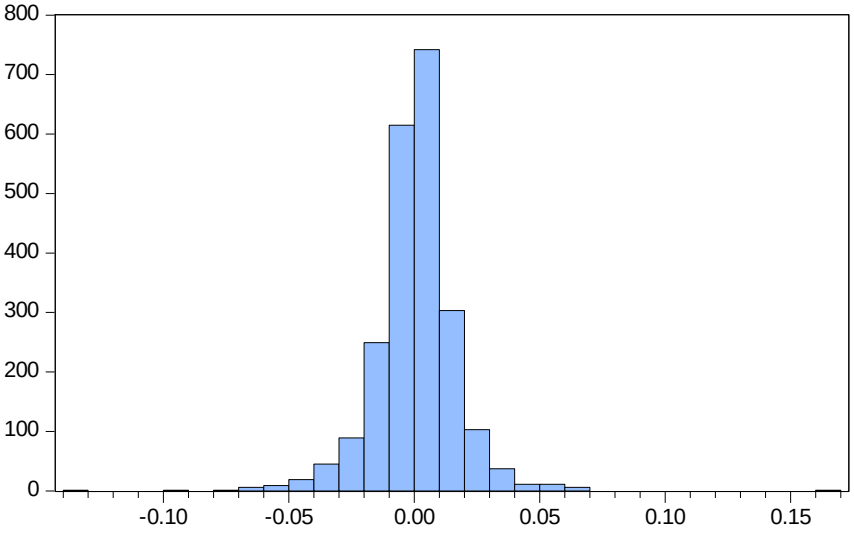
$$\Delta \boldsymbol{SMR_t} = \boldsymbol{\beta_0} + \boldsymbol{\beta_1}\Delta \boldsymbol{SMR_{t-1}} + \boldsymbol{\varepsilon_t}\,,\ \boldsymbol{\varepsilon_t} \sim \boldsymbol{N}(\mathbf{0}, \boldsymbol{\sigma^2_{t,(\Delta SMR)}}) \qquad (4)$$

In above equation (4) $\boldsymbol{\beta_0}$is the intercept, $\boldsymbol{SMR_{t-1}}$ stock return in t-1 period. Similarly $\boldsymbol{\varepsilon_t}$ is the white noise error term.

3. Results and Discussion:

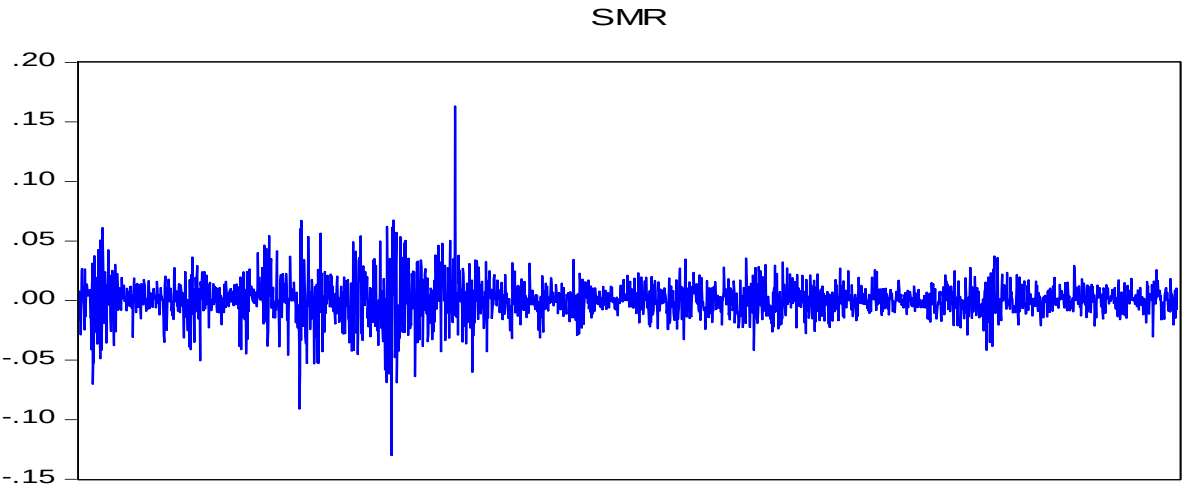
The following figure-1 shows the histogram and descriptive of nifty return for the sample period. Here the average or mean stock market return (SMR) is 0.000400. While the median and standard deviation of the series is 0.000765 and 0.016068 respectively. Here the average return is positive in the sample period. Standard deviation shows the volatility. The return is positively skewed. The p-value for Jarque-bera test 0.0000, so normality of the series has been rejected at 1% level. The figure-2 is plot of nifty returns for the sample period. During the period 2007-08 the series shows presence of high volatility, this may be because of global crisis. In overall it indicates some sort of volatility.

Figure-1 Histogram and Descriptive Statistics of Stock market return



Series: SMR	
Sample 4/03/2006 3/24/2015	
Observations 2249	
Mean	0.000400
Median	0.000765
Maximum	0.163343
Minimum	-0.130142
Std. Dev.	0.016068
Skewness	0.010302
Kurtosis	11.90015
Jarque-Bera	7422.935
Probability	0.000000

Figure 2: Plot of SMR



3.1. ADF and PP test:

The study uses Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) test for testing of stationarity. The table:1 shows the results of Unit root test on basis of ADF. The result shows that t-statistics in ADF test i.e. -44.71965 is more than the critical value and p-value is 0.0000. So the null hypothesis of unit root problem has been rejected. So the stock market return for the sample period is stationary. So the Nifty return for the sample period does not exhibit random walk behavior. Similarly in the basis of PP test it shows that p-value is 0.0001, it means highly statistically significant. So the null hypothesis of non-stationarity has been rejected. The same

was previously observed in ADF test. So SMR does not follow a random walk. This implies weak form inefficient of stock market.

Table 1: Results of Unit root test of SMR

Test type	**t –Statistics**	**Prob.**
ADF	-44.71965***	0.0001
PP	-44.65140***	0.0001

*****indicates significant @1% level**

3.2.Variance Ratio Test

I have applied variance test (Lo-Mackinlay, 1988) and the sign and rank test (Wright, 2000) to verify the random walk of stock market. The result is given in Table-2. It can be observed that the variance ratios at different horizon of period are statistically significant at 1% level. Thus the null hypothesis has been rejected. It shows random walk has been rejected in case of nifty Thus SMR is weak form of inefficient, as earlier been observed in Unit root test.

Table: 2 Variance Ratio of SMR

Variance Ratio of SMR			
Period	Var. Ratio	Rank Var. Ratio	Sign Var. Ratio
2	0.539948***	0.571058***	0.704626***
4	0.273183***	0.325572***	0.518238***
8	0.124807***	0.197932***	0.431940***
16	0.066159***	0.137409***	0.340302***

*****indicates significant @1% level**

3.3.Volatility Clustering and Persistence

To study the volatility of stock market I have applied GARCH (1,1) model. The following table: 3 shows result for SMR. Hereα_0,α_1, β_0 and β_1 are different parameters of the model for both mean and variance equation. Here coefficients of lagged squared residuals (β_0) and conditional variances (β_1) are statistically significant at 1% level. Also the aggregate of this two is near to 1, so there is presence of both volatility clustering and persistence. The same was already from plot of returns of SMR.

Table 3: GARCH (1, 1) of SMR

GARCH(1,1) of SMR			
Parameters	Coefficient	Z-stat	P-Value
α_0	0.000761	3.318835	0.0009
α_1	2.23E-06	5.202751	0.0000
β_0	0.093138	11.69367	0.0000
β_1	0.900416	112.8971	0.0000

4. Conclusion

The present study revisits the efficiency of Indian stock market. By taking nifty returns from the year 2006 to 2015, the study concludes that the weak form of market efficiency does not hold for Indian stock market. The findings are in the same line of conclusions many studies in this context. This study is more relevant from point of view of utility of different market information and analysis for outperforming the market. As the stock market does not follow the random walk hypothesis, so the past information can be judiciously used to make strategies making for abnormal profit. Though inefficient market may help to many investors or speculator in short run but in long term period it may disturb the healthy functioning the Indian Economy.

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