IPRPD
International Journal of Business & Management Studies
Volume 01; Issue no 01: July 30, 2020

A Variance-Ratio Test of Random Walk in Nepalese Stock Market

Yub Raj Dhungana [1]

[1] *PhD, Associate Professor, Tribhuvan University*

Received: 15/07/2020
Accepted for Publication: 27/07/2020
Published: 30/07/2020

Abstract

Over the past many years, researchers in finance, economics, and other related fields conduct intensive studies to examine whether stock prices follow a random walk. They, used various statistical techniques, often document mixed findings. The study tests the random walk hypothesis using the relatively fresh data, NEPSE Index, Float index, sensitive index, and sensitive float index of the Nepalese capital market from February 2015 to February 2020. The study explores that the NEPSE index follows a random walk. Results, however, other indices indicate that the stock market does not follow a non-random walk.

Keywords: Variance ratio test, Random walk, efficient market hypothesis, NEPSE index, Float index, Sensitive float index, Sensitive index

---

Introduction

Random walk hypothesis (RHM) has been a lot of researches over the years in every country. The research on this topic made by the industries, academic in finance, economics and other related fields. They conducted extensive researches about to test whether stock price of the stock market follow a random walk and do not follow a random walk. The research report explores the information to the potential investors, readers having the interest on stock market and academicians whether the stock prices are predictable based on historical scenario. About the random walk hypothesis (RWH) in relation with the efficient market hypothesis (EMH), two separate groups of research has been made, one of which theoretically and empirically (Fama, 1965). (Fama, 1995) explore that the efficient market hypothesis (EMH) implies that a series of stock price changes have no memory, namely, the history of a series cannot be utilized to forecast its price in the future in terms of independence. Several empirical studies (Cootner, 1962), (Fama, 1965), (Kamera, Ojha, & Cole, 1999) support the random walk hypothesis. More clearly, (Malkiel, 1973) published a well-known book, “A Random Walk down Wall Street” that highlights stock price randomness. Further, (Karenera, Ojha, & Cole, 1999) using the data of 15 emerging markets, find that investors are unable to make a systematic nonzero profit by using past stock price information in most markets. In contrast, many research casts doubt on RWH, including (Lucas, 1978), (Grossman & Stiglitz, 1980), (Lo & Mackinlay, 1988), and (Lim & Brooks, 2010). They found that the stock prices follow a nonrandom walk. In the book, "A Non-Random Walk down Wall Street", (Lo & Mackinlay, 1999), using various techniques, present extensive evidence on a non-random walk behavior of stock prices.

As to whether the stock price behavior follows a random walk is an ongoing debatable issue, it inspires us to use the latest data for further testing RWH. This paper uses 4 indices from the Nepalese capital market from February 2015 to February 2020 daily.

Objective of the study

The study conducted in order to test the random walk hypothesis of the Nepalese Stock Market (NEPSE) return by using daily observation NEPSE Index, Float index, sensitive index, and sensitive float index of the Nepalese capital market.

Literature Review

Numerous studies have empirically investigated the various forms of the efficient market hypothesis. Review a list of few selected empirical studies on the various forms of efficient market hypothesis. (Mlambo & Biekpe, 2007) studied the weak form of EMH for ten African stock markets using the serial correlation and run tests. Series of trading was observed on all markets, and particularly for Namibia and Botswana, the two stock markets with considerable double listing stock on the Johannesburg Stock Exchange (JSE). All previous research on the markets ,excluding Namibia, a significant number of stocks rejected the random walk hypothesis. According to Mlambo and Biekpi, the efficient market hypothesis on the Namibia stock market is also found to be random walk for the period investigated.

In Botswana, (Chiwirw & Muyambiri, 2012) evaluated the presence of weak-form efficiency in the Botswana Stock Exchange (BSE) for the period 2004 - 2008. The study used several tests to examine the randomness of BSE stock prices. They apply the following statistical tools like Augmented Dickey-Fuller tests, auto-correlation test, Kolmogorov-Smirnov Test, Runs Test, and the Phillips Perron unit root test. All the tests show that the BSE is inefficient at the weak-form suggesting the need to improve efficiency. Furthermore, the random walk hypothesis is rejected implying that investment analysts (Sing & Sapna, 2013) examined the weak form market efficiency in five stock exchanges of Asian countries. The closing price of daily, weekly, and monthly data was used. The empirical results of the run test show that the stock price of Bombay stock exchange (BSE) and Singapore stock exchange (STI) do not follow random behavior in case of daily stock prices. In the case of monthly price, BSE has been found weak-form efficient. Further, the results of the autocorrelation and Ljung-Box test revealed that all stock exchanges understudy follow random walk behavior in case of monthly and weekly prices except BSE. Form the market and they reap higher than expected profits through the use of historic data.

(Gilani, 2014) the study explored the weak-form efficiency of the Islamabad Stock Exchange (ISE) from January 2013 to December 2013. In testing for the weak-form efficiency of the Islamabad Stock exchange, different statistical techniques were used in analyzing the data of the weekly ISE-10 share index. This includes the famous tests of statistics such as run tests and the ADF test to check the Weak form of ISE. The study also focused on the random walk behavior of the stock market of Islamabad. Auto-correlation test and Run test showed market inefficiency at specific periods but ADF test showed weak form of market efficiency.

(Ojo & Azeez, 2012) investigated the existence of the strong-form efficient market hypothesis in the Nigerian capital market for the period 1986 to 2010. The empirical analysis was conducted employing the Autoregressive Conditional Heteroscedasticity (ARCH) and Generalized Autoregressive Conditional Heteroscedasticity (GARCH) models. The empirical results revealed that the Nigerian capital market was weak-form efficient.

(Potocki & Swist, 2012) the study examined the strong form of market informational efficiency, based on the assumption that the institutions issuing recommendations have access to information inaccessible to the community of investors. The research sample consists of 3,270 recommendations produced between 1 January 2005 and 31 March 2010 by 63 financial entities regarding companies making up the WIG 20 index. The results disclosed the evidence for the efficient market hypothesis that the strong form efficiency is characteristic of the WIG 20 index shares listed on the Warsaw Stock Exchange.

(Oladapo & Ayowole, 2013) the study investigates empirically the efficiency of the Nigerian Stock Market and to test whether professionally managed funds beat the market index or not. In this research the monthly returns of five banks over the period 2007 to 2011 were used. The "market model" for estimating residuals were used to test the efficiency of the Nigerian Stock Market. The excessive return of the professionally managed portfolio is found to be insignificantly different from zero. The Nigerian Stock Market discloses the result of strong form of efficiency.

Based on the afore-mentioned literature on the different forms of efficient market hypothesis, one can safely say the following: there are mixed findings for both forms of efficient market hypothesis, ranging from those disproving, having the same opinion, and no relationship at all. There are also different methodological approaches whether it is cross-country or individual country's studies. There is disparity in terms of data frequency used. There seem to be only one cross-country study by (Mlambo & Biekpe, 2007) that relates to Namibia. This study fills two gaps in the time gap and that it is country-specific looking at strong form efficiency in Namibia's capital market. It is in opposition to this background, the study plans to fill the gap and contribute to the empirical literature for Namibia.

(Cicek, 2014) the study examined the within-country market efficiency of the Turkish foreign exchange markets based on the forward rate unbiasedness hypothesis, in case of the exchange rate between Turkish lira and US dollar and the Turkish lira and Euro for the period February 5, 2005, through July 26, 2013. The study applied the unit root test and Johansen cointegration method. Unit root tests on the spot and forward exchange rates confirm that they are non-stationary but the first differencing of these variables makes them stationary. Hence, the unit root test results provide evidence for an efficient market hypothesis in its weak form, indicating all exchange rates follow a random walk. The Johansen integration test results specify that the forward rates are unified with its corresponding spot rate with a unitary cointegrating vector (1, -1). This suggests that the forward rate equitable hypothesis does not hold, advising the failure of market efficiency in its semi-strong form. The evidence presented for the forward rate unbiasedness hypothesis refers that the forward rates are an unbiased predictor of the future Spot Rate.

Hypotheses, Data, and Methodology

The purpose of this paper is, first, to examine the random walk hypothesis (RWH) by testing the weak-form efficiency in the NEPSE returns. Therefore, the hypothesis to be tested is: H0: Stock prices on the NEPSE follow the random walk model. H1: Stock prices on the NEPSE do not follow the random walk model.

The study aims to test the random walk behavior of stock market returns on NEPSE Index, Float index; sensitive index, and sensitive float index of the Nepalese capital market from February 2015 to February 2020. The Dividend distribution, new issue of equity share, and share repurchase are adjusted in stock price. The data are sourced from the official website of NEPSE the market daily return for t is calculated as

$$\mathbf{Rt = \log(P1t/P1t\text{-}1)}$$

Where, Rt is the market returns at period t, PIt is the price index at period t, PIt-1 is the price index at period t-1, and Ln is the natural log. The natural logarithm is used as it is more likely to be normally distributed.

Several tests were used in the literature to examine whether stock prices follow the random walk model. This study applies a variance ratio test. In this section, the method of conducting each test and the rationale behind it are explained.

Variance Ratio Test

The Lo and Mackinlay variance ratio test is believed to be more powerful than the DickeyFuller unit root or the autocorrelation Q tests for testing the predictability in stock price series (Lo and Mackinlay, 1989). The variance ratio test statistics is based on the assumption that the variance of increments in the random walk series is linear in the sample interval. That is to say, if a series follows a random walk, the variance of a qth differenced variable is q times the variance of its first differenced variable

$$\mathbf{Var\ (Rt - Rt\text{-}q\ ) = q\ Var\ (Rt - Rt\text{-}1)\ (8)}$$

The variance ratio is then calculated as:

$$\mathbf{VRq= Var\ [Rt(q)]/q.Var[Rt]}$$

The null hypothesis is that the variance ratio at lag q is defined as the ratio of the variance of the q-period return to the variance of the one-period return divided by q, which should equal to one under the random walk hypothesis. If any of the estimated variance ratios differ significantly from one, then the random walk hypothesis is rejected. Lo and MacKinlay (1988) developed two test statistics to test the null hypothesis, one is with the assumption of homoscedasticity increments Z (q) and the other is with the assumption of heteroscedasticity increments Z*(q).

Empirical Results

The joint test is the tests of the joint null hypothesis for all periods while the individual test is the variance ratio test applied to individual periods. Table 1 in the appendix clearly shows that the random walk null hypothesis is not rejected for the Nepalese stock market, based on the return of the NEPSE index. The results are quite similar for individuals as well as a joint hypothesis. In all individuals, since the study specified more than, there are two sets of test results. The period and joint test, variance ratio static P-value are higher than alpha (5% level of significance).as well as Z statistics also less than the degree of freedom at 5% level of significance.so, Stock prices on the NEPSE follow the random walk model, and the investors unable to earn abnormal profit from the stock market. From the table 2, 3 and 4in the appendix, the null hypothesis is rejected of the return of Nepalese capital market based on the return of Float index, sensitive float index and sensitive index from the result of both joint and individual test have lower statistical P-value than 0.05 (5% level of significance) as well as Z value is more than table value at 5% level of significance. So the test is significant and Stock prices on the NEPSE do not follow the random walk model. This implies that investors able to earn an excessive return from the Nepalese stock market. From the empirical analysis, there are conflicting results between the NEPSE index and other indices.

Concluding Remarks

Whether stock prices behave randomly or not has attracted the attention of a wide range of researchers from both industry and academic institutions that conduct extensive research on the random walk of stock price and document mixed findings. As it involvement whether the stock prices are foreseeable taking their past historical data, the topic has become one of the important research over many years. The article examines the random walk hypothesis using fresh data from Nepalese stock market indexes from February 2015 to February 2020. We find that the NEPSE index follows a random walk. Results, however, indicate that the other three follow non-random walk. Further research can be made to investigate whether the Nepalese stock market using weekly and monthly data. Other research can be made using other statistical tools like Runs test, Autocorrelation test, and Unit root test. And further research can be constructed for all the other industries separately.

Works Citation

Chiwirw, O., & Muyambiri, B. (2012). A Test of Weak Form Efficiency for the Botswana Stock Exchange. British Journal of Economics, Management & Trade.

Cicek, M. (2014). A Cointegration Test for Turkish Foreign Exchange Market Efficiency. Asian Economic and Financial Review.

Cootner, P. (1962). Stock Price Random vs systematic Changes. Industrial Management Review.

Fama, E. (1965). Random Walk in Stock Market Prices. Financial Analyst Journal.

Fama, E. (1965). The Behaviour of Stock Market Prices. Journal of Business.

Fama, E. (1995). Random Walk Stock Market Prices. Financial Analyst Journal.

Gilani, S. N. (2014). Testing the Weak Form Efficiency of Islamabad Stock Exchange. Developing Country Studies.

Grossman, S., & Stiglitz, J. (1980). On the Impossibility of Informationally Efficient Markets. American Economic Review.

Kamera, D., Ojha, K., & Cole, J. (1999). RandomWalk and Market Efficiency Test: Evidence from Emerging Equity Markets. Review of Quantitative Finance and Accounting.

Lim, K., & Brooks, R. (2010). Why Do Emerging Stock Markets Experience More Persistent Price Deviations from a Random Walk over Time? A Country-Level Analysis. Macroeconomic Dynamics.

Lo, A., & Mackinlay, A. (1988). Stock Market Prices do not Follow Random Walks: Evidence from a Simple Specification Test. Review of Financial Studies.

Lo, A., & Mackinlay, A. (1999). ANon Random Walk Down Wall Street. Princeton University Press.

Lucas, R. (1978). Assets Pricing in an Exchange Economy. Econometrica.

Malkiel, B. (1973). A Random Walk Down Wall Street. W.W.Norton.

Mlambo, C., & Biekpe, N. (2007). The Efficient Market Hypothesis: Evidence from ten African countries. Investment Analysis Journal.

Ojo, O., & Azeez, B. (2012). A Test of Strong-Form Efficiency of the Nigerian Capital Market. Business Systems Review.

Oladapo, F. &., & Ayowole, A. (2013). An Empirical Analysis of Efficiency of the Nigerian Capital Market',. Research Journal of Finance and Accounting.

Potocki, T., & Świst, T. (2012). Empirical Test Of The Strong Form Efficiency Of The Warsaw Stock Exchange: The Analysis of Wig 20 Index Shares, South-Eastern Europe'. Journal of Economics.

Sing, S., & Sapna, K. (2013). Weak form efficiency of selected Asian stock exchange. International Journal of 360°Management Review.

Appendixes

Table 1

Nepse index

Null Hypothesis: NEPSE index return is a martingale
Date: 06/13/20 Time: 15:03
Sample: 1 1165
Included observations: 1163 (after adjustments)
Heteroskedasticity robust standard error estimates
User-specified lags: 2 4 8 16

Joint Tests		Value	df	Probability
Max |z| (at period 2)*		1.008005	1163	0.7778
Individual Tests				
Period	Var. Ratio	Std. Error	z-Statistic	Probability
2	0.496027	0.499971	-1.00801	0.3135
4	0.248848	0.749972	-1.00157	0.3165
8	0.125305	0.87498	-0.99968	0.3175
16	0.063495	0.937484	-0.99896	0.3178

*Probability approximation using studentized maximum modulus with parameter value 4 and infinite degrees of freedom
Test Details (Mean = 5.39670508284e-06)

Period	Variance	Var. Ratio	Obs.
1	17.7043	--	1163
2	8.78179	0.49603	1162
4	4.40567	0.24885	1160
8	2.21843	0.1253	1156
16	1.12413	0.06349	1148

Table 2

Float index

Null Hypothesis: Float index return is a martingale
Date: 06/13/20 Time: 16:59
Sample: 2/15/2015 2/15/2020
Included observations: 1167 (after adjustments)
Heteroskedasticity robust standard error estimates
User-specified lags: 2 4 8 16

Joint Tests		Value	df	Probability
Max |z| (at period 4)*		7.400019	1167	0
Individual Tests				
Period	Var. Ratio	Std. Error	z-Statistic	Probability
2	0.6415	0.052825	-6.786513	0
4	0.320679	0.0918	-7.400019	0
8	0.160574	0.129589	-6.477616	0
16	0.078588	0.171991	-5.357328	0

*Probability approximation using studentized maximum modulus with parameter value 4 and infinite degrees of freedom
Test Details (Mean = 5.88910711225e-06)

Period	Variance	Var. Ratio	Obs.
1	0.00021	--	1167
2	0.00014	0.6415	1166
4	6.80E-05	0.32068	1164
8	3.40E-05	0.16057	1160
16	1.70E-05	0.07859	1152

Table 3

Sensitive float index

Null Hypothesis: sensitive float return is a martingale
Date: 06/13/20 Time: 17:17
Sample: 2/01/2015 2/01/2920
Included observations: 904 (after adjustments)
Heteroskedasticity robust standard error estimates
User-specified lags: 2 4 8 16

Joint Tests		Value	df	Probability
Max |z| (at period 4)*		6.544749	904	0.0000
Individual Tests				
Period	Var. Ratio	Std. Error	z-Statistic	Probability
2	0.655345	0.058271	-5.914737	0.0000
4	0.336337	0.101404	-6.544749	0.0000
8	0.171786	0.143883	-5.756173	0.0000
16	0.083177	0.191361	-4.791066	0.0000

*Probability approximation using studentized maximum modulus with parameter value 4 and infinite degrees of freedom

Test Details (Mean = 3.54880088496e-06)

Period	Variance	Var. Ratio	Obs.
1	0.00025	--	904
2	0.00016	0.65535	903
4	8.3E-05	0.33634	901
8	4.2E-05	0.17179	897
16	2.1E-05	0.08318	889

Table 4

Sensitive index
Null Hypothesis sensitive index return is a martingale
Date: 06/13/20 Time: 18:52
Sample: 2/15/2015 2/15/2020
Included observations: 1167 (after adjustments)
Heteroskedasticity robust standard error estimates
User-specified lags: 2 4 8 16

Joint Tests		Value	df	Probability
Max |z| (at period 4)*		7.464316	1167	0
Individual Tests				
Period	Var. Ratio	Std. Error	z-Statistic	Probability
2	0.644442	0.052156	-6.81715	0
4	0.322878	0.090715	-7.46432	0
8	0.165158	0.128355	-6.50417	0
16	0.079424	0.170817	-5.38925	0

*Probability approximation using studentized maximum modulus with parameter value 4 and infinite degrees of freedom

Test Details (Mean = 3.65933847472e-06)

Period	Variance	Var. Ratio	Obs.
1	0.0002	--	1167
2	0.00013	0.64444	1166
4	6.30E-05	0.32288	1164
8	3.20E-05	0.16516	1160
16	1.60E-05	0.07942	1152