THE INTERNATIONAL JOURNAL OF BUSINESS & MANAGEMENT

Random Walk Hypothesis and Security Return in Nigeria

Omuemu Stanley Osasere
Research Assistant, Department of Finance, University of Lagos, Nigeria

Abstract:
This paper was set out to validate the random walk hypothesis on security returns in the Nigeria. The primary objective was to investigate the hypothesis of random walk on security returns in the Nigeria capital market.This study made use of data collected annually from the Nigerian stock exchange (NSE) between 1986- 2017. However, in order to validate the theory of RW in the Nigeria bourse, unit root test was adopted and the hypothesis was tested at a critical value of 5% and 10% respectively. It was revealed from the analysis that the Nigeria capital market is currently nonrandom. This implies that and participant can outperform the market with past return if they can efficiently allocate their asset. We therefore recommended that investors should put into consideration the trend of movement of returns in other to maximize their portfolio.

Keywords: *Random walk hypothesis, Unit root, Autocorrelation and weak form efficiency*

1. Introduction

1.1. Background to the Study

The theory of random walkstates that stock prices follows an independent pattern, this implies that prices of stock in the future cannot be determined by past prices of security(Brealey, Myers & Allen, 2005). According to Mbat (2001), the theory of random walk implies statistically independence between future prices and their historical prices of stock in the Nigeria stock market. Importantly, RW theory is concern with prediction of prices of stock in the future based on the past prices. The theoretical underpin behind the RWH is that the future prices of stocks are independent of current prices and that the past prices fluctuate randomly about the current value or prices (Gupta, 1985). The RW theory is of the opinion that the market does not have memory about past event. That is the past event cannot be used to predetermine the future price (Gupta, 1985).

Samuelson (1965), the unstable nature of the prices stock in the market is as a result of the erratic behavior of active participant seeking abnormal returns. However, this can be as a result of the excess information at their disposal which will be applied to their investment policy and thus takes advantage of the opportunity that makes them more random. RWH states that stock market information is uninhibitedly and promptly accessible and that there are numerous market participants with adequate assets to exploit any benefitting chance emerging from methodical value developments of an individual stock. These members contend with one another making all non-arbitrary vacillations too little to possibly be abused productively (Seelenfreund, 1968). The RWH is of the opinion that information in the market is frictionless and available and there are numerous competing institutional and individual participants in the capital market with the expectation of abnormal return arising from a nonrandom movement in the asset values. The fallout of the theory was based on the fact that prices of security in most case maintain a trend overtime, and by so doing active portfolio managers can outperform the market since the current fundamental value can be ascertain based on the past this will be achieve by a technical selection of asset allocation. This current paper was conducted to analyze the recent behavior of the stock market so as to ascertain if the follows a predictive pattern or otherwise. The study also attempts to fill the gap by examining various methodologies to confirm the behavior of the security market in Nigeria. Importantly, there is therefore a need to study the RWH in the Nigerian capital market since it is a developing market and being a market in with the largest all share index in Africa. To this end, the primary focus of this paper was to validity of the random walk hypothesis on security returns in an emerging economy using Nigeria as a case study.

2. Literature Review

2.1. Conceptual Framework

The theory of random walk is model of interest in the today's financial environment. Campbell, Lo &MacKinlay (1997), stated that the hypothesis has three approaches to its definition based on the increments and the dependence in different distinct time intervals.

2.1.1. Random walk

The first definition was based on independent increment, it was assumed that there is dependency of increments and can be drawn from different form of distributions. However, variation based on the time is necessary as far as there is independency of increments. The first version of the RWH implies that increments do not have memory that is they are independent and are drawn from and identical distribution (IID) increments. Also, it assumed that the increment distribution have the same mean and variance. It simplified form of dynamics is the following:

Equation

$$X_t = X_{t-1} + \varepsilon_t,\ \varepsilon_t \sim IID\ (0, \sigma^2) \quad \text{..... 1}$$

and the increment is defined as:

$$r_t = X_t - X_{t-1} \quad \text{..... 2}$$
$$= \varepsilon_t,\ \varepsilon_t \sim IID\ (0, \sigma^2)$$

where , {Xt} is the dependent variable meaning current price, $\{\varepsilon_t\}$ is the disturbance term with an average value of zero distribute, while the variance $\sigma^2$and $\{r_t\}$ is the increment sequence. The IID increments give a sound insight about the theory of random walk. The popular assumption of incremental distribution is the normality of the error term of the white noise. Equation below was given based on this process:

$$X_t = X_{t-1} + \varepsilon_t,\ \varepsilon_t \sim IID\ (0, \sigma^2) \quad \text{.....3}$$

The second definition of random walk is independent increments which are derived from several distributions. Also, the element of time variation is also allowed in this definition given that the increments are independent. Independent assumes that both disjoint and non-linear functions of increments are not correlated:

$$Cov\big(f(r_h), g(r_k)\big) = 0, for\ any\ f, g\ and\ disjoint\ h, k \quad \text{.....4}$$

The third definition was based on a more relax assumption of the RWH. The assumption of independence was further relaxed. This definition was popular definition of RWH. The definition only assumed no correlated increments. In this case, the covariance of the two increments are equal to zero $Cov(r_h, r_k) = 0,$. Thus, this is the most relax definition of RWH. Importantly, all the three (3) definition has some properties in common. Conclusively, there is unit root in the RW process due to the unbounded and increasing variance. Thus, it is important to study the RWH in and emerging economy like Nigeria.

The random walk model has become a hypothesis for testing the capital market efficiency in the weak form. However, the theory has been proven among stock markets since the study of Lo and MacKinley (1988, 1989). The theory has been justified in several developed equity market that the stock prices has no memory of past information and that in a developed stock market, the theory is sometimes not justified(Kendall & Hill, 1953; Fama, 1965; Dryden, 1970;Solnik, 1973; Granger and Morgenstern, 1963).

Several studies has tested the validity of the random walk in developed and emerging countries, however, findings from these studies reveals that the capital market of developed countries has no memory mean they follow a random walk (Groenewold, 1997; Hudson, Dempsey, and Keasey, 1996; Sung and Johnson, 2006; Hawawini and Michel, 1984; Evans, 2006), whereas for an emerging country like Nigeria has a different result and somehow mix outcomes.

2.2. Empirical Framework

According to Ngene,Tah, and Darrat (2017) an investigation was carried out on 18 developing countries in order to validate the RWH model and to ascertain the random nature of the security market in the weak form within the sight of structural breaks for the timeframe of December 1987 to April 2013. The RWH model is dismissed within the sight of single break model and was predictable with various auxiliary breaks.

Further, Said and Harper (2015) carried out a study on the weak form of efficiency by testing the model of the random walk in Russian stock market. They employ the, the autocorrelation, Box-Ljung test statistics and the variance ratio test on the daily data of July 2003 to December 2012. The result reveals that the stock market of Russian follows a random walk. That is the market is not weak form efficient.

Gozbasi, Kucukkaplan, and Nazlioglu (2014) contemplated the Turkish securities exchange market by leading a non-linear unit root test. Day by day information was gathered structure Borsa Istanbul composite index and three diverse area files (industry part, administration division and money related segment) for the timeframe of July 2002 to July 2012. It was discovered that the market is efficient in the weak form

Tiwari and Kyophilavong (2014) tested the RWH by utilizing month to month data of BRIC (Brazil, Russia, India and Cgina) security records, for the timespan 2000 to 2010 through applying the wavelet based unit root test. Results neglects to accept the hypothesis of primary interest that there is no unit root in BRIC nations (aside from Russia league) which propose efficiency in the weak form. Further, Mobarek and Fiorante (2014) additionally inspect the efficiency in the weak form in BRIC nations for the timespan of September 1995 to March 2010. They utilize Runs test and Variance ratio to test the model. They find that BRIC markets are moving toward a condition of being weak-form efficient.

Obayagbona and Igbinosa (2014) investigated the information efficiency of the Nigeria capital market in the weak form from January 2006 to December 2011. The random walk test depended on autoregressive model in other to ascertain

the dependency of current stock prices on the pastin the Nigerian Stock Market. The general outcomes propose Nigerian Stock Market being an emerging market is not in a weak form efficient.

Nwidobie (2014) further examination of the theory of random walk in Nigeria reveals a conflicting result. The researcher collect data of all share index was gathered from the NSE from January 2000 to December 2012. The investigation embraced the Augmented Dickey-Fuller (ADF) test indicating that the prices of securities do not follow the random walk, mean past price can be used to predict future prices in the Nigerian capital market. Results additionally demonstrate the presence of inefficiencies in the Nigerian capital market.

Afego (2012) analyzes the weak form of market efficiencyin the Nigerian financial market by testing for random walk in the month to month list returns over the period 1984-2009. The result form the test show that the return forms the stock index display predictability in the Nigeria stocks, accordingly proposing that traders can acquire unrivaled returns by utilizing trading rules. Notwithstanding, Chigozie (2010) did a comparative report on the random walk theory in the Nigeria securities exchange (from the period 1984 to 2006). The method used was the GARCH. The outcome shows that the Nigerian securities market returns followa random walk. This in this manner suggests that the financial market is certainly not in a weak form efficient. We can therefore conclude that the price of stock cannot be predicted.

Udoka (2012) studied the efficiency of the Nigerian Stock Exchange (NSE) with month to month time arrangement information and utilized common least square (OLS) determine the efficiency of the NSE and found that the Share Price Index is measurably noteworthy (for example market is efficient in the weak form). Further test found that an educated financial specialist can make capital gain from the price differential coming about because of the way that the t-value is more prominent than the p-value.

Mayowa& Richard (2012) likewise investigated the information efficiency in the weak form in the stock market in Nigeria. Data was collected was the All Share Index from 2001 to 2010 was analyzed utilizing serial correlation technique. Discoveries uncover that the adjustments in cost of stock in the NSE are random and typically appropriated. They in this way presumed Nigerian Capital Market is proficient in the powerless structure.

Okpara (2010) explore whether Nigerian Stock Exchange (from the period 1984 to 2006) follows a random walk. To complete the examination, the Generalized Autoregressive Conditional Hetroseskedasticity (GARCH) was utilized. The outcomes show that the Nigerian securities exchange follows a random walk and is therefore weak form efficient.

Osamwonyi and Anikamadu (2002) conducted an investigation on the weak form of efficient in the Nigerian bourse by utilizing the runs test techniquesthe examination collected a month to month data starting from Monday closing prices of twenty-five selected stocks, with each stock having (50) cases spanning January 1990 to June 2002. It was found that from the empirically examination that that prices of stocks in the Nigeria stock market are weak form efficient. The implication to this fact is that the market prices are not randomand also the market is not efficient and abnormal return can be earned as the case may be.

Olowe (1999) analyzed proof of efficiency in the weak form of the NSE using correlation test on month to month returns information of 59 individual stocks listed on the NSE over the period January 1981 to December 1992. The outcomes provide support for crafted by Samuels and Yacout (1981) and Ayadi (1984), that is, the NSE is efficient in the weak form.

3. Methodology and Model Specification

This part of this paper gives a view of the design, the techniques the modalities the researcher used to validate the random walk hypothesis. It displays a cautious depiction of information gathered and information sources just as model determination. This investigation utilized yearly information gathered from the Nigerian stock trade (NSE) between1986-2017. This investigation used the normal yearly return of all share index in the Nigeria bourse. This information which was absolutely secondary was gathered from the yearly report of the Nigeria stock market in 2017.

3.2. Model Specification

A model is a mathematical expression of economic phenomenon. For this study, we use the random walk model with independent and identical distributions

Model 1

$r_t=\alpha + r_{t-1} + \epsilon_t$, $\epsilon_t \sim IIDN(0,6^2)$ ……5

Where:

Dependent variable

r_t = Securities returns under investigation

Independent variable

r_{t-1} = past securities returns under investigation

α = Drift parameter (i.e. the expected return change)

ϵ_t = Random error term

IIDN $(0,6^2)$ = Independent and identically distributed as a normal distribution with Zero mean and homoscedastic variance.

The data presented is the return of Nigeria all share data between 1986 and 2017. The return was calculated as below

$rt = (ASI_t - ASI_{t-1})/ ASI_{t-1}$……6

Where:

ASIt = All share index at time t

ASIt-1 = All share index at past period.

3.3. Data Analysis Techniques

Several methods were conducted to validate the random walk model. This current study utilized the unit root test to validate the stationarity or non-stationarity of the return series in the Nigeria stock market. Also, autoregressive model was adopted in this current paper to test the randomness of returns in the Nigeria stock exchange. The autoregressive model specifies that the current return of stock variable is dependent on the previous stock price and on a stochastic term. In conclusion of theautoregressive (1) model, if B_1<1 (The series is called stationary, meaning that the mean level and variance do not change over time), B_1= 1 (The series has no mean level and, thus, is called nonstationary) and B_1 >1 (series is explosive and also nonstationary)

4. Presentation and Analysis Of Results

The test on the validity of the random walk in Nigeria capital was presented in this section based on the unit root conducted. The estimated outcome of the specified model using unit root to test for their stationary represented below in the following table.

Null Hypothesis: RASI has a unit root

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.638840	0.0106
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(RASI)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RASI(-1)	-0.627017	0.172312	-3.638840	0.0011
C	15.18461	6.969452	2.178738	0.0376

R-squared	0.313466
Adjusted R-squared	0.289792
Durbin-Watson stat	1.772685
F-statistic	13.24116
Prob(F-statistic)	0.001056

Table 1: Unit Root Test Result
Source: Author's computation, 2019

For the ADF statistics, the 99%, 95%, and 90% critical values are shown after each ADF test critical value at the left hand side of second column of table 1. The data was discoverednot to contain a unit root at level. This implies that is the null hypothesis which is the hypothesis of primary interest was rejected that there the return of the stock market has unit root. This can be seen by comparing the observed values of the ADF test statistics at 5% and 10% levels of significance with the computed ADF test-statistic.That is if the absolute value of ADF statistics is greater than the critical values at 10%, 5%, significant level, respectively, therefore we can reject Ho. This implies that past return value of the all share of the Nigeria stock market has a significant effect on the current value. We can therefore conclude that the market is a weak form efficient within the time frame of our analysis. This means that theory of the random walk that security market is memoryless and that current price is independent of the past prices of stock in the Nigeria bourse do not hold.

ARIMA regression

Sample: 1986 - 2017 Number of obs = 32
Wald chi2(1) = 2.32
Log likelihood = -8.222786 Prob > chi2 = 0.1277

averageasit	Coef.	OPG Std. Err.	z	P>|z|	[95% Conf.	Interval]
averageasit						
_cons	.2395525	.0799877	2.99	0.003	.0827794	.3963256
ARMA						
ar						
L1.	.3051243	.2003015	1.52	0.128	-.0874594	.697708
/sigma	.3123899	.0386667	8.08	0.000	.2366045	.3881752

Table 2: Simple Autocorrelation Test
Source: Author's computation, 2019

The table above presents a simple autoregressive model with an order 2. From the analysis, the dependent variable was regressed on itself with a lag using stata 13. The dependent variable here represents the return of Nigeria stock market index.We also observed that the coefficient of the AR(1) model (0.305) is less 1 as such the series is stationary, meaning that the mean level and variance do not change over time. This implies that past return of the all share of the Nigeria stock market affect the current value but its effect is insignificant. We can therefore conclude that the Nigeria stock market return is a weak form efficient which confirm with the findings of (Olowe 1999 and Omuemu 2013).

5. Conclusion and Recommendation

This current study adopted data from the Nigeria capital market in other to validate the random walk theory. Unit root test was adopted and the hypothesis was tested at a critical value of 5% and 10% respectively. The findings from the analysis reveal that the Nigeria capital market is currently nonrandom. This implies that and participant can outperform the market with past return if they can efficiently allocate their asset. This means that investors can gain abnormal returns from the opportunity disclosed in the market. Conclusively, the Nigeria capital market does not follow a random walk. We can therefore recommend that investors should put into consideration the trend of movement of returns in other to maximize their portfolio. Also, it was recommended that should establish and agency that will ensure early dissemination of price and price movements, financial results, and close of day information which are vital to investors and their investment decisions.

6. References

i. Afego, P. (2012). Weak form efficiency of the Nigerian Stock Market: An Empirical Analysis (1984 – 2009). *International Journal of Economics and Financial Issues*, 2(3), 340-347
ii. Brealey, R.A., Myers, S.C. & Allen, F. (2005).*Corporate Finance*: 8th Edition. New York: McGraw-Hill Irwin.
iii. Campbell, J.Y., Lo, A.W. & A.C. MacKinlay, (1997). *The econometrics of financial markets*. Princeton University Press: Princeton, New Jersey
iv. Chigozie, O.G., (2010). Analysis of weak-form efficiency on the Nigerian Stock Market: Further Evidence from GARCH Model. *The International Journal of Applied Economics and Finance, 4: 62-66.*
v. Dryden, M., (1970). Filter Tests of UK Share Prices. Applied Economics.
vi. Evans, T. (2006). Efficiency tests of the UK financial futures markets and the impact of electronic trading systems. *Applied Financial Economics*, 16(17), 1273-1283
vii. Fama, E. (1965). The behaviour of stock market prices.*Journal of Business*, 38, 34-105
viii. G. A. Mayowa, & O. Richard, (2012).Testing the weak form of efficient market hypothesis in Nigerian Capital Market.*Accounting and Finance Research*, 1(1).
ix. Gozbasi, Onur&Kucukkaplan, Ilhan&Nazlioglu, Saban, (2014). tests. Economic*, Elsevier,* 38(C), 381-384.
x. Granger, J.W.C. & Morgenstern, O., (1963). *Predictability of stock market prices*. Massachusetts: D.C. Heath and & Co.
xi. Groenewold, N., (1997). Share market efficiency: Tests using daily data for Australia and New Zealand, Applied financial economics 7: 645-657. doi:10.1080/758533856
xii. Hawawini, G. & Michel, P. (1984).*European equity markets: A Review of the Evidence on Price Behavior and Efficiency in European Equity Markets*: Risk, Return and Efficiency, Garland Publishing Company, New York and London
xiii. Hudson, R., Dempsey, M., &Keasey, K. (1996). A note on the weak-form efficiency of capital markets: The application of simple technical trading rules to UK Stock prices-1935 to1994. *Journal of Banking & Finance,* 20, 1121-1132.
xiv. Kendall, M., G., & Hill, A. B., (1953). The analysis of economic time-series – Part 1: Prices. *Journal of the Royal Statistical Society*, Series A, 16 (1), 11-34
xv. Lo A.W. &MacKinlay A.C. (1988). Stock market prices do not follow random walk: Evidence from a simple specification test. *The Review of Financial Studies*, 1, 41-66
xvi. Lo, A.W. &MacKinlay, A.C. (1989). The size and power of the variance ratio test in finite samples. A Monte Carlo Investigation.*Journal of Econometrics,* 40, 203-238.
xvii. Mbat, D. O. (2001). *Financial management*. Domes Associates Publishers. Uyo, Nigeria First Edition.
xviii. Mobarek, A. &Fiorante, A. (2014). The prospects of BRIC countries: Testing weak-form market efficiency. *Research in International Business and Finance*, 30, 217-232.
xix. Ngene, Geoffrey &Tah, Kenneth A. &Darrat, Ali F., (2017).Long memory or structural breaks: Some evidence for African stock markets. *Review of Financial Economics, Elsevier,* 34(C), 61-73.
xx. Nwidobie, B. M. (2014). The Random walk theory: An empirical test in the Nigerian capital market. *Asian Economic and Financial Review*, 4(12), 1840-1848.
xxi. Obayagbona, J &Igbinosa, S. O. (2014). Test of random walk hypothesis in the Nigerian Stock Market. *Current Research Journal of Social Sciences* 7(2), 27-36.
xxii. Okpara, G. C. (2010). Analysis of weak form efficiency on the Nigerian Stock Market: Further Evidence from GARCH Model. *The International Journal of Applied Economics and Finance*, 4(2), 62 – 66.
xxiii. Olowe, R.A. (1999). Weak form efficiency of the Nigerian Stock Market: Further Evidence*. African Development Review*, 11(1), 54-68.
xxiv. Osamwonyi, I.O. & M.O. Anikamadu, (2002). The Nigerian stock market, efficient market hypothesis and the run test. Niger. *J. Bus. Admin*., 4(2): 30-53.

xxv. Said, A., & Harper, A. (2015). The efficiency of the Russian stock market: A revisit of the random walk hypothesis. *Academy of Accounting and Finance Studies Journal*, 19(1), 42-48.

xxvi. Samuelson, P. (1965). Proof that properly anticipated prices fluctuate randomly. *Industrial Management Review,* 6(2), 41- 49.

xxvii. Seelenfreund, A., Parker, C.G. & Van, J. C. (1968).Stock price behavior and trading.*Journal of Financial and Quantitative Analysis*, 3, 263-281

xxviii. Solnik, B.H., (1973). A note on the validity of Random Walk for European Stock Prices.*Journal of Finance.* 28, 5: 1151 – 1159.

xxix. Sung, M. & Johnson, J. (2006). A new perspective on weak form efficiency: empirical evidence from the UK bookmaker based betting market. In, The 13th International Conference on Gambling & Risk Taking, Nevada, USA, 22-26.

xxx. Tiwari, A. K., &Kyophilavong, P. (2014). New evidence from the random walk hypothesis for BRICS Stock Indices: a Wavelet Unit Root Test Approach. *Economic Modelling*. 43: 38-41.

xxxi. Udoka, C. O (2012). Weak form market efficiency: Dynamic effects of information on the Nigerian stock market. *Interdisciplinary Journal of Contemporary Research in Business* 4 (7) 417-429

xxxii. Olowe, R.A. (1999), *Weak Form Efficiency of the Nigerian Stock Market: Further Evidence,* African Development Review, 11(1), 54-68.

xxxiii. Omuemu O.S (2013)Weak Form Market Efficiency in the Nigerian stock market: Using the Variance Ratio test. University of Lagos. Unpublished