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RANDOM WALK HYPOTHESIS AND SECURITY RETURN IN NIGERIA (1986-2017)

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Abstract

This study examines the random walk hypothesis on security returns in the Nigeria. The primary objective was to test random walk hypothesis on security returns in the Nigeria capital market.This study made use of annual data collected from the Nigerian stock exchange (NSE) between 1986- 2017. However, in order to validate the random walk theory in the Nigeria bourse, 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. 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, Nigerian stock exchange, Unit root, Autocorrelation and weak form efficiency*

INTRODUCTION

Background to the study

The random walk model states that the prices of stocks follows an independent pattern, this implies that future prices have no relationship with historical prices of the same stock (Brealey, Myers & Allen, 2005). According to Mbat (2001), the random walk theory implies that the prices of stocks are statisticallyindependent between future prices of stock and their past prices. Importantly, the random walk hypothesis is concern with the prediction of future prices based on the past prices. The theoretical underpin behind the random walk hypothesis is the future prices of stocks are independent of current prices and that the pact prices fluctuate randomly about the current value or prices (Gupta, 1985).The

random walk theory is of the opinion that the market does not have memory about past event. That is the past event can be used to predict future price(Gupta, 1985).

Samuelson (1965), randomness in the stock market is as a result of the erratic behavior of active participant in the stock market seeking for 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 give rise to their behavior.The theory of 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 theory of random walk is of the opinion that market information is frictionless and readily available and there are numerous competing participants in the market with the expectation of making excess profit from the market arising from a nonrandom movement in the stock prices. The fallout of the theory was based on the fact that stock prices 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. According to Campbell, Lo &MacKinlay (1997), there are three main definition of the theory, depending on the nature of increments, and the dependence that exists between increments in different distinct time intervals.

Random walk

The first definition was based on independent increment, it was assumed that all increments are independent and can be drawn from differently from various distributions. However, variation based on the time is necessary as long as the increments are independent. Independent is an assumption that not only disjoint increments are uncorrelated, but it also implies any of the non-linear functions of increments are uncorrelated. The first version of the random walk hypothesis 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 form the same distribution have the same mean and variance. The simplest form of the dynamics is the following:

Equation

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

and the increment is defined as:

$$r_t = X_t - X_{t-1} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ 2$$

$$= \varepsilon_t,\ \varepsilon_t \sim IID\ (0, \sigma^2)$$

Where, {Xt} is the dependent variable meaning current price, $\{\varepsilon_t\}$ is the white noise with a distributed of mean 0 and variance 6^2, and $\{r_t\}$ is the increment sequence. The assumption of IID increments is often too strong and theoretical, but it provides good insight about the behaviour of random walk in general. The most common distributional assumption of the increments ε_t is normality. The process is given by the following equation:

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

The second definition of random walk is independent increments which can be drawn from different distributions. Also, the element of time variation is also allowed in this definition as long as the increments are independent. Independent assumes that both disjoint increments and non-linear functions of increments are uncorrelated:

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

The third definition was based on a more relax assumption of the RWH. The assumption of independence was further relaxed. This definition was a more general version of the RWH. The version only assumed uncorrelated increments. In this case, the covariance of the two increments are equal to zero $Cov(r_h, r_k) = 0,$. Thus this is the weakest form of the random walk hypothesis. Importantly, all the three definition has some properties in common.

Conclusively, the random walk processes are non-stationary because of unbounded and increasing variance. Thus, it is important to study the RWH in and emerging economy like Nigeria.

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

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 (Evans, 2006; Groenewold, 1997; Hawawini and Michel, 1984; Hudson, Dempsey, and Keasey, 1996; Sung and Johnson, 2006), whereas for an emerging country like Nigeria has a different result and somehow mix outcomes. Based on the above argument it is worthwhile to study the random walk hypothesis in the Nigerian stock market since it is an emerging market and being one of the market in African with the largest all share index. To this end, the primary objective of the study is to test the validity of the random walk hypothesis in an emerging economyusing Nigeria as a case study.

EMPIRICAL FRAMEWORK

Ngene, Tah, and Darrat (2017) performed a comprehensive analysis on 18 emerging countries including Turkey, Thailand, South Africa, Russia, Poland, Philippines, Morocco, Mexico, Malaysia, Korea, Indonesia, India, Egypt, Colombia, China, Chile, Brazil, and Argentina. The purpose is to test the RWH model in these countries in the presence of structural breaks for the time period of December 1987 to April 2013. The RWH model is rejected in the presence of single break model but the findings are consistent with the RWH models in the presence of multiple structural breaks.

Further, Said and Harper (2015) examined the weak form efficiency of Russian stock market testing the Random walk hypothesis model. They follow the Box-Ljung test statistics, the autocorrelation, and the variance ratio test on the daily data of July 2003 to December 2012. Results suggest that Russian stock market is not weak form efficient.

Gozbasi, Kucukkaplan, and Nazlioglu (2014) examined the Turkish stock market efficiency applying the non-linear unit root tests. They incorporate the daily data Borsa Istanbul composite index and three different sector indexes (industry sector, service sector and financial sector) for the time period of July 2002 to July 2012. The findings support the weak form efficiency of Turkish stock market depicting that Turkish market affirm the efficient market hypothesis.

Tiwari and Kyophilavong (2014) used the monthly observation of BRIC (Brazil, Russia, India and Cgina) stock indices, for the time period 2000 to 2010 to test the Random Walk Hypothesis through applying the wavelet based unit root test. Results reject the null hypothesis of unit root in BRIC countries (except Russia federation) suggesting that stock prices can be predicted using the historical information. Further, Mobarek and Fiorante (2014) also examine the weak form efficiency in BRIC countries for the time period of September 1995 to March 2010. They use a bias free statistical techniques (Variance ratio and Runs test) to test the model. They find the significant positive autocorrelation in returns suggesting that BRIC markets are approaching a state of being weak-form efficient.

Obayagbona and Igbinosa (2014) investigated the weak-form market hypothesis in the emerging capital market of Nigeria from January 2006 to December 2011. It uses three tests of randomness based on autoregressive technique to check for the presence or otherwise of autocorrelation in daily stock prices from the Nigerian Stock Market. All the tests including the Z-statistics for both stock prices and their returns show significant indications of dependence in return series and hence, of non-randomness. The overall results suggest that the emerging Nigerian Stock Market is not efficient in the weak form.

Nwidobie (2014) further investigated the random walk hypothesis in Nigeria. Analysis of all-share index (ASI) data of firms on the Nigerian Stock Exchange from January 2000 to December 2012 using the Augmented Dickey-Fuller (ADF) test shows that share price movements on the Nigerian Stock Exchange do not follow the random walk pattern

described by Fama (1965), and thus the random walk hypothesis is not supported by findings in the Nigerian capital market. Results also indicate the existence of market inefficiencies in the Nigerian capital market necessitating the inflow of cheap and free information about security fundamentals into the market for share pricing by the forces of demand and supply.

Afego (2012) examines theweak-form efficient markets hypothesis for theNigerian stock market by testing for random walks inthe monthly index returns over the period 1984-2009.The results of the non-parametric runs test show thatindex returns on the Nigerian Stock Exchange (NSE)displays a predictable component, thus suggesting thattraders can earn superior returns by employing tradingrules. However, Chigozie (2010) also seeks to know whether the Nigerian stock market (from the period1984 to 2006) follows a random walk. To carry out theinvestigation, the Generalized Autoregressive Conditional Hetrosecedasticity (GARCH) was employed. The result shows that the Nigerian stock market follows a random walk and is therefore weak form efficient.

Udoka (2012) investigated information efficiency of the Nigerian Stock Exchange (NSE) with monthly time series data and adopted ordinary least square (OLS) to determine the efficiency of the NSE and found that the Share Price Index is statistically significant (i.e. the market is efficient in the weak form). Further probe found that an informed investor can make capital gains from the price differential resulting from the fact that the t-value is greater than the p-value.

Mayowa& Richard (2012) also tested the weak form of efficient market hypothesis in the Nigeria Capital market. The All Share Index from 2001 t0 2010 were analyzed using serial correlation technique. The analysis found that price changes of shares in the NSE are unrelated and normally distributed. They therefore concluded that Nigerian Capital Market is efficient in the weak form.

Okpara (2010) investigate whether Nigerian Stock Exchange (from the period 1984 to 2006) follows a random walk. To carry out the investigation, the Generalised Autoregressive Conditional Hetroseskedasticity (GARCH) was employed. The results show that the Nigerian stock market follows a random walk and is therefore weak form efficient.

Osamwonyi and Anikamadu (2002)empirically examine the weak form of Efficient MarketHypothesis in the Nigerian Stock Market, using the runtest econometric analysis on monthly Monday closingprices of twenty-five selected stocks in the first-tiermarket, with each stock having (50) cases spanningJanuary 1990 to June 2002. The results from theempirically analysis reveal that all the securitiesindicated positive values, with scanty differencesbetween the actual and expected number of runs and that the runs tests by total, actual and expected numberof runs confirm dependency. By implication, the resultsshow that stock prices in the Nigerian stock market arenon-random and those inefficiencies exist in the stockmarket occasioned by information asymmetry, leadingto insider manipulations. Olowe (1999) examined evidence of weak-form efficiency of the

NSEusing correlation analysis on monthly returns data of 59 individual stocks listedon the NSE over the period January 1981 to December 1992. The results providesupport for the work of Samuels and Yacout (1981) and Ayadi (1984), that is, theNSE is efficiency in the weak-form.

METHODOLOGY AND MODEL SPECIFICATION

This section gives an overview of the methods, the procedures the modalities and the sequential steps the researcher adopted in the paper to ensure validity of the random walk hypothesis. It presents a careful description of data collected and data sources as well as model specification.This study made use ofannual data collected from the Nigerian stock exchange (NSE) between 1986- 2017. This study utilized the average annual return of all share indexes in the Nigeria bourse. These data which was purely secondary was collected from the annual report of the Nigeria stock exchange in 2017.

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 homoschedastic 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.

Method of Data Analysis

Several methods are used to test the validity of 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 depends linearly on its own previous values and on a stochastic term. In summary of the AR(1) model, if $_1$<1(The series is called stationary, meaning that the mean level and variance do not change over time), $_1$= 1 (The series has no mean level and, thus, is called nonstationary) and $_1$ >1 (The series is explosive and also nonstationary)

DATA ANALYSIS AND INTERPRETATION

The test on whether the Nigeria capital market follows a random walk was presented in this section based on the unit root conducted. The estimated results of the specified model using unit root to test for their stationary are presented in the following table.

Table 1:Unit Root Test Result

Null Hypothesis: RASI has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		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)
Method: Least Squares
Date: 10/03/18 Time: 05:51
Sample (adjusted): 1987 2017
Included observations: 31 after adjustments

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	Mean dependent var	-0.230045
Adjusted R-squared	0.289792	S.D. dependent var	36.56367
S.E. of regression	30.81361	Akaike info criterion	9.756131
Sum squared resid	27534.87	Schwarz criterion	9.848646
Log likelihood	-149.2200	Hannan-Quinn criter.	9.786288
F-statistic	13.24116	Durbin-Watson stat	1.772685
Prob(F-statistic)	0.001056		

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 series was found not to contain a unit root at level. This implies that is the null hypothesis 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.

Table 2: Simple Autocorrelation Test

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

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).

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.

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