RANDOM WALK HYPOTHESIS OF SECURITY PRICES IN NIGERIA STOCK MARKET.

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Abstract
The desire to empirically examine the validity of random walk hypothesis of security prices in Nigeria capital market stimulated the need for the research. The study employed cross sectional security prices from selected quoted companies in Nigeria stock market; in performing the analysis, various sophisticated econometric tools were used, such as Box Jelkin Q Statistic, Variance ratio, forecast error technique, jarque bera normality and EGARCH model. The test result of the analysis revealed the presence of random walk hypothesis in the behaviour of stock prices at 99% confidence level.

Keyword: Box Jelkin Q Statistic, random walk hypothesis, Variance ratio, EGARCH model

1.0 Introduction

Random walk movement or hypothesis of stock prices in an efficient capital market has stimulated so much interest among various researchers in recent times; the major importance of behavioral finance as it relate to efficient capital market is to determine the behavior of stock prices and its volatility pooling.

There are various schools of thought relating to the behavior of stock prices in an efficient capital market; however, the first school of thought known as random walk hypothesis was first postulated by Malkeil (1973), he advocates that stock prices follow random walk pattern and as such, knowledge of historical values cannot be used to predict future values; this stem from the stance that the market is in a weak form hypothesis and that information content is not fully reflected in the stock price. The opposite school of thought known as the technicians believed that the market forces of demand and supply determines the prices of security and that stock prices follows historical pattern which implies that past prices can be used to forecast future prices. The other school of thought known as the fundamentalist advocates that the prices of security adjust so quickly to new information about the stock under consideration; every stock has an intrinsic value that is reflected in the price of such security.

Various empirical studies have been demonstrated in attempt to either confirm or reject the random walk hypothesis and to ascertain the ability of past values in predicting future stock prices. Many of them drew evidences from developed and less developed economics but the controversy still remains unresolved. Although, the stock prices movement has been well documented for developed and some less developed economics, though Nigeria's stock market as categorized by Harvey (1995) is a market with low efficiency, low exposure to world risk factors, little integration with other world market, low volatility but increase average returns for investors.

Significance of the Study

The findings will be of immense benefit to portfolio managers, individual and institutional investors, financial analyst and regulatory bodies who are concern with monitoring and analyzing stock prices on a daily basis.

2.0 Theoretical underpinning and Empirical Review

The random walk hypothesis postulates that current market values of any security fully reflects the information content of its historical values. Okofor (1983). Therefore detailed analysis of historical prices will not enhance the quality of investment decisions of investors; random walk hypothesis believed that successive prices of security are independent and random.

The technicians upholds the forces of supply and demand as the major determinant of security prices; they advocates that prices follows identifiable trends and history of prices repeat itself in the market. This is a complete negation of the random walk hypothesis; consequently, detailed analysis of past prices of security will enhance the quality of investment decisions.

The fundamentalist believed that the prices of any security is the information content of its worth; they advocates that every security has an intrinsic value which is reflected in the prices of the security. Therefore, detailed analysis of companies' fundamentals (dividend declaration, earnings per share, merger and acquisition etc) will enhance the quality of investment decisions.

2.1 Empirical Review

Tobira l.l (2014), empirically examined the random walk hypothesis and behaviour of stock prices in Nigeria; he used the following estimating tools such as Box Jenkin Q Statistic, variance ratio test, lilliefors, cramer-von mises, Anderson-Darling, ARCH-GARCH and TGARCH. He utilizes weekly closing prices of stock ranging from January 5th 2006 – December 27th 2012; the test result revealed the absence of random walk hypothesis in the Nigeria stock market.

Alexander (1964), used filter estimating tool to incorporate the daily closing prices of market indices; the result demonstrate evidence of the rejection of random walk hypothesis in the Dow Jones market.

According to Kemp and Reip, four known parametric tests were applied on British stock prices data; the econometric tools used were runs test, watlis –moore test and Sald- Wolfowit Z-test for auto correlation. The result revealed the absence of random walk hypothesis in British stock market.

In contrast to that, Kendall (1953), investigate the behaviour of weekly changes in 19 stock values using the spot prices for cotton in British stock market. The result revealed that the stock prices are extremely un- correlated which demonstrated evidence of random walk hypothesis in the British stock market.

Cootner (1964) & Fama (1965), employed serial correlation and runs test using weekly stock prices to examined the validity of random walk hypothesis; the result shows strong evidence of un-correlation of stock prices which is the strong presence of random walk behaviors of stock prices.

Ayadi (1983), examined the random walk behaviours of stock prices in Nigeria stock market; he however employed both parametric and non-parametric tests in the analysis, cross sectional prices of thirty companies in the daily official list in the Nigeria stock exchange was incorporated in his tests. The result revealed that the data are un-correlated and evidenced the presence of random walk hypothesis in the Nigerian context. This was also in conformity with the study by Samuel and Yacout (1981).

However, from the stance of academic literature, the test of random walk hypothesis in stock prices has stimulated much interest among researchers in different times; there are considerable evidences for and against the presence of random walk hypothesis especially in developed countries. Though, not much tests has been carried out in the Nigeria stock market to determine the validity of random walk hypothesis. Therefore, more sophisticated econometric tools such as Box Jenkin Q Statistic, Variance ratio test, forecast error graph, EGARCH and Jarque-Bera Normality test will be employed to test for or against random walk hypothesis in Nigeria stock market. These may help in providing further empirical evidence to the controversies surrounding random walk hypothesis. Most importantly, the acceptance or rejection of null hypothesis of no auto-correlation shows either the presence or absence of random walk hypothesis of stock prices in Nigeria context.

3.0 Methodology

The research is design to empirically demonstrate the presence of random walk hypothesis in Nigeria stock market; sophisticated econometrics tools such Box Jenkin Q Statistic (test for linear dependency), Variance ratio (test for random walk), forecast error graph, EGARCH (test for volatility clustering) and jarque – Bera normality test will be employ in analyzing quarterly stock prices of (22) companies. Operationally, the stock spot price is the intrinsic value that goes into an investors account should his exercise the option of selling. The study employs parametric and non-parametric models. Below are discussions of a few of these models.

3.1 Box Jenkin Q Statistic

BJ Statistic was postulated by Box and Pierce (1970), Ljung and Box (1978) as a test for linear dependency and auto correlation in time series data, symbolically:

$$Q^* = T\,(T+2)\sum_{L=1}^{N} A^{JI2}l\; x^2N\; T\text{-}L$$

Where:

Q* = Computed statistic for the Box Jenkin

T= the sample size

N = maximum lag length

L= the lag operator

$A^{JI}l$ = Autocorrelation coefficient at a given length which is given as:

$$=\sum^{n-l}=i=1 \ (X_I - E(X) \ (X_{I+L}-E(X)$$

$$\sum^{N}_{I=1} (X_I - E(X)^2$$

Where:

X_I = the series under investigation

E(X) = the expected value or mean of the series.

3.2 Variance Ratio (VR) specification

The ratio was first developed by Lo and Mackinlay (1988); it is a non parametric test that tests the hypothesis that a given data demonstrate a random walk hypothesis, symbolically:

$$VR_{z(q)} = \frac{VR(h) - 1 \ \mu(0,1)}{\theta\sqrt{(h)}}$$

$$VR_{z(q)} = \frac{VR(h) - 1 \ \mu(0,1)}{\theta(h)^{0.5}}$$

$$\theta(h) = \frac{2(2h-1) \ (h-1)}{3h(nh)}$$

Where:

VR is the variance ratio; θ(h) represent the asymptotic variance ratio and n(h) is the number of observation.

However, Darrat and Zhong (2000) advocates that if the calculated variance ratio is less than one, it shows negative autocorrelation (it implies the presence of random walk hypothesis), but if $VR_{z(q)}$ is greater than one, it indicates positive autocorrelation, however, if $VR_{z(q)}$ is equal to one, it indicates evidence of equal conditional variance or absence of heteroskedasticity which means that the null hypothesis of random walk can be rejected.

3.3 EGARCH model specification.

EGARCH model was credited to Nelson (1991); the conditional equation is given by:

$$In(\sigma^2_t) = w + \beta in(\sigma^2_{t-1}) + y \frac{\mu t-1}{\sqrt{\sigma^2_{t-1}}} + \infty \left[\frac{u_{t-1}}{\sqrt{\sigma^2_{t-1}}} - \sqrt{2}\right]$$

Where:

Log (σ^2) is the conditional variance of volatility and return.

4.0 Empirical Result

One way to test for random walk hypothesis is to test for market efficiency; according to Fama (1965), the instant changes in properties of an efficient market indicates successive price changes in individual securities will be independent. This means that knowledge of past prices cannot be used to predict future prices. However, the acceptance of such hypothesis indicates that the market is efficient and that no investor can consistently and always beat the market. To investigate this, various econometric tools were employed such as Box Jenkin Q Statistic, Variance Ratio, forecast error, EGARCH model and Jarque Bera normality test. We start from understanding the correlation coefficient among the share prices.

4.1 Testing for linear dependency

Linear dependency is an valid claim of serial-correlation and absence of random walk behaviour of stock prices which can make prediction of future prices using past prices possible thereby allowing for inefficiency in the market; we employed Box Jekin Q statistic (BJ) to determine serial correlation in the quarterly stock prices of selected quoted firms in Nigeria stock market. The output of the BJ test are produced in table 4.1 below;

Included observations: 22

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
. | . |	. | . |	1	0.023	0.023	0.0134	0.908
. | . |	. | . |	2	0.032	0.031	0.0400	0.980
. *| . |	. *| . |	3	-0.081	-0.082	0.2210	0.974
. |* . |	. |* . |	4	0.100	0.103	0.5128	0.972
. | . |	. | . |	5	-0.014	-0.015	0.5192	0.991
. | . |	. | . |	6	0.002	-0.011	0.5193	0.998
. | . |	. |* . |	7	0.068	0.088	0.6827	0.998
. | . |	. | . |	8	0.038	0.020	0.7365	0.999
. *| . |	. *| . |	9	-0.077	-0.084	0.9785	0.999
. *| . |	. *| . |	10	-0.133	-0.119	1.7582	0.998
. *| . |	.**| . |	11	-0.201	-0.209	3.6949	0.978
. | . |	. | . |	12	-0.044	-0.052	3.7964	0.987

Note that as a rule of thumb, the upper and lower band is given as $\pm$ ($1.96*1/T^{1/2}$) where T is the number of observation (22); in our case, the upper and lower band is +0.4 and -0.4, it is therefore considered to be significance if the first and second coefficient of the autocorrelation and partial autocorrelation falls outside the band.

Table 4.1 shows the result of the BJ test, it is discovered that the first and second coefficients of the autocorrelation and partial autocorrelation falls within the band. Therefore, in line with the

rule of thumb, the coefficients of the autocorrelation and partial autocorrelation are insignificance which indicates acceptance of the null hypothesis of no autocorrelation at 99% level of confidence. Therefore, the BJ test revealed the absence of linear dependency and concludes that random walk hypothesis is presence among the various stock prices in Nigeria capital market.

4.2 Testing for random walk hypothesis

The variance ratio test was employed to determine the validity of random walk hypothesis in Nigeria capital market; the result is reproduced in table 4.2 below

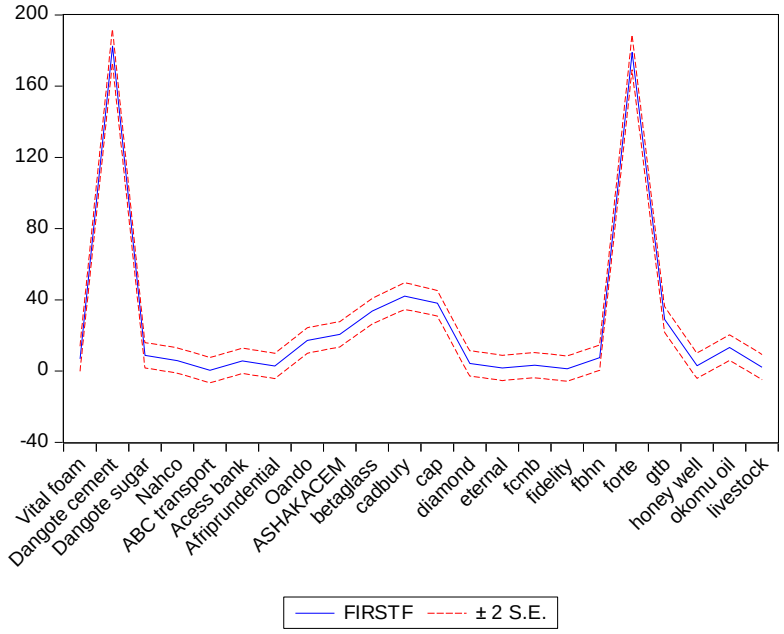
HP	VR	Z-STA	PB
4	0.292054	-1.354173	0.1757
8	0.122487	-1.422758	0.1548
16	0.011145	-1.469667	0.1417
4	0.322728	-1.225964	0.2202
8	0.108697	-1.372783	0.1698
16	0.039975	-1.358497	0.1743
4	0.329585	-1.115787	0.2645
8	0.104051	-1.268414	0.2047
16	0.092948	-1.177316	0.2391

Note that by the rule of thumb, when the calculated variance ratio is lesser than one, it portrays negative autocorrelation and an acceptance of the null hypothesis of random walk in stock prices. (Darrat & Zhong, 2000).

The variance ratio test revealed that the coefficient of our VR of the three holding periods respectively is less than one; therefore, the null hypothesis of random walk can be accepted at 99% confidence level. Acceptance of random walk hypothesis is an evidence of weak form market efficiency.

4.3 Forecasting future prices

Here we employed the forecast error techniques to forecast the percentage changes in stock prices in Nigeria capital market. The result is reproduced in table 4.3 below

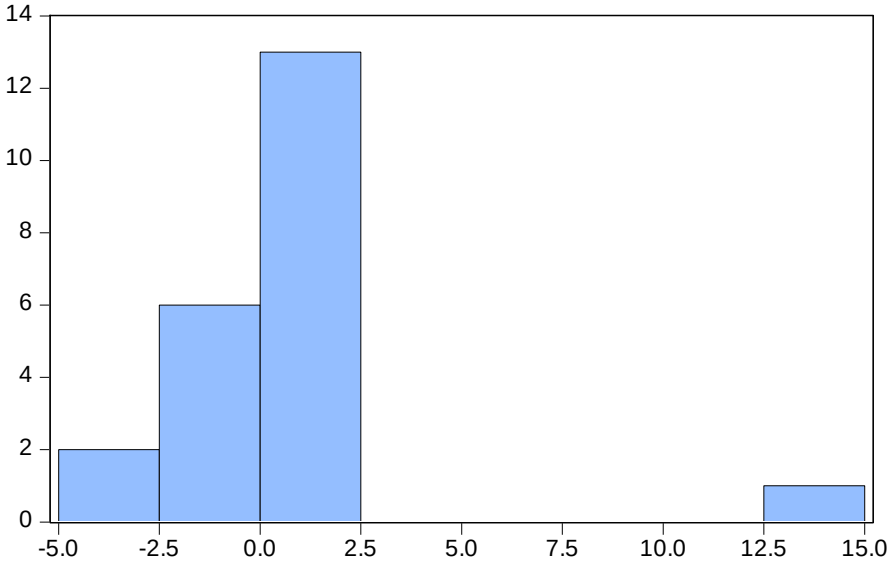


Forecast: FIRSTF	
Actual: FIRST	
Forecast sample: 1 22	
Included observations: 22	
Root Mean Squared Error	3.383836
Mean Absolute Error	1.728157
Mean Abs. Percent Error	15.22646
Theil Inequality Coefficient	0.029608
Bias Proportion	0.011029
Variance Proportion	0.000610
Covariance Proportion	0.988362

The forecast result shows the value of RMSE, MAE, MAPE, and Theil inequality coefficient. It was observed that the root mean squared error, mean absolute error and the mean absolute percentage error figures are well below 100%; therefore, we conclude that the prices cannot be used to predict future prices in the market.

4.4 Testing for Normality

Here we employed Jarque Bera normality test to examine the behaviour of stock prices. Normality is an indication of the absence of random walk and the presence of linear dependency. The result is reproduced in table 4.4 below.



Series: Residuals	
Sample 1 22	
Observations 22	
Mean	0.355360
Median	0.171979
Maximum	14.23694
Minimum	-3.608297
Std. Dev.	3.444315
Skewness	3.028846
Kurtosis	13.33910
Jarque-Bera	131.6265
Probability	0.000000

As expected, the jarque bera result of 131.6265 which is large enough and the probability result which is highly significance indicates the absence of normality; we conclude that the stock price exhibit randomity in behaviours.

4.5 Volatility testing

We employed EGARCH model to examine the conditional variance of volatility and return. The presence of volatility clustering indicates absence of random walk hypothesis in stock prices. The output is shown in table 4.5 below:

EGARCH result of volatility and return

Variable	Coefficient	Std. Error	z-Statistic	Prob.
SECOND	2.119780	0.000188	11275.34	0.0000
THIRD	-1.073003	1.9E-104	-5.6E+103	0.0000
Variance Equation				
C(3)	2.547057	0.379199	6.716939	0.0000
C(4)	-2.226822	0.267618	-8.320907	0.0000
C(5)	-0.014369	0.227252	-0.063230	0.9496
C(6)	0.285477	0.141858	2.012409	0.0442

The result shows that the coefficient of the conditional variance is not actually persistent and that the negative coefficient indicates that volatility of the present period cannot influence returns of the next period. Therefore, the result shows the absence of volatility clustering and concludes that random walk hypothesis is actively presence in the behaviour of stock prices in Nigeria capital market.

Concluding Remark

Random walk behaviour in stock prices has stimulated much interest among institutional and individual investors in Nigeria stock market.

However, the test result of linear dependency shows the absence of auto correlation among the stock prices which is a strong indication of the presence of random walk hypothesis; testing for randomity using variance ratio also accept the presence of random walk in the stock market which by implication, the Nigeria stock market is said to be in a weak form market efficiency.

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