THE WEAK FORM MARKET EFFICIENCY AND THE NIGERIAN STOCK EXCHANGE

Article · May 2018

CITATION
1

READS
25

4 authors, including:

Adebanjo Falaye
Landmark University
19 PUBLICATIONS **14** CITATIONS
SEE PROFILE

Oluwasegun Eseyin
Landmark University
7 PUBLICATIONS **12** CITATIONS
SEE PROFILE

Gift Eboigbe
National College of Ireland
1 PUBLICATION **1** CITATION
SEE PROFILE

Afro Asian Journal of Social Sciences
Volume IX, No IV Quarter IV 2018
ISSN: 2229 – 5313

THE WEAK- FORM MARKET EFFICIENCY AND THE NIGERIAN STOCK EXCHANGE

Adebanjo Joseph Falaye, Awonusi Frank and Eseyin Oluwasegun
Accounting and Finance Department, Landmark University, Omu-Aran, Kwara State, Nigeria
Eboigbe Gift
Economics Department, Landmark University, Omu-Aran, Kwara State, Nigeria

ABSTRACT

This study examined the weak- form efficiency of the Nigerian stock market. This was done by using the Partial autocorrelation (PACF) test to test for independence of stock prices, the runs test and the distribution patterns to test for randomness of stock prices and the one-sample Kolmogorov Smirnov test to test for observable trend in the pattern of stock price movements. The movements of stock prices in the stock market were found to be independent. The movements of stock prices in the stock market were not random. There was an observable trend in the pattern of stock prices movement in the stock market. The result of the partial auto correlation test indicates that the movements of the stock prices are independent. In addition, the result of the runs test and the distribution patterns also shows that the movements of stock prices were not completely random.

Key-words

Stock exchange, market efficiency, weak form, price movement, information efficient

Introduction

The efficient market hypothesis is a buttress to the assertion that stock markets boost economic activities. The hypothesis holds that investors do not make abnormal profits when the market is efficient. That is, in an efficient market, past and available current information are fully reflected in current stock prices. Hence, investors do not make abnormal profits.

Given that markets can either be efficient or inefficient, the efficiency of any stock market is held to be a function of the precision with which the market reacts to relevant information.

Reason being that irrespective of its form, information is of extreme importance in determining shares' prices in the stock market. Stock prices in turn provide accurate signals for resource allocation.

Stock market efficiency is concerned with the relationship between information and prices of shares. On the measurement scale are three forms or degrees of efficiency. As defined by Fama (1970), the three degrees could be in the weak-form, semi-strong form, or strong-form. Therefore, a market is said to be efficient at the weak form if prices of shares speedily reflect all current information. It is a state where past information has no relationship with the current market prices of shares.

If prices rapidly and accurately react to all relevant new information, it is said that the market is relatively efficient at its weak form. When the market is at the weak form, the stock prices are at random, which makes it impossible to find historical price patterns that could enable any investor to seize the advantage of price movement. That is, daily prices of stocks in the market are completely independent of each other. Hence, past earnings cannot predict present or future earnings. Equally, price momentum is assumed not to exist.

Thus, efficiency of the stock market is a conditional phenomenon. Its characteristics vary constantly overtime and across markets.

Study objectives

The broad objective of this study is to investigate the weak-form efficiency in the Nigerian stock market. The specific objective is to investigate the extent to which the movement of stock prices in the Nigerian stock market depends on previous stock price movements.

In addition, study set out to examine whether successive stock price movements in the Nigerian stock market are random. That is, it equally set out to determine the extent to which there is an observable trend in the movements of stock prices in the Nigerian stock market.

Research hypothesis

$H_{01:}$ The movements of stock prices in the Nigerian stock market are not independent.

$H_{o2:}$ The movements of stock prices in the Nigerian stock market are not random.

$H_{03:}$ There is no observable trend in the movement of stock prices in the Nigerian stock market.

Empirical evidence

Following the work by Fama (1965) on the US Stock market, a number of studies have attempted to test the efficient market hypothesis in diverse stock markets. Vitali & Mollah (2010:95) examined the weak-form of market efficiency in Africa by testing the Random walk hypothesis using the unit root, auto-correlation, runs, and variance ratio tests on the daily price indices of Egypt, Kenya, Mauritius, Morocco, Nigeria, South Africa and Tunisia over the period 1999 to 2009. The empirical results rejected the random walk hypothesis for all the stock market's indices over the entire sample period with the exception of South Africa over the second sub-period (2007-2009). That is, only South Africa Stock Exchange proved to be weak-form efficient market. The results obtained implied that stock prices do not fully reflect all historical information. And those stock markets in Africa should further improve on technological and regulatory modernization in order to improve information efficiency.

Aga & Kocaman (2008:131) examined the efficient market hypothesis in Istanbul stock exchange market, the study used a computer index called return index- 20 and also used time series model to test the weak-form of the efficient market hypothesis for the period across 1986 to 2005. The result obtained from the time series analysis showed evidence of weak-form efficient market in Istanbul stock exchange. The result was not consistent with that of Vitali & Mollah (2010:95).

Bhattacharya and Mukherjee (2002:40) examined the nature of the causal relationship between stock prices and macroeconomic aggregates in India. The study adopted the techniques of unit-root tests, co-integration and long-run granger non-causality tests. The major findings of the study showed that no causal linkage between stock prices and money supply; stock prices and national income; and also between stock prices and interest rate. Secondly, index of industrial production led the stock prices; and thirdly, there existed a two-way causation among stock price

and rate of inflation. The study concluded that Indian stock market was moving toward informational efficiency.

Also, Dragota et al (2009:147) tested the weak-form of information efficiency of the Romanian capital market using a database that consisted daily and weekly returns for 18 companies listed on the first tier of the Bucharest Stock Exchange and also in daily and weekly market returns projected by using the indexes of the Romanian capital market. The study made use of a multiple variance ratio. The findings of the study revealed that most of the stock prices were information efficient.

Vosvorda et al (1998:95) tested the efficient market hypothesis on the Prague stock exchange for the period 1995-1997. The findings of the study reject the weak-form market efficiency. Macskai and Molnar (1996:6) used the Ljung-Box Q-statistics tested for the efficient market hypothesis on Budapest Stock Exchange and found that the Budapest Stock Exchange was not efficient; because of the possibility of traders making excessively high returns.

With respect to the Nigerian economy, Nwosa & Oseni (2011:38) examined the weak-form efficiency of the Nigerian stock market using a sample data spanning the period 1986-2010, the study adopted a serial-correlation and regression method of analysis, the variables used in the study were tested for stationarity using the Augmented Dickey Fuller and Phillip Perron test. The result showed that the variables were stationary at first difference, the result of the serial auto-correlation and regression analysis both revealed that the Nigerian stock exchange is information inefficient. That is, stock price did not exhibit random walk.

Afego (2012:340) tested for weak form market efficiency in the Nigerian stock market by testing for Random walks using the monthly index returns over the period 1984-2009. He employed the non-parametric runs test. From the result obtained, the Nigerian stock market was not efficient in the weak form.

Ajao & Osayuwu (2012:169) tested the weak form of the Nigerian stock market using all securities traded on the floor of the Nigerian stock exchange and the month end value of the All

Share Index from 2001-2010. The serial correlation technique of data analysis was used to test for independence of price movement and the distributive pattern while runs test was used to test for randomness, the outcome of the serial correlation coefficients did not violate the two-standard error test. In addition, the Box-Ljung statistic showed that none of the serial correlation coefficients was significant and the Box- pierce Q statistics revealed that the overall significance of the serial correlation test was poor while the result of the distribution pattern indicated that stock price movements were approximately normal, they concluded that the Nigerian stock market was efficient in the weak-form.

Olowe (1999:54) carried out tests using monthly data on 59 randomly selected securities from 1981-1992 on the Nigerian stock exchange. He found the Nigerian stock market to conform to weak-form efficiency in joint Q tests of partial autocorrelation coefficient for ten lags in the return data, though he argued that poor information flows and inefficient communications system cast doubts on the ability of the market to pass higher hurdles of efficiency.

Besides Olowe's study, other empirical tests of the weak form of the efficient market hypothesis have been conducted on the Nigerian stock exchange by Ekechi (2002:57), Inegbedion (2009), Aguebor et al (2010:342) and Rapuluchukwu (2010:321). Results of the various tests were not consistent. While studies conducted by Ayadi (1983:57) and Rapuluchukwu (2010:21) concluded that the Nigerian stock market was efficient in the weak form.

Those conducted in later years by Ekechi (2002:57), Inegbedion (2009:50), as well as Aguebor et al (2010:342) indicated that the Nigerian stock market was not efficient in the weak form. But it is important to note that all the studies that showed that the Nigerian stock market was efficient in the weak form made use of the All Share Index, which is the aggregation of all price gains and losses for the whole securities traded on the floor of the Exchange in the analysis. The studies that revealed that the market was not efficient in the weak form used a sample of selected securities (Ajao and Osayuwu, 2012:170).

Research design

Data used in the study were sourced through online publications of the Nigerian stock exchange and the CBN statistical bulletin. The monthly all share indexes were used and was sourced from the Central Bank of Nigeria statistical Bulletin 2014. The population of this study consist the Nigerian stock market indices. The sample includes monthly observations of the all share index. A market index is a quick measure to judge the overall direction of the market and the scope of its movements. The all-share index gives a total picture of the behaviors of the common shares quoted on the stock exchange which provides a complete representation of the market.

Model specification

This model specification was adapted from Pearson's product moment, Box-pierce and Ljung Box.

ri= $\frac{n\sum xy-\sum x\sum y}{\sqrt{[n\sum xi^2-(\sum xi)^2][n\sum yi^2-(\sum yi)^2]}}$

Q= n$\sum rt^2$

Where Q=Box-pierce statistic

ri =serial correlation coefficient for the ith lag; and

n =sample size for the security in question

The Box-pierce statistic follows a chi-square distribution with m degrees of freedom, where m is the number of lags.

Test for randomness of stock prices

The test for randomness of changes in stock prices is:

The Z test for randomness, where

Z= $\frac{R+0.5+R_1}{SR}$

Where: R= number of runs (stock price changes)

R= $\frac{2N1N2}{N1+N2}+1 = Meannumberofpricechanges.$

SR= $\sqrt{\frac{2N1N1(2N1N2-N1-N2)}{(N1+N2)2(N1+N2-1)}}$

Where N1= number of positive price changes;

N2= number of negative price changes; and

SR= standard deviation of the distribution of the number of price changes

Data analysis

Data were tested for stationarity using Augmented Dickey Fuller (ADF) test. On the basis of the results, the data were adjusted for stationarity by differencing (integrating) once, owing to the failure of the test for stationarity using ADF. Afterward, the integrated data were analyzed.

Table A. Nigeria All Share Index. Month end values (2004-2014)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DE
2004	22,712.9	24,797.40	22,896.40	25,793.00	27,730.80	28,887.40	27,061.10	23,774.30	22,739.70	23,354.80	23,270.50	23,84 0
2005	23,078.3	21,953.50	20,682	21,961.70	21,482.10	21,564.80	21,911.00	22,935.40	24,635.90	25,873.80	24,355.90	24,08 0
2006	23,679.4	23,843.00	23,336.60	23,301.20	24,745.70	26,316.10	27,880.50	33,096.40	32,554.60	32,643.70	32,632.50	33,18 0
2007	36,784.5	40,730.70	43,456.10	47,124.00	49,930.20	51,330.50	53,021.70	50,291.10	50,229.00	50,201.80	54,189.90	57,99 0
2008	54,189.92	65,652.38	63,016.56	59,440.91	58,929.02	55,949.00	53,110.91	47,789.20	46,216.13	36,325.86	33,025.75	31,45 8
2009	21,813.76	23,377.14	19,851.89	21,491.11	29,700.24	26,861.55	25,286.61	23,009.10	22,065.00	21,804.69	21,010.29	20,82 7
2010	22,594.90	22,985.00	25,966.25	26,435.20	26,183.21	25,384.14	25,844.20	24,268.20	23,050.60	25,042.20	24,764.70	24,77 2
2011	26,830.70	26,016.80	24,621.20	25,041.70	25,866.60	24,980.20	23,827.00	21,497.60	20,373.00	20,935.00	20,003.40	20,73 0
2012	20,875.80	20,123.50	20,562.50	22,045.70	22,066.40	21,599.60	23,061.40	23,750.80	26,011.60	26,430.90	26,494.40	28,07 0
2013	31853.18	33,075.14	33,536.25	38,485.56	41,474.40	42,482.48	42,097.49	41,532.31	36,585.08	37,622.74	38,920.85	41,32 9
2014	40,571.62	39,558.89	38,748.01	38,485.56	41,474.40	42,482.48	42,097.49	41,532.31	41,210.10	37,550.24	34,543.05	34,65 5

Source: Central Bank of Nigeria Statistical Bulletin 2014

Unit root test

In order to observe the time series properties of the stock returns in the Nigerian Stock Exchange, unit root test was performed on the data. The Augmented Dickey Fuller (ADF) was conducted on the series. The result of the unit root test is reported in table 4.3 below.

Table B

Augmented Dickey Fuller (ADF)					
VARIABLES		TEST STATISTIC	PROBABILITY	STATUS	REMARK
ASI	1ST DIFFERENCE	-4.180128	0.0010	1(*1*)	STATIONARY

From the table above, the ADF test showed that the All Shares Indexwas stationary at first difference. What this means is that the 1st difference of the variables can be used to perform time series analysis without turning out abnormal results.

Test of hypotheses

Test for independence

The Partial Autocorrelation test was used to test for independence of the movement (changes) in the prices of shares traded on the floor of the Nigerian stock exchange. In addition to the above, the two standard error test, Ljung-Box and the Box-Pierce test were used to test for significance of the Autocorrelation coefficients. On the basis of the series of tests conducted the research inferences were made.

Hypothesis 1**:** The movements of stock prices in the Nigerian stock market are not independent.
Test Statistic: Partial Autocorrelation test (PACF) and Autocorrelation test (ACF).

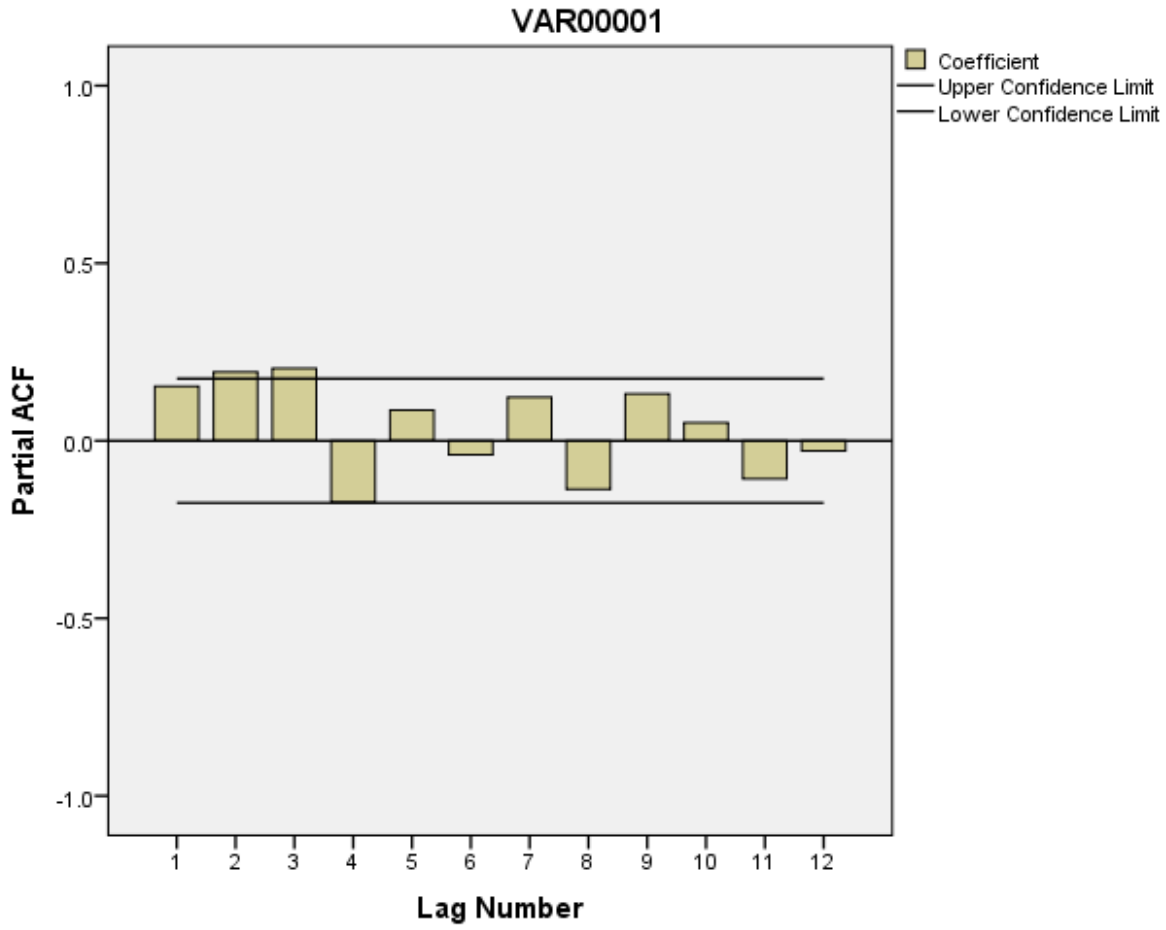
Lag	Partial Autocorrelation	Std. error
1	.153	.087

Table C

2	.194	.087
3	.204	.087
4	-.173	.087
5	.086	.087
6	-.040	.087
7	.123	.087
8	-.136	.087
9	.132	.087
10	.051	.087
11	-.107	.087
12	-.029	.087

Result of the Partial Autocorrelations

Fig 1: Partial Autocorrelation Two Standard Error Test



Results in fig.1 show that lags 2, 3 out of the 12 lags violate the two standard error limits, while lag 4 is barely within. All the remaining nine lags are within the range. The implication is that a significant proportion of the 12 lags (above 75%), are within the two standard error limit. In this case, we cannot reject the null hypothesis. We may thus conclude at the 95% confidence level that the movements of stock prices in the Nigerian Stock Exchange are independent.

Table D. Autocorrelations

Lag	Autocorrelation	Std. error[a]	Box-Ljung Statistic			
			Value	Df	Sig.[b]	Remark
1	.153	.086	3.154	1	.0.76	Not significant
2	.213	.086	9.255	2	.0.10	Significant

3	.248	.086	17.623	3	.001	Significant
4	-.086	.085	18.254	4	.001	Significant
5	.136	.085	20.819	5	.001	Significant
6	-.004	.085	20.821	6	.002	Significant
7	.084	.084	21.821	7	.003	Significant
8	-.035	.084	21.999	8	.005	Significant
9	.079	.084	22.893	9	.006	Significant
10	112	.083	24.709	10	.006	Significant
11	-.108	.083	26.416	11	.006	Significant
12	.064	.083	27.018	12	.008	Significant

The Box-Ljung statistic from the Autocorrelation test shows that only the first lag is not significant. Results of the Box-Pierce Q statistic shows that the overall significance of the Autocorrelation test is poor since the calculated value of the Box-pierce Q is less than the tabulated value the implication is that we cannot reject $H_{0.}$ In other words, it is reasonable to conclude that at the ninety five percent (95%) confidence level, the changes in stock prices traded on the floor of the Stock Exchange are independent. The result of the Box-Pierce Q test is consistent with the results of the partial Autocorrelation test.

$Q = n\sum r_i^2$ where n is the sample size

The perception behind the use of the statistic is that high sample Autocorrelations lead to large values of Q. If the calculated value of Q exceeds the appropriate value in a χ^2 table, one could reject the null hypothesis of no significant autocorrelation at the appropriate significance level. Rejecting the null hypothesis means accepting an alternative that at least one autocorrelation is not zero.

Box-pierce statistic: Table E

0.153^2	0.023409
0.213^2	0.045369
0.248^2	0.061504

-0.086^2	-0.007396
0.136^2	0.018496
-0.004^2	-0.000016
0.084^2	0.007056
-0.035^2	-0.001225
0.079^2	0.006241
0.112^2	0.012544
-0.108^2	-0.011664
0.064^2	0.004096
	Σ=0.158414

$Q = 0.158414 \times 132$
$Q = 20.911$
Box-pierce statistic$\sim\chi^2_{\propto, m}$
$\propto = 0.05$
Bp$\sim\chi^2_{0.05}$, 12=21.026
Bp$\geq \chi^2_{\propto}$, m

Consequently, the null hypothesis (H_0) is accepted; since Q > Bp

What this result implies is that stock price changes are not independent. The fact that the stock price changes are not independent means that investors can predict future stock price movement from past stock price movement. This further proves that the Nigerian stock market is not efficient even when measured at the weak form level of efficiency.

Test for randomness

The runs test was carried out to test for randomness of the stock price movements and Distribution Pattern, which was used to further test for randomness of the distribution of the stock price changes.

Hypothesis 2**:** The movements of stock prices in the Nigerian stock market are not random.

Table F Runs test

	VAR00001
Test value	31568.9164
Cases < Test value	80
Cases >= Test value	52
Total Cases	132
Number of runs	4
Z	-10.988
Asymp.Sig.(2-tailed)	.000

The result in Table F shows that the calculated value of the Z-statistic is -10.988 with an associated asymptotic significant (2-tailed probability of 0.000). Consequently, the null hypothesis that the stock price changes are not random is accepted at the 1% level. The implication is that we can conclude at the 99% confidence level, that the stock price movement on the floor of the Nigerian Stock Exchange is not random.

Although the results from this study contradict few previous studies on the NSE which have employed the Runs test, they are consistent with many others e.g. Appiah-Kusi and Menyah (2003), Smith (2008), Emenike (2008), and Mollah and Vitali (2011). Given that African Stock Markets, including the Nigerian stock exchange, are bothered by problems of thin trading, lack of market transparency and poor regulatory standards (Mlambo & Biekpe, 2005). Therefore, the results reported in this study are not inconsistent with expectations.

Distribution patterns

The normal curve in fig 2 shows that the distribution Patterns is asymmetrical, since the shape of the curve to the left of the line of symmetry is conspicuously different from the shape to the right of the line of symmetry. The implication is that the distribution pattern of the Stock price movement is not Random. This is consistent with the result of the Runs test earlier carried out.

Test for an observable trend

Hypothesis 3: There is no observable trend in the movement of stock prices in the Nigerian stock market.

This test was carried out using the one-sample Kolmogorov smirnov test.

Table G. Result of the One-Sample Kolmogorov Smirnov test

N		132
Normal Parameters[a,b]	Mean	31568.9164
	Std. Deviation	11177.58123
Most Extreme Differences	Absolute	.217
	Positive	.217
	Negative	-.147
Kolmogorov-smirnov Z		2.497
Asymp.Sig.(2-tailed)		.000

One-sample Kolmogorov-smirnov test

Result in Table G shows that Kolmogorov-smirnov calculated value of the Kolmogorov-smirnov Z is 2.496 with an associated asymptotic significant (2-tailed probability of 0.000). Consequently, the null hypothesis that there is no observable trend in the pattern of stock price movement is rejected. The implication of this is that it is safe to conclude at the 99% confidence level that there is an observable trend in the pattern of stock price movement in the stock market.

Findings

The results of the autocorrelation and partial autocorrelation tests indicate that the movements of stock prices in the Nigerian stock market are independent. This means that it is not possible for investors to use previous stock price movements to predict today's stock prices or use today's stock price movements to predict future stock prices.

Contrarily, the results of the runs test and distribution patterns of the stock price changes show that the stock price movements are not random, thus suggesting that the Nigerian stock market is

not efficient in the weak form. This means that new information is not always diffused instantaneously.

In other words, it is possible for investors to beat the market; that is, make gains on the basis of privileged information, even if not always. This result is inconsistent with Olowe (1999), and Rapuluchukwu (2010). However, the results are consistent with the findings of Ekechi (2002) and Inegbedion (2009).

REFERENCES

1. Afego, P. 2012. Weak form efficiency of the Nigerian Stock Market: An empirical analysis. International Journal of Economics and Financial Issues **2**(3): 340 – 347.
2. Aguebor, S.O.N., Adewole, A.P., and Maduegbuna, A.N. 2010, "A Random Walk Model for Stock Market Prices," Journal of Mathematics and Statistics, 6(3): 342-346. http://dx.doi.org/10.3844/jmssp.2010.342.346
3. Ayadi, O. 1984, Random Walk Hypothesis and the Behavior of Stock Price in Nigeria, The Nigeria Journal of Economics and Social Studies, 26(1), 57-71.
4. Appiah-Kusi, J., Menyah, K. 2003, Return Predictability in African Stock Markets, Review of Financial Economics, 12(3), 247–270.
5. Ekechi, A.O. 2002. "The Behavior of Stock Prices on the Nigerian stock exchange: Further Evidence," First BankQuarterly Review, March edition.
6. Emenike, K. 2008, Efficiency across Time: Evidence from the Nigerian Stock Exchange, MPRA Paper 22901, University Library of Munich, Germany; available online at http://mpra.ub.unimuenchen.de/22901/
7. Fama, E. 1965, the Behavior of Stock-Market Prices, the Journal of Business, 38(1), 34-105.
8. Fama, E.F. 1970. Efficient Capital Markets: A Review of Theory and Empirical Work. Journal of Finance, **25**(2):383-417.
9. Fama, E.F. 1991. Efficient Capital Markets: II **46**(5):1575-1617.

10. Inegbedion, H.E. 2009. "Efficient Market Hypothesis and the Nigerian Capital Market," an Unpublished M Sc. Thesis written in the Department of Business administration, University of Benin, Nigeria.

11. Macskasi, Z., & Molnar, J. 1996. The Predictability of Hungarian Stock Exchange, Research Memoranda of the Conference, Applied Macro and Micro Economic Modeling for European and Former Soviet transition economies. University of Leicester, England.

12. Mlambo C., Biekpe, N. 2005, Thin-trading on African stock markets: Implications on market
efficiency testing, The Investment Analyst Journal, 61, 29-40.

13. Nwosa, P. I., & Oseni I. O. 2011. Efficient market hypothesis and Nigerian Stock Market. Research Journal of Finance and Accounting, 2 (12), 38 - 46.

14. Olowe, R. 1999. "Weak Form Efficiency in the Nigerian Stock Market: Further Evidence," African Development Review, 11(1), 54-68.

15. Rapuluchukwu, E.U. 2010. "The Efficient market Hypothesis: Realities from the Nigerian Stock Market" Global Journalof Finance and Management 2(2):321-331.

16. Smith, G. 1990. Investments, London: Glenview.

17. The Nigerian Stock Exchange, 2004. Annual Report and Accounts. pp:34.

18. Mollah, S. & Vitali, F. 2010. Stock Market Efficiency in Africa, Evidence from Random Walk Hypothesis, Mid-West Finance Association Annual Meeting, West Chicago River North, March 2-5, 2011.

19. Vosvorda, M., Filacek, J., & Kapicka, M. 1998. The Efficient Market Hypothesis on the Prague Stock Exchange, Workshop to ACE Phare Project Paper P95-2014-R.

20. Dragotă, V., Stoian, A. M.., Pele, D. T., Eugen, M. & Malik, B. 2009. The Development of the Capital Market, Evidences on Information Efficiency, Romanian Journal of Economic Forecasting, 10, pp. 147-160.

21. Bhattacharya, B., & Mukherjee, J. 2002. The Nature of the Causal Relationship between Stock Market and Macroeconomic Aggregates in India, an Empirical Analysis, Paper Presented in the 4th AnnualConference on Money and Finance, Mumbai.

22. Vitali, F., & Mollah, S. 2010. Stock Market Efficiency in Africa, Evidence from Random Walk Hypothesis, Mid-West Finance Association Annual Meeting, West Chicago River North, March 2-5, 2011.