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TESTING THE WEAK FORM EFFICIENCY OF THE NIGERIA STOCK EXCHANGE MARKET

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ABSTRACT: *The efficient market hypothesis has become a controversial subject due to empirical results against market efficiency in various stock markets. The measurement of the Nigerian stock market is considered crucial for several reasons, including investors and participants in the securities market decried non-reflection of the firm performance in the prices of their stock traded in the Nigerian stock exchange. The focus of this study is to assess the weak form efficiency of the Nigerian stock exchange market. Nigerian stock exchange all share historical daily, weekly and monthly returns were employed for the analysis. The data was analyzed using unit root tests of stationarity and random walk, Jarque-Bera for normality and graph presentation. The results revealed that, the Nigerian stock exchange all share historical daily, weekly and monthly returns exhibited significant random walk. The study concludes that the Nigerian stock exchange market is efficient in the weak form. It is therefore recommended that efforts should be made by government to develop and implement stock exchange policies that will ensure active trading and vibrancy in the market.*

KEYWORDS: weak-form, efficient market hypothesis, adf unit root test, jarque-bera, normality.

INTRODUCTION

The stock market plays important roles in the financial system by performing several crucial functions, such as; mobilizing private and public savings and channeling the savings to productive investment units, protect investments from fraudulent and shady deals, facilitates transactions in government securities and advertises investors, industries and government dealings with securities and serves as a medium for information to investors and industries (Olabisi, Jeremiah, Phillip, Omobola, & Ademola, 2017). Resource mobilization with capital formation role by the stock market helps reduce illiquidity risk and promotes investment opportunities (Nzotta, 2014). More particularly, the market creates a platform for participants to buy and sell existing stock; and also, raise new issues (Abina, 2019). By this, the market performs a very germane function of resources allocation.

For proper allocation of financial resources, the stock market needs to be efficient (Afrafayia, 2018). The market is said to be efficient when current prices of stock traded in the market reflect all available information (Callado & Leitao, 2018; Aliyev, 2019). There is efficiency, if there is an open floor for pure competition in the stock market; meaning that prices of the securities are solely determined by the market (forces of demand and supply), based on available information. The effectiveness of the market lies on the investors' behaviour and investment pattern, influenced by information and competition (Pervez, Rashid, Chowdhury, & Rahaman, 2018). This implies that

all investors deal with the same information, movements in the securities prices in an efficient market are unpredictable and the information entering the market is absorbed swiftly by all participants, thus no investor can be more advantageous to make unfair gain in the market. Fama (1970), in his Efficient Market Hypothesis (EMH) put forward that an efficient market refers to a stock market where expected inflows cannot be exploited by trading in a particular pattern. Efficient market hypothesis relates to the notion of random walk, which portrays staggered movement or changes in prices of securities such that the current prices cannot be predicted from previous records or prices. The opinion of random walk is that the successive price changes are independent and identically distributed random variables, which indicate that the series of price changes has no relationship; and the past cannot be employed to predict the future - as the prices are devoid of any meaningful trend. (Fama, 1970).

However, the efficient market hypothesis has become a controversial subject due to empirical results against market efficiency in various stock markets. Summers, (1986); Poterba and Summers, (1988); Lo and MacKinlay, (1988); Fama and French, (1988), and others, have contradicted the random walk notion on the basis of certain behavioural and psychological elements and showed evidence against the hypothesis and submitted that stock market inflows to a considerable level, are predictable. From then, it has been a subject that is debatable and becomes an interesting area of study (Shamshir & Mustafa, 2014). This is a major motivation for this study: to test the random walk concept in the Nigerian stock market.

Measurement of the Nigerian stock market is considered crucial for several reasons. Severally, investors and participants in the securities market have decried non-reflection of the firm performance in the prices of their stock traded in the Nigerian stock exchange (Owui, 2019). The price volatility in the Nigerian stock market has been attributed to some macroeconomic variables which can be predicted (Ibrahim, 2017). Okonkwo (2019) posits that investors are directed to adjust their stocks relative to changes in macroeconomic trends in order to make unfair gain. Ogbulu (2016) maintained that despite the implementation of various capital market reforms, adoption of automation and ICT in the operation of the Nigeria stock exchange to achieve stock market efficiency.

Malaolu, Ogbuabor and Orji, (2013) concluded that movement of a nation's securities prices are often influenced by changes in fundamentals of the economy and the expectations about future prospects of these fundamentals which cannot be predictable. In all it has been a controversial debate in the finance literature. The random walk hypothesis disclosed that movements in stock prices can change without limit in the long run, therefore, making its projection very impossible. The theory asserts that, if stock prices are characterized by random walk process, then innovation to the prices will be permanent, thereby making market forecast based on historical prices difficult, with attending potential for increase in long run fluctuations over time and if the stock prices are mean reverting such that it follows a stationary trend, forecast of future inflows based on historical data or prices become possible (Isola, Nwanji, Idama, & Otekunrin, 2017).

Fama (1970) expressed efficient market hypotheses in empirical ground, and separated market efficiency into three levels information base: weak form, semi-strong form and strong form. Weak-

form of efficient market hypotheses reckons that current securities prices fully reflect all historical market information; such as historical sequence of trading volumes, prices and any market created information. Semi strong-form efficient market hypotheses theorize that current securities prices reflect not only the historical data or information but also new publicly available data or information; such as economic, political and dividend announcements. Third, the strong-form efficient market hypothesis reckons that securities prices reflect all information from both public and private sources, so that no one investor can derive unfair return.

Policy makers all over the world are making frantic effort at all times to make best policies in order to minimize the level of market interposition to the barest minimum. It would be difficult to obtain outstanding inflows unless there is a gap between market efficiency and information (Ananzeh, 2014). Investors, policy makers and academicians are willing to delve into the behaviour of securities prices because if a security market is inefficient, the pricing system may not guarantee the efficient allocation of funds in the economy which could negatively affect the aggregate economy (Ananzeh, 2014). Thus, this study investigates the stock market of Nigeria, to find out whether the market is efficient especially in the weak form, employing recent data.

REVIEW OF RELATED LITERATURE

Theoretical and Conceptual framework

Efficient Market Hypothesis (EMH)

The efficient market hypothesis began with the work of Fama's Ph.D. thesis at the University of Chicago. Eugene Fama, born February 14, 1939, is an American financial economist, who is known for his works on efficient market hypothesis, asset pricing, and portfolio theory. In the early 1960s, Eugene Fama came up with the efficient market hypothesis, which states that at any given period, stock prices fully reflect all available information. Since all the buyers and sellers have the same available information which continuously comes unexpectedly into the market, price fluctuations are unpredictable and will react to unknown information for the market.

In May 1970, Fama published an article called "Efficient Capital Markets: A Review of Theory and Empirical Work". In the article, Fama proposed that, there are three types of efficiency: weak form, semi-strong form and strong form. In the weak form of stock market efficiency, which is our focus on this study, the prices of the stock instantly fully reflect all available information of past prices. It implies that by exploring past prices, future price fluctuations cannot be predicted.

Empirical review

The study on weak form of stock market efficiency is considered vital for institutional investors and individuals and has implications in their investment decision (Angelovska, 2018). To ascertain the true position of this controversial debate on the subject, Ajekwe, Ibiamke, and Haruna, (2017) investigated the random walk hypothesis in the Nigerian stock market by dissecting whether stock prices follow a random walk distribution. The study used the daily equity prices of 20 performing

stocks on the Nigerian stock exchange for the period 2010 to 2014. Runs test and autocorrelation functions were used for testing the hypothesis. It was found that the daily stock prices in the Nigerian stock market were randomly distributed, showing that the Nigerian Stock market is informational efficient at the weak form for the period under review. Andabai, (2019) measured share price movements on the Nigerian Stock Exchange for two periods; from 1990 to 2010 and from 2010 to 2017 with ADF unit root test application. The study revealed serial independence or randomness from the ADF result, indicating market inefficiency for the period but indicated randomness or independency, showing stock market efficiency from 2010 to 2017.

Onwukwe and Ali, (2018) investigated stock market returns from the insurance sector in Nigeria between 2009 and 2016 via the application of descriptive analysis, run test, autocorrelation function and Ljung-Box Q statistics. The Jarque-Bera test of normality indicated non randomness in the insurance sector, run test also reject null hypothesis of randomness in the series and the autocorrelation function showed the evidence of serial correlation. In overall, the insurance sector indicated not efficient in the weak form. Also, Ogbulu, (2016) estimated the stock returns in the Nigerian stock exchange from 1999 to 2013 to know how efficient is the Nigerian stock market by using daily, weekly, monthly and quarterly stock prices. Through the use of Philip Perron unit root, ADF unit root, variance ratio test, autocorrelation, normality/random walk test, granger causality test, ARCH-GARCH and regression analysis for the period. It was revealed that the Nigerian stock market was inefficient in daily, weekly, monthly and quarterly for the period under investigation.

In an attempt to know if the stock market in Pakistan is efficient in the weak form, Tahir, Gul and Qazi, (2017) employed ADF unit root, Run test, Philip Peron unit root, autocorrelation function and regression methods foe measuring random walk, capital market efficiency and predicting stock return in Karachi stock exchange between 1998 and 2013. The study indicated that, return distribution of Karachi stock exchange was not normally distributed and short term predicability exists in Karachi exchange. Arshed, Hassan, Grant, and Aziz, (2018) also examined Karachi stock exchange in Pakistan between 2004 and 2014 via panel cointegration method. The measurement of the share prices for the firms listed in Karachi stock exchange indicated inefficiency in the market for the period.

Rehman, Masood, Arshed, and Shah, (2012) utilized daily closing indices in South Asian markets; Karachi stock exchange of Pakistan, Bombay stock exchange of India and Colombo stock exchange of Sri Lanka from 1998 to 2011 in evaluating the weak form of market efficiency with the application of Q. statistics method, ADF unit root, descritive statistics method and autocorrelation function. It was revealed that, Karachi stock exchange and Bombay stock exchange were inefficient for the period; not weak form efficient but Colobo stock exchange of Sri Lanka was efficient for the period.

In another development, Ali, Naseem, and Sultana, (2013) tested weak form efficiency hypothesis in Colombo stock exchange of Sri Lanka, Bombay stock exchange of India, Karachi stock exchange of Pakistan and Dhaka stock exchange of Bangladesh via the application of Ljung-Box Q-statistic, run test, ADF unit root, variance ratio test and autocorrelation function by using daily

return indices. The daily returns of indices from the results found to follow non-normal distribution and all monthly returns of all indices were negatively skewed. It was concluded that non of the capital markets were characterized by random walk and hence are not weak form efficient for the examined period.

Pervez , Rashid, Chowdhury, and Rahaman, (2018) predicted stock market efficiency in weak form in Dhaka stock exchange of Bangladesh from 2004 to 2018. Using run test, lilliefors, ADF unit root, variance ratio test, kolmogorov-smirnov and autocorrelation function in measuring share prices index, the results rejected the null hypothesis of randomness, the study show inefficiency of Dhaka stock exchange in the weak form which shows that, investors have a chance to make an abnormal gain in predicting the historical data. Zaman, (2019) estimated weak form efficiency in Chittagong stock exchange and Dhaka stock exchange of Bangladesh between 2013 and 2017. Utilizing Ljung-Box Q test, run test, descriptive statistics, ADF unit root, autocorrelation function, Philip Perron unit root and variance ratio test to measure stock prices, it was found that the both stock markets were not efficient in the weak form.

Soon, Baharumshah and Chan, (2015) investigated Malaysian economic sectors; the finance, plantation, properties, tin & mining, construction, consumer products, trade & services and technology sub-sectors in the stock market from 1980 to 2011. The reason was to know if the stock market is efficient in the weak form via the use of ADF unit root and break test. It was revealed that, the market was predictable, meaning the market was not efficient in the period. Kok, Munir and Lean, (2019) evaluated informational efficiency of stock market in Malaysia with non-linear threshold autocorrelation model to measure stock prices. There was no evidence of full stationary and cannot infer inefficiencies, meaning Malaysia stock exchange is efficient for the period under review.

Josephine, (2016) tested efficient market hypothesis on the Nairobi stock exchange of Kenya from 2008 to 2015 with serial correlation test. The result did not support random walk for the Nairobi stock exchange; it showed that Kenya market was not weak form efficient for the reviewed duration. Adigwe, Ugbomhe and Alajekwu, (2017) examined stock prices of African stock markets to find out if the markets are efficient or not. The study employed descriptive statistics and ADF unit root for analyzing the stock markets. The research revealed the following results; African stock markets did not follow normal distribution, succeeding price changes are not independent and move randomly. The study thus concluded that, African stock markets are weak form inefficient within the period under study. Awiagah and Choi,(2018) investigated if the stock prices in stock market of Ghana is random or predictable by applying Jarque-Bera statistics of normality, Ljung-Box, autocorrelation function, ADF unit root, variance ratio test and run test respectively from 1990 to 2017. The study rejected the predictiveness of the stock market, meaning, Ghana stock exchange was not efficient in the weak form for the period.

Aliyev, (2019) explored 12 weeks stock prices of Borsa Istanbul in 2015. Smooth transition autocorrelation was employed in testing the market efficiency hypothesis. Borsa stock prices were found to be predictable, it shows that Borsa Insnbul was not weak form efficient for the study period. Amelot, Usha and Lamport, (2017) used exchange rates and examined stock market of

Mauritius by utilizing Philip Perron unit root and ADF unit root for ascertaing weak form efficiency, emplying cointegration, Granger causality test and variance decomposition for ascertaining semi-srong form of efficiency. It was revealed that the market was efficient at the weak form but not efficient in the semi-strong form.

Gilani, Nawaz, Shakoor, and Asab, (2014) tested stock prices of Islamabad through run test and ADF unit root in January to December 2013. The purpose was to know if the Islamabad stock exchange is efficient in the weak form. The results showed that Islamabad stock market was weak form efficient for the year under study. Olubiyi and Olopade, (2018) found weak form of market efficiency in Qatar after employing ARCH model in measuring stock returns from 2005 to 2016. Angelovska, (2018) examined weak form of market efficiency by employing basic random walk model and GARCH model in stock price measurement in Macedonian stock exchange between 2005 and 2018. Macedonian stock market was found not efficient for the period.

Younas and Mehmood, (2018) examined market efficiency of NASDAQ stock exchange of America via autocorrelation fuction and run test from 2009 to 2017. NASDAQ stock exchange of America was found not efficient therefore investors can achieve abnormal returns by predicting the future trends based on the previous stock movements. In another development, Tokic, Bolfek and Pesa, (2018) evaluated efficient market hypothesis in developing Eastern European countries; Croatia, Serbia, Slovenia and Slovakia from 2006 to 2016 by measuring daily returns of the stock market indices via variance ratio test, run test and ADF unit root. The results revealed that, except Serbia, all other stock markets confirmed weak form of efficiency for the period.

From the above, it is cristal clear, both from developed and developing countries, that the subject of random work is still a serious debate, measurement of various stock markets produce conflicting results and conclusions. Research in the Nigerian stock market with regards to its level of efficiency is also inconclusive. This study employs recent data and rubost econometric tools to examine the level of market efficieny in the Nigerian stock market.

METHODOLOGY

Study design

This is a descriptive study, which aims to describe the behaviour of the Nigerian stock market, particularly with respect to how stock prices respond swiftly to available past information.

Data and Empirical Tests

The All Share Index is used to measure the stock market in terms of the magnitude and direction of general price movement. It also indicates the total market index, which reflects the behavior of stock in the market. (Udom & Richard, 2019). The All-Share Index (ASI), therefore, also serves as useful indicator of stock market efficiency.

Secondary data were collected on the Nigerian stock exchange all share historical daily, weekly and monthly returns; Daily NSE all share index covered June 27, 2019 to August 18, 2019; weekly

NSE all share index from August 5, 2018 to September 22, 2019 and monthly NSE all share index from October 2014 to September 2019.
The research utilizes two empirical tests namely ADF Unit root and normality test via descriptive statistics to ascertain the random walk pattern on the Nigerian stock exchange. The justification behind employing the two tests: Efficiency in the weak-form requires that the return series are non-stationary at level. The study, therefore, the uses of ADF unit root test to know if the NSE all-share index for the period is stationary at level or not. Efficiency in the stock market requires that the return series are normally distributed; hence, the normality test via descriptive statistics is used to test the normal distribution of the data.

RESULT

Descriptive statistics and test of normality

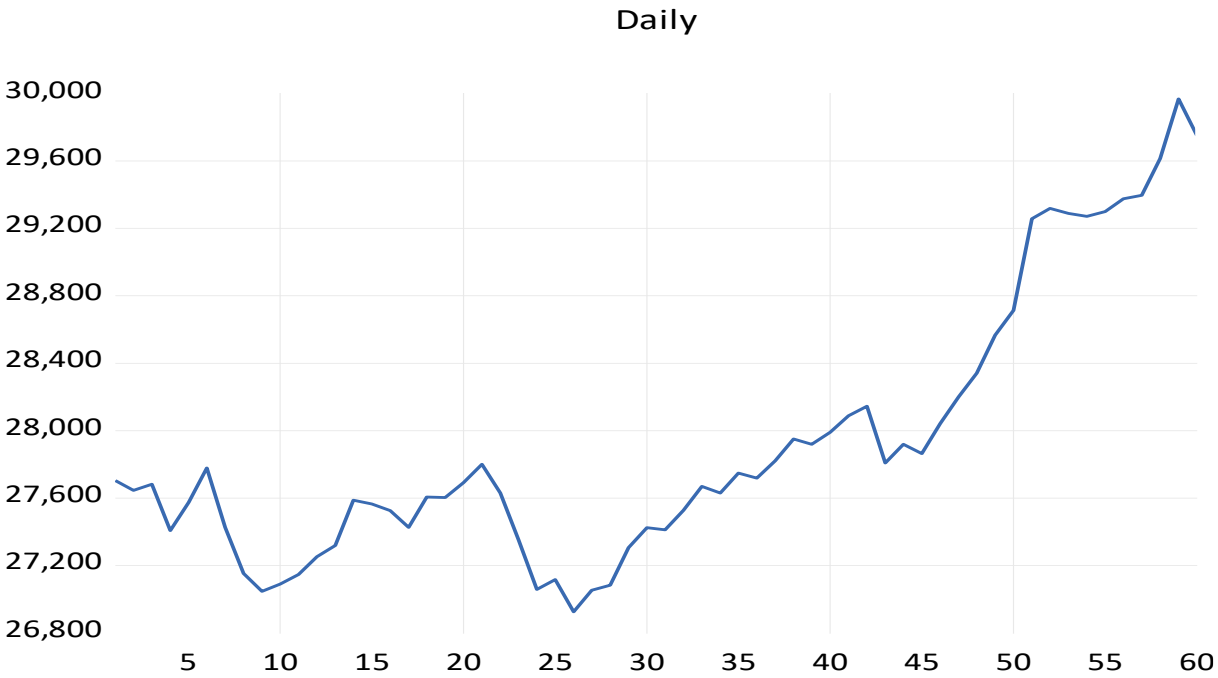
Table 1 shows the descriptive statistics (including the mean, median, maximum, minimum, standard deviation, skewness, kurtosis, Jarque-Bera, and probability) of the Daily NSE all share index from June 27, 2019 to August 18, 2019; weekly NSE all share index from August 5, 2018 to September 22, 2019 and monthly NSE all share index from October 2014 to September 2019.

Table 1

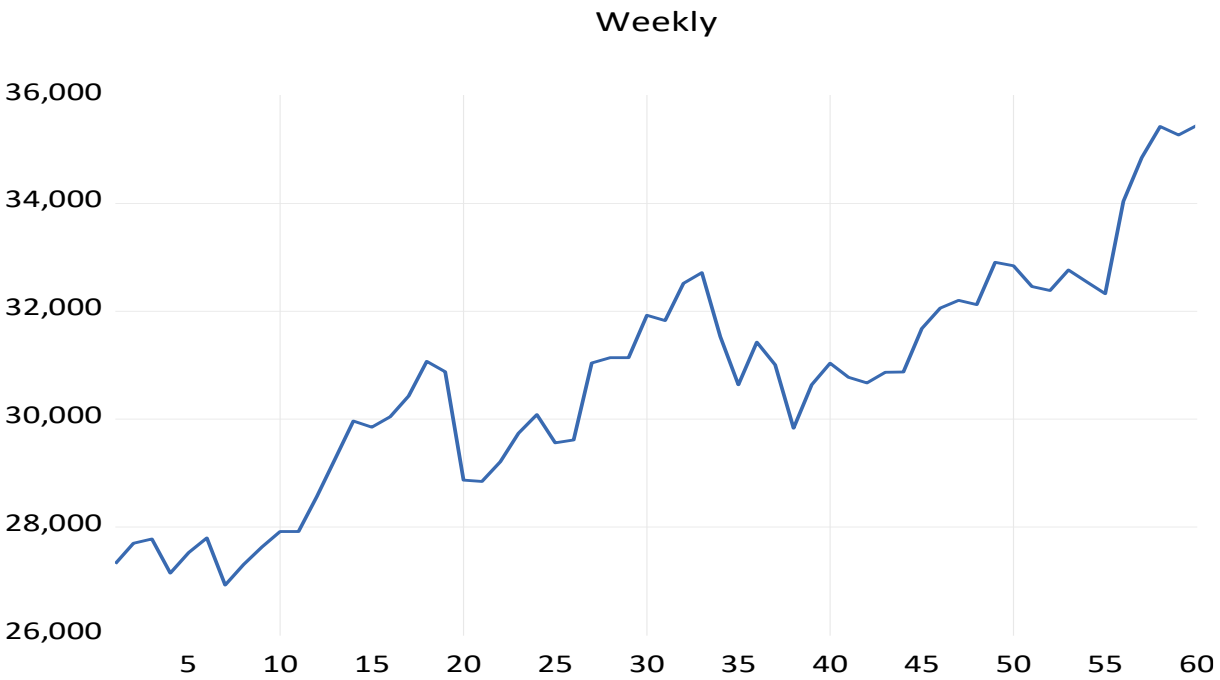
	DAILY	WEEKLY	MONTHLY
Mean	27926.62	30698.39	31565.49
Median	27686.73	30870.50	30715.69
Maximum	29966.87	35446.47	44343.65
Minimum	26925.29	26925.29	23916.15
Std. Dev.	782.4807	2145.970	4931.517
Skewness	1.115595	0.182415	0.639529
Kurtosis	3.184700	2.621044	2.755111
Jarque-Bera	12.53080	0.691771	4.239905
Probability	0.001901	0.707594	0.120037
Sum	1675597.	1841904.	1893929.
Sum Sq. Dev.	36124283	2.72E+08	1.43E+09
Observations	60	60	60

The descriptive statistics on table 1 reveals that the expected NSE all share indexes under review for daily is 27926.62; weekly is 30698.39 and monthly is 31565.49. The maximum values show that daily is 29966.87, weekly is 35446.47, and monthly is 44343.65; while the minimum values show that daily is 26925.29, weekly is 26925.29, and monthly is 23916.15. The Jarque-Bera with their corresponding probabilities revealed that daily is not normally distributed with a probability of 0.001901 but weekly and monthly are normally distributed with 0.707594 and 0.120037 respectively at 5 percent.

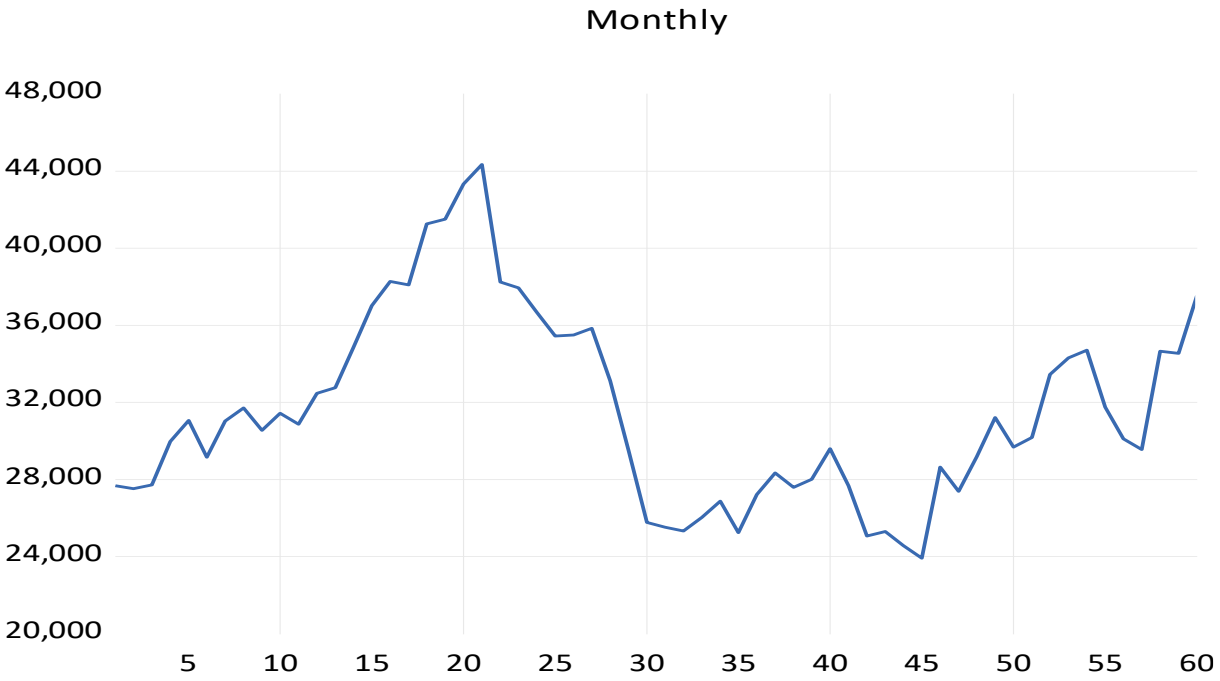
Fig. 1 Graphs of the distribution



Source: Eviews 10 software output, 2019



Source: Eviews 10 software output, 2019



Source: Eviews 10 software output, 2019

The graphs above reveal non-stationary movement along the period under study.

Test of stationarity:

Below are the results of the various tests of stationarity using Augmented Dickey-Fuller (ADF) test.

Table 2
Augmented Dicky-Fuller unit root test results summary at level

Variable	ADF - Test statistic at level	Critical Values	Order of integration	Prob
Daily	-1.391065	1% -4.121303 5% -3.487845 10% -3.172314	@ level	0.8536
Weekly	-2.397637	1% -4.121303 5% -3.487845 10% -3.172314	@ level	0.3770
Monthly	-1.398588	1% -4.121303 5% -3.487845 10% -3.172314	@ level	0.8513

Source: Eviews 10 software output, 2019

The Augmented Dickey-Fuller unit root test results on table 2 above reveal that none of the variables (Daily, Weekly, and Monthly) were stationary at level (order of 0).

DISCUSSION OF FINDINGS

Results of the ADF unit root tests reveal that none of the variables (Daily, Weekly and Monthly), at 5% significant level, was stationary at levels. The non-stationarity of data at level series indicates that the behaviour of the NSE all share indexes conforms to and is consistent with the weak form efficiency of the market, which states that financial time series behave as random walks. The daily, weekly and monthly graphs results are also consistent with the normality test and ADF unit test results, indicating that the Nigerian stock exchange market is efficient in the weak form, meaning no investor can make unfair gain in the market by predicting the market. The results from the normality test are also consistent with the unit root test of stationarity indicating that the Nigerian stock exchange market is efficient in the weak form except the daily index that shows inconsistency. This implies that the participants in the Nigerian stock exchange market cannot devise any statistical technique to gain from the stock exchange market transactions on consistent basis.

Comparing the findings of this study with those of earlier studies in Nigeria, the results of the tests conducted seem to concur with the findings of Andabai, (2019), who investigated the weak form of efficiency of the Nigerian stock exchange using Augmented Dickey Fuller unit root test for two periods (1999-2010 and 2010-2017) and found random walk from 2010 to 2017 and concluded

that participants cannot predict the market for the period. But the findings of this study is inconsistent with the findings of Ogbulu, (2016), who examined the weak form efficiency of the Nigerian stock exchange market using the Augmented Dickey Fuller and normality test from 1999 to 2013 and concluded that the Nigerian stock exchange is inefficient when daily, weekly, monthly and quarterly prices are examined. The inconsistency with the above could be as a result of the period under review. Comparing the findings of this study with those of earlier studies elsewhere, the results of the tests conducted seem to be consistent with the findings of Kok, Munir, & Lean, (2019), who examined the weak form efficiency of the Malaysia stock exchange market using the non-linear threshold autocorrelation model and found efficiency of the market in the weak form.

Summary of Findings

From the data analyzed above, the following are the findings of this study:

1. All the three frequencies (Daily, Weekly and Monthly) studied exhibited a random walk, at level series. In other words, the NSE index for the daily, weekly and the monthly are efficient in the weak form.
2. The results of the ADF unit root, Jarque-Bera test for normality and the Graph are consistent indicating that the Nigerian stock exchange market is weak form efficient.

CONCLUSION

The focus of this study is to assess the weak form efficiency of the Nigerian stock exchange market. Nigerian stock exchange all share historical daily, weekly and monthly returns were employed for the analysis; Daily NSE all share index from June 27, 2019 to August 18, 2019; weekly NSE all share index from August 5, 2018 to September 22, 2019 and monthly NSE all share index from October 2014 to September 2019 were used. The data was analyzed using unit root tests of stationarity and random walk, Jarque-Bera for normality and graph presentation. Based on the findings that the Nigerian stock exchange all share historical daily, weekly and monthly returns studied exhibited significant random walk, the study concludes that the Nigerian stock exchange market is efficient in the weak form.

Recommendations

In line with the findings, the following are recommended:

1. Government should improve on ICT in the Nigerian stock exchange market at regular basis.
2. Efforts should also be made by government to develop and implement stock exchange policies that will ensure active trading and vibrancy in the market.

Suggestions for further studies

This study focuses on assessing the weak form efficiency of the Nigerian stock exchange market by employing Augmented Dickey Fuller (ADF) unit root test, Graph presentation and Jarque-Bera

test of normality for the daily NSE all share index from June 27, 2019 to August 18, 2019; weekly NSE all share index from August 5, 2018 to September 22, 2019 and monthly NSE all share index from October 2014 to September 2019. Further studies could extend in the time frame and employ other analytical tools to verify the claims of this study. It will be appropriate to also employ other statistical tools for testing unit root in order to compare the results and ascertain consistency and reliability. Finally, studies can be conducted to evaluate both the semi-strong and strong forms efficiency of the Nigerian stock exchange markets.

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