TESTING FOR SHORT/LONG RANGE DEPENDENCY AND MARKET EFFICIENCY IN NIGERIAN STOCK MARKET RETURNS: 2006- 2017

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ABSTRACT

Understanding stock markets price fluctuations is very important in financial economics, corporate investment and financing strategies. The more efficient is the market, the more random is the sequence of price changes generated by the market. Therefore, the existence of long range dependency (long memory) in stock market returns would affect the investment horizon of portfolio decisions. This study provides a detailed examination of long-range dependence in daily returns for Nigeria stock market from Jan, 1 2006 to April 10 2017. Using ARFIMA models and Modified Hurst Exponents. The results indicated that stock market returns in Nigeria has long-range dependence over the period investigated. The existence of long range dependency has serious implication in the Nigerian Capital Market. This result indicates that stock market agents and participants can predict future value of stock prices thus re-enforcing the weak form hypothesis

Key words: Long, memory, capital, dependence, Exponents, financial, stock, fluctuation, decision.

INTRODUCTION

Long-range dependence (LRD), also called long memory or long-range persistence, is a phenomenon that may arise in the analysis of time series data. It relates to the rate of decay of statistical dependence of two points with increasing time interval between the points. A series is usually considered to have long-range dependence if the dependence decays more slowly than an exponential decay. One way of characterizing long-range and short-range dependent stationary process is in terms of their auto-covariance functions (ACF). For a short-range dependent process, the coupling between values at different times decreases rapidly as the time difference increases. Either the auto covariance drops to zero after a certain time-lag, or it eventually has an exponential decay. In the case of LRD, there is much stronger coupling. The decay of the auto covariance function is power-like and so is slower than exponential.

The presence of long range dependency in some stock returns have continued to generate controversies over the potency of the weak form hypothesis in the Efficient Market Hypothesis. There is a continuing debate in the literature concerning the empirical implications from tests of the weak form of market efficiency for stock returns. Opposing what the random walk hypothesis suggests several studies have discovered positive autocorrelation for stock returns in the short run (see Mill, 1999), and negative autocorrelation in the long run (see also Pan, Liu and Bastin 2016). The random walk hypothesis that stock returns at current period are independent of previous periods' stock returns and the deviations of returns from its long term level (the constant drift parameter) are" white noise". Negative autocorrelation means that stock prices are mean reverting and the stock price fluctuates violently, if this is true, this will of course have important implications for modern financial economics.

The evidence of positive correlation in the short run and negative in the long run on stock returns has given rise to Mills (1999)" fads hypothesis"; stock prices overreact to relevant news which leads to a positive correlation in the short run, followed later on by a correction of the prices. The correction means that a run of positive returns eventually tends to be followed by negative returns, indicating a negative autocorrelation over longer horizons.

This study examines the presence of long range dependency in Nigerian stock returns coherent with the efficiency market hypothesis (EMH) to determine if there is presence of weak form in Nigerian stock exchange.

REVIEW OF LITERATURE

Theoretical Considerations

Efficient Market Hypothesis

The efficient markets hypothesis predicts that market prices should incorporate all available information at any point in time. There are, however, different kinds of information that influence security values. Consequently, financial researchers distinguish among three versions of the Efficient Markets Hypothesis, depending on what is meant by the term “all available information”. Mills (1999) categorized the EMH into three (3) forms based on the definition of the information available namely:

I. Weak form EMH
II. Semi-strong form EMH
III. Strong form EMH

Weak Form EMH

The weak form EMH states that current stock prices are assumed to mirror any information that may be restricted in the past history of the stock price including information on historical sequence of prices, rates of return, trading volume data, and the market generated information. This hypothesis implies that the previous returns and any other market data have no relationship with future rates of return. Therefore, one should gain small from any trading rule that determine whether to buy or sell a security based on the past rates of return or any other market data. For example, if they be a seasonal outline in stock prices such that stock prices drop on the last trading day of the year and then increase on the first trading day of the following year. Under the weak form of hypothesis, the market will come to recognize this and price would swiftly adjust to incorporate the phenomenon.

Expecting an increase in price on the first day of the year, traders will try to get in at the very beginning of trading on the first day. This will in turn lead to rise in price in the first minutes of the first day. Thoughtful traders will then notice that in other to beat the rest of the market, they will have to get in late on the last day of the year when stock prices have historically dropped.

Attempting to buy late in the day will act to support prices and reduce the range of the fall on the last trading day of the year. The process of trying to get in earlier will continue until the entire year-end pattern is excluded from the price series. In other words, the complicated patterns in price series will be detected and excluded in the same fashion until it becomes unable to forecast the future course of the series by analyzing its behavior. As soon as this state has been established, the weaker form of the EMH will be satisfied.

Semi-Strong Form of EMH

The semi strong form of EMH states that security prices rapidly change to accommodate all public information. That is to say all public information available is presumed to be reflected in securities prices. This includes information in the stock price series as well as information in the firms accounting reports, the reports of competing firms, announced information relating to the state of economy and any other public information available which is relevant to the valuation of the firm. This information might contain annual filings, annual reports, earnings reports, announcements, and other important information that can be easily gathered. This hypothesis assists those investors who base their decisions on new information. The public should not get above average profits from their transactions considering the cost of trading, because the security price already shows all such new public information.

Strong Form of the EMH

The strong form EMH on the other hand states that stock prices fully reflect all information from public and private sources. This means no group of investors has monopolistic access to useful information about the formation of prices. Therefore, no group of investors should be able to constantly derive above average profits. The strong form includes both weak form and semi strong form EHM respectively. Furthermore, the strong form straightens the assumption of efficient market, in which prices adjusts quickly to the release of new public information. It assumes perfect markets, in which all information is free and available to entire public at the same time. Under this form, those who get inside information act on it, by buying or selling the stock. Their responds affect the price of the stock, and the price quickly adjusts to show the inside information.

Random Walk Theory

Random stock price movement and its connection with information were first made by Chodhry in 1994 in one of his paper, *"The Theory of Speculation"*. He ends up saying that commodity prices vary randomly thus building the foundation for information efficiency. Most Empirical work on stock markets preceded the theory of market efficiency and was established later to explain randomness in price data. Several studies on stock prices behaviour concluded that the prices were just as random as a series of randomly generated series of numbers. Stock price are analyzed based on indices using spectral analysis and found that time series data conformed to random walk theory. This means that an investor is unable to predict future price movement.

The Random Walk model can be used to test for weak form EMH and the model is stated as follows:

$$P_{t+1} = P_t + e_{t+1} \text{..} 2.1$$

Where:

P_t is Price of share at time t;

P_{t-1} price of share at time t-1 ;

e_{t-1} is random error with zero mean and finite variance.

Equation (2.1) indicates that the price of a share at the current period 't' is equal to the price of a share at pervious period 't-1' plus given stochastic value that depends on the new information arriving between time 't' and 't-1'. This shows that the change of price in time't' is independent of past price changes.

A natural logarithmic transformation is performed on the data to generate a time series of continuously compounded returns. Daily returns are computed as follows:

$$r_t = \log(p_t) - \log(p_{t-1}) = \log(p_t/p_{t-1}) \text{......................} 2.2)$$

Where p_t and p_{t-1} are the stock prices at time *t* and *t-1*.

Random Walk Theory and Competitive Markets

The theory demonstrates that randomly generated series of numbers could have a pattern resemblance to a 52 week Dow Jones index movement. It is argued that technical analysis to predict future prices is not important for efficient markets. Therefore, a lack of randomness in stock price movement shows an unexploited opportunity for economic rent. This situation represents an inefficient market. In random walk theory (RWT), successive stock price changes are independent of past prices; the current price *(P_t)* has no relation to former price *(P_{t-1})*. Future prices P_{t+1}, P_{t+2}, P_{t+n} too have no relation to current or previous prices. Some assumptions of basic efficient market hypothesis include; (i) a considerable number of rational profit amplifiers actively competing with each of them attempting to predict future market values of individual securities (ii) that information are costless and freely available to all participants in the market. Gaining possession of public information has a cost and hence this has to be balanced against its marginal worth. Efficient market hypothesis (EMH) was then later re-defined to explain that *“security prices fully reflect all information to the point where marginal cost of responding to the information that does not exceeds its benefit”*.

Weak Form Market Efficiency

The information set characteristic of weak form efficiency is embedded in historical prices of stocks, and it states that whatever information is available is fully reflected in prices. Consequently, it is not beneficial to look for trends or patterns of price fluctuation to infer future price movement. This is the concept underlying random walk theory. Test for weak form efficiency is therefore test for random walk which is testing independence or randomness in price movement. Two statistical tests have been suggested for independence in price movement. These are serial correlation coefficients test and run test.

Types of Weak Form Efficiency

Random walks have three (3) successively stronger tests listed and briefly explained below:

I. Random Walk 3 (RW3)
II. Random Walk 2 (RW2)
III. Random Walk 1 (RW1)

Random Walk 3 (RW3)

In this type of market, it is not possible to use historical prices to forecast future prices. Lack of presence of *Serial Correlation (SC)* suggests that prices are driven by inside information or lack of liquidity. The test is least limiting to the three (3) random walks.

Random Walk 2 (RW2)

Random Walk (RW2) puts an additional condition on RW3. It says that it will be impossible to utilize information on the variance of past prices to forecast future changes of the market. Hence variability of historical prices is not related to variability of future prices of stocks.

Random Walk 1 (RW1)

Finally, the third market, is neither possible to forecast future price movement nor future price changes by analyzing information on past prices. A test for RW1 asserts that a test for heteroscedasticity in the previous time series of price data. It is much more contained and thought to be characterized only by most mature and efficient equity markets.

EMPIRICAL REVIEWS

In the literature of financial economics there exists different studies that investigated questions related to the dependence of short and long-term memory for financial time series. Choudhry (1994) analyzed stock indices of seven countries which are members of OECD organization, *Co-integrations* test were used to test the monthly stock indices from 1953-1989. The stock indices as expressed in these seven countries were found efficient during the period he reviewed. The co-integration results gave no evidence about long run connection between the seven (7) stock series and using Co-integration tests,

Also Chan, Gup and Pan (1997) tested for weak form efficient market hypothesis of eighteen (18) international stock exchange markets. The data used were from 1962-1992 a period of thirty (30) years with 384 monthly observations of each stock series. The stock markets were analyzed to test for Weak form market efficiency separately and collectively. The conclusion drawn from the study was that all the stock markets analyzed individually were weak form efficient. Ceretta and Costa (2002) had investigated the behavior of the prices relative to the short dependence of the Latin America stock markets returns series. The study used variance ratio test version. Parametric and nonparametric for the indices of Argentina, Brazil, Chile, Colombia, Mexico and Venezuela. The results show that equity prices in Argentina and Brazil follow a random walk. In contrast, the Colombia and Chile indices show a greater tendency contrary to random walk model. Pant and Bishnoi (2002) conducted and rejected the Weak form Efficient Market Hypothesis while accessing the Indian stock markets using the *Auto-Correlation test, DF and Variance Ratio tests.* The study was conducted for the period of 1996-2001. Using daily and weekly stock indices they study investigated weak form market efficiency using future market in India.

Twenty four (24) Stock futures and *NIFTY* futures were used and they concluded that both are shifting from normal distribution. The future prices were not stationary at all levels. *AMIRA* process found both *NIFTY* and stock future returns are dependent and reflects strong dependency.

The degree of long-range dependence in indexes of the banking sector was examined in 41 different countries in Cajueiro and Tabak (2005). The results suggest that there is a stronger degree of long-range dependence in equity returns for emerging markets than for developed economies. Furthermore, on average long-range dependence in volatility seems to be stronger in developed economies than in emerging markets.

Generalized Hurst exponent was used for the examination of a wide variety of stock markets indexes in Matteo et al. (2005). They concluded that many indexes show sensitivity of the Hurst exponent to the degree of development of the market. United State, Japan, France and Australia, all the indexes presented H < ½. On the other hand, H > ½ was calculated for Russian, Indonesian, Peru and other countries. They had suggested that this sensitivity of the scaling exponent comes to serve as a reference for a new and simple way of empirically characterizing the development of financial markets.

Cajueiro and Tabak (2005) present empirical evidence of short and long-run predictability in stock returns for European transition economies. Strong evidence of short- term predictability from variance ratio statistics was found in all indices, with the exception of the Bulgarian stock exchange index and the Ukrainian KAC-20 Liquid Index. Evidence of long-range dependence was found for all indices through the application of Hurst exponents. Furthermore, they find evidence of strong time-varying long-range dependence in these economies stock returns, which is in line with evidence of multifractality of equity returns.

Abrosimova et al (2005) studied Weak Form Efficient Market Hypothesis for the Russian Stock market using daily indices, weekly time series for the period of six (6) years that is 1995-2001. Results of both *Auto-Correlation (AC) and Variance Ratio (VR) tests* were rejected by the random walk hypothesis for daily and weekly data, but was accepted for monthly data. So they decided to analyze the daily and weekly data for linear and non-linear dependence using *ARIMA and GARCH* models. The model comparison approach was also employed. Their conclusion was that none of the analyzed models is better than the other. The finding supports the weak form market efficiency hypothesis with proves from the Russian Stock market. Maria (2007) also analyzed Weak form Efficient Market Hypothesis on Portuguese Stock index prices of Lisbon Stock Exchange for 1993-2006 (13 years). *The Serial Correlation (SC) test and Runs test* were used to analyze the hypothesis that stock elements follow the Random walk. These tests were carried out using the daily, weekly and monthly returns for the entire period reviewed. The Author found out mixed results, but on the whole the results were evidence that the Lisbon Stock market had been accelerating towards the Random Walk behavior since year 2000 with the decrease in the serial dependence of returns. Gupta and Basu (2007) likewise used the daily indices of Bombay Stock Exchange and National Stock Exchange from 1991-2006.From the study, they rejected existence of the weak form market efficiency by using the *Serial Correlation tests (SC).*

On the same path Smith (2007) studied the existence of weak form Efficient Market Hypothesis in five stock markets in the Middle East. He applied *Multiple Variance Ratio (MVR)* tests to the data. The Israeli, Lebanese and Jordanian markets were proven to be weak form and followed the random walk. On the other hand, for the Stock markets of Kuwait and Oman, Random walk hypothesis was rejected. Furthermore, Vigg et al (2008) applied *Run test* and *Auto-correlation* on 30 different companies of Bombay Stock Exchange *Sensex* to investigate the Weak Form Market hypothesis and concluded that Bombay Stock Exchange was Weak Form Efficient.

Thomas and Kumar (2010) studied the Indian Stock market for the Weak Form Efficient Market Hypothesis. The statistical tests applied was *Auto-correlation* and *Run test* and they came to a conclusion that both parametric and non-parametric test gave prove that the Stock markets do not follow the random walk. Therefore, the Indian stock markets do not have weak form efficiency. Grau-Carles (2010) examined the long-range dependence of the stock market returns using daily data of five indexes. The series examined include the Dow Jones, Standard & Poor 500 and FTSE and the methodology applied was Hurst exponent and DFA. The conclusion of the authors is that no long-range dependence for returns, but strong dependence for absolute and squared returns. The results of the ARFIMA estimation for the parameter are significant in all cases except for the squared returns of the FTSE. However, for the returns the value of parameter is very small.

Mishra (2011) investigated some selected emerging and developed countries to test for the Weak form market efficiency. He selected eight (8) countries for the analysis using the data from 2007-2010. He applied the *Unit Root test GARCH model* and observed that these markets are not weak form efficient during the period he reviewed but are moving towards efficiency in the long run.

Crato and Lima (2014) examined persistence in the conditional variance of US stock returns indexes. The results had shown evidence of long memory in high-frequency data, suggesting that models of conditional heteroscedasticity should be made flexible enough to accommodate such dependences. Shiller and Radikoko (2014) tested the authenticity of Weak form Market Efficiency hypothesis of daily indices of the Canadian equity market. Various statistical tests had been used like *BG*, *Auto-correlation and the Run test* were used which supported that returns are serially correlated. Whereas the overall results rejected the *Random walk Model of TSX index* return thus it supported the phenomenon that Canadian equity markets are not weak form efficient. Also Birau (2015) carried out a study on the Romanian and Hungarian markets in era of financial crisis during the period of 2007-2011 based on daily price indices. The authors from their findings rejected the Weak form efficiency and drew a conclusion that both markets are inefficient.

Pan, Liu and Bastin (2016) examined the short and long-term behavior of foreign exchange rates, namely the British pound, the Canadian dollar, the Deutsche mark, the Japanese yen, and the Swiss franc. In this research, the authors had used the heteroscedasticity-robust variance-ratio test and the modified rescaled range analysis. The empirical results indicated the existence of short-term dependence for four of the five nominal, and two of the five real exchange rate series examined, implying the rejection of the random walk hypothesis. Additionally, long-term persistence is found in the same four exchange rates that show short-term dependence, although the evidence for the British pound is marginal.

METHODOLOGY

ARFIMA Model

In this study an ARFIMA tests will be conducted to examine long range dependency in Nigerian Stock returns. The Auto-Regressive Fractional Integrated Moving Average (ARFIMA) model, is formulated to examine if there exists long range dependency in stock returns. The ARFIMA models have the desired ability to match the slow decay of the autocorrelation functions. The ARFIMA model is given as;

$(1- L)^d Y_t$

(R/S)T = (1)/ST([Max ¿ k (rj - rT) - Min ¿ k (rj - rT)])Ñ Ñ . (3.3)

(1□k□T j=1 1□k□T j=1)

For Equation 3.3, the value of $s_T = [\square\ (r_j \square r_T)^2]^{1/2}$ is the usual standard deviation; r_j is continuously compounded asset returns($r_1,...,r_T$) and r_T denote the sample mean. Campbell et al. (1997) shows that the first term in 3.3 is the maximum of the partial sums of the first k deviations of r_j from the sample mean. Since the sum of all T deviations of r_j's from their mean is zero. The second term in 3.3 is the minimum of this same sequence of partial sums. The difference of the two quantities, called the range is always-nonnegative value and hence R/S□ 0.

The value of Hurst exponent (H) is generally obtained from the linear regression over a sample of temporal growing $\ln(R/S)_T = H \ln(T) + \ln(C)$. An estimated value of H = ½ means that the process has no long-range dependence, but if H > ½ the series is persistent and if H < ½ the series is considered anti-persistent or mean reverting. Although it has long been established that the R/S statistic has the ability to detect long-range dependence.

Lo (1991) showed that this statistic may be significantly biased when there is short-term dependence in the autocorrelation or heteroskedasticity and suggested the use of a modified rescaled range statistic. The difference between the Lo's modified statistic and the usual approach is the substitution of s_T for $s_T(q)$ which becomes a consistent estimator for the variance of the partial sum in 3.3.

In this suggested method, the value of s_T is given by $s_T(q) = \sigma_T^2 + 2\sum_{j=1}^{q} w_j(q)\gamma_j$

where $w_j(q) = 1 \square [j/(q+1)]$ and;

$\hat{\gamma}_j = 1/T [\sum_{i=j+1}^{T} (x_i - \bar{x}_T)(x_{i-j} - \bar{x}_T)]$ for all $q > T$.

Relationship Between Hurst Coefficient and ARIMA

The Hurst coefficient H is related to the *fractional differencing* parameter d, of a fractionally integrated time series. The relationship is given by:

d = H – 1/2

According to Mills et-al (2007), for values of $d \in (0, \frac{1}{2})$, the series is stationary and has long memory. For values of $d \in (-\frac{1}{2}, 0)$, the time series is anti-persistent, while for values of $d \in (-\frac{1}{2}, \frac{1}{2})$ the series is stationary and ergodic. Therefore, the Hurst coefficient and the fractional difference parameter, d can be used interchangeably for testing for the presence of long memory in a stationary time series.

Basically the hypothesis for the Hurst hypothesis is given as;

H_0 = {no long-range dependence, i.e., H = 0.5} against the

composite H_1 = {there is long-range dependence, i.e. 1/2 < H < 1}.

The Hurst coefficient is computed using the expression:

Data

The data used are daily stock prices index and volume of transaction obtained from the Nigerian Stock Exchange Report and it span from January 1st 2006 to April 10, 2017. This consist of 2814 observations. The Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test statistic will be used to test for stationarity of the data. The choice of KPSS is because it is most efficient among other class of Unit root test. Also it was discovered that the stock price contains constant and trend, as such KPSS is the ideal Test for stationarity for the data.

Estimation

The results presented in this section are computed using R consule and Python 3. All the results are based on the proposed test and model stated in the previous section.

Table 4.1 Summary Statistics on Stock Price

Statistics	**Coefficient**
Mean	7902.24
Maximum	51.724
Minimum	23.767
Std. Dev.	5.685
Kurtosis	20.647
Skewness	-1.675
Jarque-Bera	8227.53
Probability	0.000
Autocorrelation	0.090*
(p)	2814

* Rejected null hypothesis of non-autocorrelation at the 5% significance level;
** Rejected null hypothesis of non-autocorrelation at the 1% significance

Table 4.2: Unit Root Stationarity Result

Variables	KPSS Statistics	Critical Value	Stationary Status
Stock Price	0.702792	0.63900(1%) 0.46300(5%) 0.34700(10%)	I(0)
Volume of	0.839203	0.783940(1%) 0.534220(5%) 0.47030(10%)	I(0)

Source: Author's Computation

Table 4. 2 shows the unit root test for stock price and Volume of Transactions in the Nigerian stock exchange. From the result both variables are stationary at level, as such the

ARFIMA model will take cognizance of the stationary level of the data.

4.1 **Periodiogram of Stock Price and Volume of Transaction**

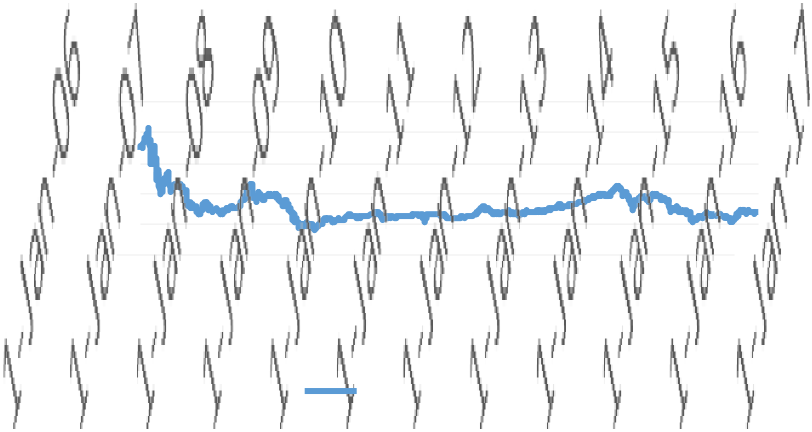

Figure 1.0 Stock Price Movement

From figure1, Stock price fluctuates from January 2006 to January 2017. The diagram shows a decline in stock prices between these period.

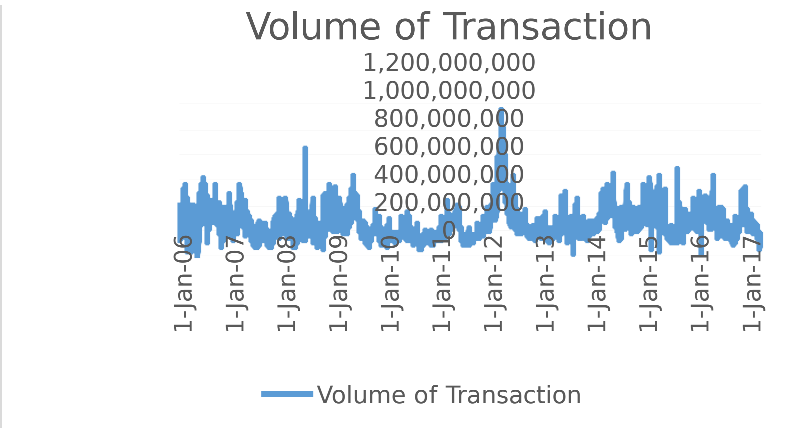

Figure 2. Volume of Transaction Movement

Unlike stock price, Volume of transaction is highly volatile from the diagram. Volume of transaction fluctuates between 2006 to 2017 as depicted in figure 2.

ARFIMA Model Estimation

The selection of the lag length for the Auto-Regressive and Moving Average model AR(p) and MA(q) is based on lag selection criteria using Akaike information criteria, Schwarz information criteria and Hannan-Quinn information criteria. The selected ARFIMA model is ARFIMA (3,d,2), AR(3) and MA(2). "d" will be allowed to take any value to determine the presence of long/short memory in stock prices. The comparism of the various ARFIMA model is shown Below.

Table 4. 3. Model Selection

Mode l	**Faction al Integrati**	**R^2**	**AIC**	**SIC**	**HQ IF**
ARFIMA (2-d-1)	**0.109**	**0.71324**	**-5.898**	**-5.715**	**-5.657**
ARFIMA (2-d-2)	0.390	0.64231	-5.718	-5.73	-5.553
ARFIMA (2-d-3)	0.421	0.58996	-5.582	-5.593	-5.417
ARFIMA (3-d-1)	0.293	0.56243	-5.517	-5.528	-5.352
ARFIMA (3-d-2)	**0.349**	**0.81214**	**-5.984***	**-5.915****	**-5.473***
ARFIMA (3-d-3)	**0.021**	**0.68432**	**-5.211**	**-5.215**	**-5.219**

Source: Author's Computation

From Table 3, ARFIMA(3,d,2) will be selected based on lag selection criteria, which are Akaike information criteria, Schwarz information criteria and Hannan-Quinn information criteria.

Table 4. 4. ARFIMA (3,d,2) Estimates

Parameters	**Coefficients**	**T statistics**	**Probability**
AR (3)			
Constant	**0.049431**	**3.09492****	**0.000000**
α_1	**0.849372**	**5.04932****	**0.000000**
α_2	**0.075942**	**0.45943**	**0.120438**
α_3	**0.081524**	**1.63221****	**0.002324**
MA (2)			
β_1	**0.004938**	**2.09332****	**0.000021**
β_2	**0.002948**	**1.28403**	**0.013801**
Fractional Integration			
D	**0.348921**	**2.093921****	**0.000329**

* Rejected null hypothesis ofinsignificance at the 5% significance level;
** Rejected null hypothesis ofinsignificant at the 1% significance

Source: Author’s Computation

From table 3, the fractional integration parameter is 0.348921, according to Mills (1999) When 0 < *d* < ½ the ARFIMA process is said to exhibit long memory with positive dependence. As such since 0 < 0.348921 < ½, Nigerian Stock Price Exhibit positive long range dependency over the period investigated going by the ARFIMA result.

Estimating Modified Hurst Exponent

The Hurst statistics is estimated using Lo (1991) procedures. An estimated value of H = ½ means that the process has no long-range dependence, but if H > ½ the series is persistent and is H < ½ the series is considered anti-persistent or mean reverting.

The Estimated Hurst exponent (H) is given below

Table 4.5. Hurst Exponential Estimate

Husrt Statistics	**Wald Test**
0.848921	16.646

Source: Author’s Computation

From table 4.5. Hurst Statistics is given as 0.848921 which is more than 0.5, this indicate the presence of long range dependency (long memory) in the stock price.

Concluding Remarks

This study provides a comprehensive empirical analysis of the Nigerian stock markets connected with long-range dependence. We have studied daily stock markets returns of Nigeria from January 2006 to April 2017. The returns series were obtained from Nigeria Stock Exchange database. This study was carried out using original returns. The individual analysis of the modified Hurst exponent identifies strong evidence of long-term dependence in Nigeria stock returns. In general, our results support the claim that the stock market returns in Nigeria has long-range dependence based on the ARFIMA model where the fractional integrate parameter is positive and less than 0.5 suggesting strong long memory in Nigerian Stock.

The existence of long range dependency has serious implication in the Nigerian Capital Market. Is indicated that stock market agents and participants can predict future value of stock prices thus re-enforcing the weak form hypothesis.

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