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An Investigation of Weak Form Efficiency in the Nigerian Capital Market

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ABSTRACT: The study investigated if the Nigerian stock market (NSM) is weak and inefficient from1990 and 2019. To properly capture the studied periods, they were clustered, the data used to conduct this research is monthly All Share Index (ASI) source from the apex bank Bulletin, 2019. The specific objectives investigated include: (1) presence of normal distribution, (2) the randomness or stock market returns' independence so as to forecast future market returns. Various tests conducted includes: descriptive statistics, Kolmogorov-Smirnov Test, runs test, unit root test, and simple regression. The results are as follows: (1) the NSM is highly risky;(2) The NSM returns is not normally distributed in the period between 1990 and 1997; 1998 and 2004; 2005 and 2015, and in the whole periods (1990 to 2019) though was normally distributed between 2011 and 2014 (3) the NSM seems to be inefficient from 1990 to 1997, 1998 to 2004, 2005 to 2015 and in the whole periods (1990 to 2019); (4) the market fashioned after the random walk from 2016 to 2019 suggesting that investor were able to forecast the market returns efficiently in these periods; and(5) previous stock market return has 15% positive relationship, and 0.23 0.23% predictive power. Thus, concludes that the NSM was only become in the weak and inefficient from 2016 up to 2019. As such, the study submits that information security fundamentals should be provided by issuers as at when due for security valuation at no cost.

KEYWORDS: Market efficiency, capital market, normality, random walk, Nigeria

INTRODUCTION

Stock market efficiency is an important concept, both in terms of an understanding of the working of capital markets and in their performance and contribution of the development of a country's economy. Since the global crises, the efficient market hypothesis (EMH) remains the most widely debated concepts in finance. Fama (1970) stated that the stock market can only be efficient if market participants are furnished with right information at ease. As such, such market prices must accounts for the intrinsic values of the stocks. This further implies that, an effective stock market is a market that efficiently allocates financial resources in such a way that meets both investors' and the entire country's demands (Copeland & Weston, 1988).

Again, the stock market is an organized financial arrangement established solely for mobilization and channelization of funds. Most stock markets have specific locations where in exchanges are consummated. Usually, companies that trade in the stock market must have to fulfil certain criteria before they are allowed to trade in the market. Through exchange between and among different agents in the stock market, funds are mobilized and channelized to the most productive groups with a view to increase the industrial base of the economy.

The efficiency of the emerging markets assume a greater importance as the trend of investment is accelerating in these markets as a result of regulatory reforms and removal of other barriers for the internationally equity investments. The term market efficiency is used to explain the relationship between information and share in the capital market literature.

Critical review into the Nigerian capital market (NCM) clearly revealed that though the assumption of seems to be paramount to the NCM yet there is no clear cut conclusion and stand point for all the researchers in Nigeria. More so, the issue of perfect information is not true in the Nigerian capital market context since the prices of securities in the market are not determined only by the prices of demands and supply. Issues of stock market manipulations, insider trading and slow pace of provision of security are some factors that disrupt flow of information in the market (in the market (Nwidobie, 2013), and the dependence of security price. Arising from these missing links, this study was conducted. Broadly speaking, the present study however, aimed to investigate if the Nigerian stock market (NSM) is weak and inefficient from 1990 and *2019*. The specific objectives include:

1. To test if stock prices in the NCM are distributed normally.

2. To determine the present market price that relates with the past stock prices (test of serial independence).
3. If the market is not weak and inefficient, a predictive model should be developed.

The period under study spanned 1990 to 2019. However, the period is subdivided into clusters: the first cluster is 1990 to 1997 (8yrs); the second cluster is 1998 to 2004 (7yrs); the third cluster runs through 2005 to 2005 (9yrs) while the fourth cluster covers 2006 to 2019 (6yrs). The essence of the clusters is to find out whether one period is more efficient than other.

LITERATURE REVIEW

Historical Development of the Nigerian Capital Market

The NCM was established in 1960 as the Lagos stock exchange. The exchange was renamed NSE in December 1977. Trading commenced at the exchange in 1961 with about nineteen (19) securities. By the end of 1971, there were 34 securities quoted on the NSE. Since then, there have been significant changes to the NSE in terms of structure and operations. These changes have resulted in a significant growth in the number of listed firms and trading activity. The major stock market index – the Nigerian All Share Index - was introduced in 1984 and its composition is restricted to ordinary shares only. In February 2009 the NSE introduced five (5) additional indices. These are: NSE 30 index, NSE Banking 10 index, NSE Insurance 10 index, NSE Food/Beverage 10 index and NSE Oil/Gas 5 index.

As at April 2009, there were 13 branches of the NSE and trading takes place 5 days a week, Monday through Friday. The trading settlement cycle is currently T+3, that is, the international standard. Additionally, the Exchange boasts of a central depository - the Central Securities and Clearing Systems (CSCS) - which electronically handles clearing, settlement and delivery of transactions on the Exchange. Currently, no restrictions exist for participation or ownership by foreign investors. In 2009, the NSE received a big boost towards its drive at internationalization when Bloomberg announced that real-time stock market data from Nigeria can be accessed from its database by the global investment community. The Nigerian stock market is currently the most liquid stock market in West Africa and the third largest stock market in Africa, after South Africa and Egypt (Allen, Otchere&Senbet, 2011).

THEORETICAL FRAMEWORK

Theory of market efficiency or the efficient market hypothesis provides an appropriate theoretical framework for the study. This theory stressed that, share prices react all available information speedily (Fama, 1991). As such, market helps to provide accurate signals for resource allocation since the market prices accounts for the intrinsic value of each security. However, the prices of such securities though can deviate from its true/intrinsic value but it does not do that completely value. Hence, such deviations are random completely and are also uncorrelated (Fama, 1970). Thus, the prices of securities are a true reflection of all available information on the expected risk and return of such security.

The fundamental analysis approach to security valuation posits that at any point in time, an individual security has an intrinsic value which depends in turn on such fundamental factors as quality of management, state of the firm's industry and returns, rate of return on equity and the general economic outlook. Variations in the values of these variables result in variations in share values which change follow any definite pattern (an outcome of random walk behaviour). Fama (1965) submitted that security prices are the actual values of the securities wandering randomly about their intrinsic values.

EMPIRICAL FRAMEWORK

An ample of empirical studies has been done test if the NSE or other African countries, the Asian countries and the world at large is weak, inefficient or not. These studies have shown conflicting findings. In Nigeria, for instance, eleven empirical works were reviewed, four supported that NCM is weak and inefficient (Obayagbona&Igbinosa, 2014; Okpara, 2010; Udoka, 2012; Ajao, &Osayuwu, 2012) while six of them (Gimba, 2012; Afego, 2012; Nwidobie, 2014; Osazevbaru, 2014; Ezepue& Omar, 2012; Emenike, 2008) reported that the market is weak and inefficient. These show the inconclusiveness of studies in this area. However, Samuel and Oka (2010) noted availability of information contributes to efficiency of capital market to a great extent. This implies that the more information is adequately distributed among players and investors alike, the more efficient the market might be.

More so, studies in other African countries including Ghana, Mauritius, Egypt and South Africa and Zimbabwe show conflicting results. The review so that South African Stock (Simons &Laryea, 2015) market is efficient while Ghana (Simons &Laryea, 2015), Mauritius (Simons &Laryea, 2015), Egypt (Simons &Laryea, 2015) and Zimbabwe (Sunde&Zivanomoyo (2008) are inefficient.

In Asia countries however, this conflicts exist. For India particularly, the specific studies in India show that Indian stock market is weak and inefficient (Khan, Ikram&Mehtab, 2011; Kumar& Singh, 2013 and Shafi, 2014). Equally, other panel studies involving posit that Asian stock market is not weak and inefficient (see, Patel, Radadia&Dhawan, 2012 for India, Hong Kong, China, and Japan; Nisar&Hanif, 2012 for South Asian India, Pakistan, Bangladesh and Sri Lanka; and Hamid, Suleman, Shah &Akash, 2010 for Asia-Pacific Markets of Pakistan, India, Sri Lanka, China, Korea, Hong Kong, Indonesia, Malaysia, Philippine, Singapore, Thailand, Taiwan, Japan and Australia). However, Haque, Liu and Nisa (2011) Pakistani equally support the weak form inefficiency of the Asian markets. Only a study in Vietnam (Phan& Zhou,

2014) provided evidence weak for efficiency in Asia. Moreover, an Asian study in Bangladesh noted that when the number of stocks included in the sample exceeds 3, stock market becomes weak and inefficient (Nguyen & Ali, 2011).However, studies involving France, Germany, UK, Greece, Portugal and Spain, only France, Germany, UK, Greece, Portugal and Spain are weak and inefficient while Greece, and Portugal are approaching efficiency by 2003.

A cursory look through the summary on Table 1 below show that the studies that provided these conflicting results equally used similar methodology, time frame, and type of data (daily, weekly or monthly). It becomes worrisome to find out the source of conflict in weak form efficiency tests with particular interest in Nigeria. As noted in Okpara (2010) that some years (periods) could experience market efficiency while other years would not, this present study will divide the period into chronological clusters to examine market weak form efficiency for those periods. However, in line with Emenike (2008) the present study would divide the periods.

METHODOLOGY

Data and Sources

This study used the Nigerian stock exchange all-share-index data on monthly basis (that is, all the all listings on the exchangeion monthly basis),. Given that using daily or weekly prices in are turn series comprising of infrequently traded stocks may lead to significant biases in the results (Lo&MacKinlay, 1988). Additionally, we use index prices, rather than individual stock prices, to provide market-wide evidence. The index isin local currency and the data consists of 360observations spanning the period spanning from 1st of January 1990 to 31st of December, 2019. The data was sourced from the CBN Statistical Bulletin, 2019. The monthly Stock market indices are converted into stock market returns using the formula below:

$$R_{mt} = \text{Ln}(P_t / P_{t-1})*100 \quad (1)$$

Where: R_{mt} represents monthly market return for period *t*, P_t and P_{t-1} denote market prices for period *t* and period *t-1* respectively and *Ln* denotes natural logarithm.

We use this log transformation to convert our data into continuously compounded rates. This practice is common rather than using discrete compounding.

Model specification

The study used a simple autoregressive model where the regress and is hypothesized to depend on its own past values. This helps to identify the presence or otherwise of autocorrelation in the model. We compute the test statistics for randomness or efficiency by means of auxiliary regression. Tests of statistically significant dependence or correlation in stock price changes, as defined by the random walk model, are traditionally used to test for weak and inefficient markets (Mabhunu, 2004).

The specified model is as follows:

$$y_t = a_0 + y_{t-1}b + e_t$$

Where:

y = Monthly stock prices or returns which the dependent variable.

e = the residuals.

t = Time (monthly in this case)

y_{t-1}=Monthly stock prices or returns in the previous year is the independent variable in the above model

a= constant; b = coefficient of the relationship between y and y_{t-1}.

Method of Analyses

The study has relied on a number of statistical and econometric tools. The study has relied on descriptive statistics for determining if the market is random or weak based on the normality test estimates, runs test, Kolmogorov-smirov test, Augmented Dickey Fuller test, and simple regression test for analyzing the data and realising the objective of the study.

Test of Normality

1. Descriptive Statistics

The basic requirement for any market to be random or to follow the weak form is that the market returns is normal distributed. This was determined through the aid of the descriptive statistics. Various parameters considered are skewness (S)-measure of asymmetry with benchmark value of 0, Kurtosis (K)- measured peakedness, flatness, and thickness of the distributiontails with benchmark value of 3, and Jarque-Bera (J.B)-measures normality of the series with benchmark value of > 5% (Brooks 2008). This pre-test makes parametric or non-parametric tests become more practical when examining a random walk.

2. Kolmogrov-Smirnov (K-S) goodness of fit test

The Kolmogorov Smirov one sample test is used to examine an unknown distribution. This test is widely used to check whether a particular data follows a particular distribution or not. The test is relevant here because we want to check whether our data is normally distributed or not.

Test of randomness or serial independence

1. Runs test

To determine if the stock prices are serial independence, the study adopted the runs test. This test is used to check if two values differs (Okpara, 2010). Wherein the two values differs, the null (H0) hypothesis of randomness in successive price variation is rejected

2. Unit Roots

The Augmented Dicey-Fuller (ADF) test was used to determine the stationarity (absence/presence of randomness) of the value of the shares. The ADF test given us a t-statistic which is generally negative. The higher negative the t-statistic, higher are the chances of rejecting the null hypothesis. The t-statistic is often compared with the critical values calculated at 5%. If the t-statistic is less than the critical value calculated at a given critical level at 5%, then the researcher has to reject the null hypothesis of the series being random.

PRESENTATION AND INTERPRETATION OF RESULTS

The descriptive statistic and Kolmogorov Smirov analyses are shown on Table 1 and 2 respectively.

Table 1: Descriptive Statistics: Monthly returns of NSE All Share Index (ASI)

	stock return (1990 to 1997)	**stock return (1998 to 2004)**	**stock return (2005 to 2015)**	**stock return (2016 to 2019)**	**All Period stock return (1990 to 2019)**
Mean	0.024183	0.018557	0.011726	0.006992	0.015988
Maximum	0.240400	0.184800	0.323500	0.126100	0.323500
Minimum	-0.230400	-0.185800	-0.365900	-0.102900	-0.365900
Std. Dev.	0.046192	0.049209	0.076966	0.050966	0.060558
Skewness	0.194179	-0.123598	-0.579555	0.155581	-0.499774
Kurtosis	18.96280	6.983453	8.625031	2.914011	10.92941
Jarque-Bera	1009.224	55.75152	181.4148	0.208432	955.4578
Probability	0.000000	0.000000	0.000000	0.901031	0.000000
Observations	95	84	132	48	359

The descriptive statistics of the stock returns of the Nigerian Stock Market is presented on Table 1 above. Normality of distribution is one of the basic assumptions underlying the weak and inefficient market (Simons and Laryea, 2006). Thus, if NSE monthly returns follow normal distribution, it means that we cannot predict the future returns or prices from the mean of today's return or prices. In such instances, the NSE is termed weak and inefficient.

Furthermore, the results show that the returns are not normally distributed. Mean stock returns are positive with large volatility (standard deviation) for all countries. This suggests that the market is highly risky.

Generally, values for skewness (zero) and kurtosis (3) represents that the observed distribution is perfectly normally distributed. The kurtosis coefficient (10.92941) from 1990 to 2019 is a peaked distribution and negative skewness (-0.499774). Cluster 1 has peaked kurtosis (18.96280) and positive skewness (0.194179), cluster 2 has peaked kurtosis 6.983453 and negative skewness (-0.123598), cluster 3 has peaked kurtosis 8.625031 and negative skewness (-0.579555), while cluster 4 has flat 2.914011 kurtosis and positive skewness (0.155581). This shows that the series is leptokurtic in cluster 4 and playtykurtic distribution in all the other clusters and the All-time period. As the value of skewness and kurtosis of stock return series of NSE are not equal to 0 and 3 respectively.

From the results of the calculated Jarque-Bera statistics and p-values in the table 1, the p-values for all the indices (except cluster 4) are less than (0.01). Thus, the hypothesis of normal distribution is rejected at the conventional 5% level for all the period, cluster 1, 2 and 3 and accepted for cluster 4. Therefore, this suggests that the returns of the NSE are against the random walk theory.

Kolmogorov-Smirnov (KS) Test compares the observed cumulative distribution function for a variable with a specified theoretical distribution which may be normal, uniform, and exponential or Poisson.

Table 2: *Kolmogrov-Smirnov (K-S) goodness of fit test*

One-Sample Kolmogorov-Smirnov Test

	stock return (1990 to 1997)	**stock return (1998 to 2004)**	**stock return (2005 to 2015)**	**stock return (2016 to 2019)**	**All Period stock return (1990 to 2019)**
Absolute	.194	.113	.083	.066	.099
Positive	.173	.113	.071	.066	.088
Negative	-.194	-.099	-.083	-.049	-.099

Kolmogorov-Smirnov Z	1.887	1.934	2.955	.455	1.878
Asymp. Sig. (2-tailed)	.002	.005	.000	.341	.002

a. Test distribution is Normal.
b. Calculated from data.

The Kolmogorov Smirnov Goodness of fit test (KS) shows a 0.0000 probability for the Z at the 5 percent level of significance, in case of normal distribution for all except cluster 4. This signals the monthly values of NSE for clusters 1,2, 3 and ALL do not fit normal distribution, while cluster 4 follows normal distribution. The summary of the analyses of objective one indicate that NSE is not normally distributed. However, taken the 2016 to 2019 alone, it appears that the market follows normal distribution.

This signals that the NSE is generally weak and inefficient in all the periods as well as for the periods 1990 to 1997, 1998 to 2004 and 2005 to 20105. However, the market is weak and inefficient in the period 2016 to 2019. This indicates that NSM is predictable from the historical data of the ASI except for the period between 2016 to 2019.

Determination of the extent to which current values of the stock prices are related to various lags of the past stock prices

Runs test was used to test for serial independence or randomness. Guidi, Rakesh and Maheshwari (2010) noted a positive or negative Z value is obtained, if the runs test either exceeds or fall below the expected runs. Notably, while negative Z values evidence positively correlated, a positive Z value denotes negatively correlated. The result is presented below:

Table 3: Runs test

	stock return (1990 to 1997)	**stock return (1998 to 2004)**	**stock return (2005 to 2015)**	**stock return (2016 to 2019)**	**All Period stock return (1990 to 2019)**
Test Value[a]	.0198	.0163	.0070	.0052	.0163
Total Cases	95	84	132	48	359
Number of Runs	33	14	48	22	121
Z	-3.197	-6.367	-3.320	-.729	-6.289
Asymp. Sig. (2-tailed)	.001	.000	.001	.466	.000

a. Median

Notes: if the Z-statistic ± 1.96 indicates rejection of the null hypothesis.

From the Table, the runs test shows that the successive returns for all the clusters except the stock return between 2016 to 2019, are not independent both at 1% and 5% level (significance value of ±1.96) and the null hypothesis of return independence because our p-value <0.05 at 5% .(Ho: *The current values time series of the Nigerian stock markets prices are not associated to the past stock prices*. Differently placed, *The succeeding price changes are not dependent and move randomly*) from 1990 to 1997, 1998 to 2004, 2005 to 2015 and the whole period 1990 to 2019. This indicates that the stock markets are inefficient and that the investor scan predict the markets return. However, stock returns for period 2016 to 2019. Hence, the paper claimed that the market is efficient and that it followed the random walk. Hence, the investors may not be able to predict the market returns in the period.

Table 4: Unit Root Test Augmented Dickey-Fuller (ADF Test)

		At Level with Constant, No trend	
		t-Statistic	P. value
Stock return (1990 to 1997)		-12.45684*	0.0001
Stock return (1998 to 2004)		-3.343005*	0.0160
Stock return (2000 to 2010)		-9.834589*	0.0000
Stock return (2016 to 2019)		-5.618203*	0.0000
All Period stock return (1990 to 2019)		-6.149308*	0.0000
Test critical values:	1% level	-3.501445	
	5% level	-2.892536	
	10% level	-2.583371	

To further investigate the randomness of the series, the ADF test is employed. The ADF is primarily used to check whether a given series is stationary or not. The ADF t-statistic has the test critical values at 1%, 5% and 10% were equal to -3.501445, -2.892536, and -2.583371 respectively. The t-statistic for Stock return (1990 to 1997) is -12.45684, Stock return (1998 to 2004) is -3.343005, Stock return (2005 to 2015) is -9.834589, Stock return (2016 to 2019) is -5.618203 and All Period stock return (1990 to 2019) is -6.149308. Evidently, all in all, both the Unit Root Test (i.e. the ADF test) revealed that the data is non-stationary. As such, concludes that the Nigerian Stock Markets is not randomized.

Predictive model of Stock Market Returns in Nigeria

Having seen that the NSE is inefficient, weak, most values clusters, and that the stock prices are predictable, the model is predicted below:

Table 5: Regression Model-Future Returns and Previous Returns

Dependent Variable: STOCKREURNS (y)
Method: Least Squares
Date: 02/16/22 Time: 05:44
Sample (adjusted): 1990M02 2019M11
Included observations: 358 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Y_{t-1}	0.154760	0.052359	2.955724	0.0033
C	0.013546	0.003280	4.130209	0.0000

R-squared	0.023952	Mean dependent var	0.016023
Adjusted R-squared	0.021211	S.D. dependent var	0.060639
S.E. of regression	0.059992	Akaike info criterion	-2.783636
Sum squared resid	1.281264	Schwarz criterion	-2.761957
Log likelihood	500.2708	Hannan-Quinn criter.	-2.775014
F-statistic	8.736304	Durbin-Watson stat	2.045314
Prob(F-statistic)	0.003327		

From Table 5 above, show the relationship between Future returns and previous returns as hypothesised in the model $y_t = a_0 + y_{t-1}b + e_t$. From the table, the equation of the relationship is:

$$y_t = 0.0135 + 0.1547b$$

Where: y is the future return, 0.1547b is the coefficient of the previous return. Thus, the relationship between previous return (y_{t-1})and future return (y) is 0.1547b. This shows that future stock return and previous return are related positively. This implies as unit rise in previous month stock return will lead to about 15% rise in the next month return. Also, a unit fall in previous return will lead to 15% in next month return.

The Durbin Watson is 2.04 which indicate that no autocorrelation. Thus, the model is sound for predict purposes. The R^2 (coefficient of determination) is 0.023and implies that only 0.23% of change in future stock return is explained by previous return. This explanatory power is too low to enable investor to predict the market without risk. However, the t-value and the F-value is statistically significant at 5%. These indicate that previous stock returns is significant statistically future stock returns in Nigeria. This implies that future stock returns are predicted from previous trends based on 15% positive relationship and 0.23 predictive powers.

IMPLICATIONS OF THE FINDINGS AND CONCLUSION

The findings from the study has shown that the NSE is efficient from 1990 to 2015 but seem to improve into weak and inefficient in the recent times 2016 to 2019. This means that the share price movements which did not follow the random-walk pattern previously as stated by Fama(1965) is trending towards the EMPH. This indicates that the price changes of the securities were not independent before 2016 and therefore technical analysis was more efficient. The result in the 2016 to 2019 periods suggest NSE is no longer easily exploitable, making it difficult for arbitrage portfolios to be constructed based on trading rules in the recent times.

Equally, the old trends where there was availability of little information about securities, high cost of accessing of market information, hoarding of information by privileged few and non-imputation of this information in market decision seem to have reduced as from 2015. Thus, the arbitragers can

hardly make risk-less profit from the NSE as from 2016. Therefore, the practice of looking for undervalued assets and selling the same simultaneously at higher prices without using any resources of is relatively not feasible in Nigeria. Also, NSE seems to be inefficient from 1990 to 2015. This signals low liquidity, infrequent trading, and market participants' inexperience. This evidence that,that there is improvement in these characteristics in Nigeria from 2016 to 2019. As it were in the old when the best strategy would be to identify a value stock and to buy and hold the same for long periods so as to earn fair return on investment, has becomes less obtainable.

POLICY RECOMMENDATIONS

The following submissions were made arising from the conclusion reached earlier:

1. The regulators of the NSE should take a leading role in regulating abnormal financial activities. In the meantime, an inefficient market could suffer over inflated stock prices, speculation, and insider trading, all potentially intensified by herding behaviour.
2. Market operators culpable for insider trading offences should be punished to ensure availability of information on securities to the market allowing the free interplay of demand and supply to determine security values as current market values of securities on the NSE reflect available security information.
3. Information security fundamentals should be provided by issuers as at when due for security valuation;
4. Capital market regulators should ensure that information provided in the market are correct; and
5. Laws to protect investors and guard against manipulation of information in the Nigerian capital market should be promulgated and enforced.

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