

TEST OF WEAK FORM EFFICIENT MARKET HYPOTHESIS IN NIGERIAN STOCK MARKET

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Abstract

The study investigated the presence of weak form efficiency in the Nigerian stock market within the period of 1985 and 2015. The period was divided into clusters to enable the researcher determine whether certain periods are more efficient than the others. The data used to conduct this research is the All Share Index (ASI) converted to stock market returns. The specific objectives investigated include (1) presence of normal distribution, (2) and the randomness or independence of the stock market returns. These tests were conducted with descriptive statistics, Kolmogorov-Smirnov Test, runs test, ADF unit root test and simple regression. The results are as follows: (1) the large differences between the Mean and Standard deviation of the variables in the descriptive statistics suggest that the stock market is highly risky. (2) Descriptive statistics and One-Sample Kolmogorov-Smirnov Test, show that stock market returns in Nigerian is not normally distributed in the period between 1985 - 1992; 1993 - 1999; 2000 - 2008, and in the whole period (1985 to 2015). However, in the recent period, 2011 to 2014, it was found that stock returns are normally distributed. (3) The results of the test of serial independence or randomness as obtained from Runs and ADF tests show that in periods 1985 - 1992, 1993 - 1999, 2000 - 2008 and the whole period 1985 - 2015, the Nigerian stock market is dependent and not random thus inefficient. The study showed that Nigerian stock market was inefficient between 1985 and 2008 and improved into weak form efficiency overtime 2009 till 2015. Among the recommendations preferred was that the Securities and Exchange Commission should take a leading role in regulating abnormal financial activities such as inflated stock prices, speculation, and insider trading normally intensified by herding behaviour.

Keywords: stock market returns, market efficiency, Nigeria, Stock Exchange

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. During the past decades, the efficient market hypothesis (EMH) has been at the heart of debate in financial literature because of its important implications. Fama (1970) defined a market as being efficient if its prices fully reflect all available information. If the stock market is efficient, the prices will represent the intrinsic values of the stocks and in turn, the scarce savings will be automatically allocated to productive investments in a way that benefits both investors and the country economy

(Copeland & Weston, 1988). Fama suggested three models for testing market efficiency: the fair game model, the sub martingale model and the random walk model. Stock market is an organized market for buying and selling financial instruments known as securities which includes stocks, bonds, options and futures. Most stock markets have a specific locations where the trades are completed known as stock exchanges. For a company to be traded at these exchanges, it must be listed, and for it to be listed, it must satisfy certain requirements. Stock market plays a crucial role in cementing the relationship between investors and the corporate sector. In this process, they help mobilizing the savings of people and direct them to the growth of trade, commerce and industrial sectors of an 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. . One way to measure the efficiency of the market is to ask what types of information, encompassed by the total set of all available information, are reflected in securities prices. When we talk about market efficiency, we are interested not in the form of structural relationship between risk and expected return but rather in the precision with which the market securities in relation to its structure. If new information becomes known about a particular company, how quickly do the prices of securities adjust to reflect the new information? If prices respond to all relevant new information in a rapid fashion, we can say the market is relatively efficient. If, instead, the information disseminates rather slowly throughout the market, and if investors take time to analyzing the information and reacting, and possibly overreacting to it, values may deviate from values based on a careful analysis of all available relevant information. Such a market could be characterized as being relevantly inefficient.

The characteristics of an efficient security market include: (1) Security prices respond rapidly and accurately to new information; (2) Trading rules fail to produce superior returns in simulation experiments; (3) Professional investors fail to produce superior returns individually or as a group; and (4) Changes in expected returns are driven by time varying interest rates and risk premia. The combined effect of information coming in a random, independent fashion and numerous competing investors adjusting stock prices rapidly to reflect new information means that one would expect price changes to be independent and random. Since the current prices fully reflect all available information then they are consistent with the risk involved.

Fama (1970) in the Efficient Market Hypothesis (EMH), categorized the market efficiency into three levels based on the definition of the available information set namely, the weak form EMH, the Semi strong form EMH, and the Strong form EMH. In the weak form, only the past information on prices of shares are reflected, in the semi strong form, it reflects all publicly available information in securities prices, including the past securities prices and the announcements of dividend payments, changes in capital structure, change of management and other event; while the strong form captures ALL information be it external, internal and even unannounced.

Statement of the Problem

The Nigerian capital market is a regulated one in which prices of securities are not determined solely by the interactions between the forces of demand and supply. Security prices determined by market forces are restricted by an imposed price band by the Nigerian Stock Exchange which prevents security prices from moving beyond 5% above and 5% below at the beginning of a trading day. The existence of manipulations in the market (Nwidobie, 2013), insider trading and slow pace of provision of security and market information to the market (Osaze, 2007), and the dependence of security price determination on security and market information on previous periods resulted in the description of the Nigerian capital market as efficient in the weak-form efficient (Adelegan, 2003).

Gordon (1959) postulated that stock values are determined by dividends paid in the immediate preceding period, the growth rate of the dividend and the equity capitalization rate. Change in any of these variables results in a change in the price of that stock. Subsequent stock values vary as values of these determinants vary. Fama (1965) contended that future price path of stocks are not determinate as they move as numbers that are random, not following any definite path. This movement to him is feasible as the stocks “fully reflect” available information, implying that successive price changes (successive one-period returns) are independent. This proposition of Fama (1965) has been tested in different capital markets across the globe with varying results. Yet, there is no clear cut conclusion and stand point for all the researchers in Nigeria, hence this study comes in to further investigate the subject.

The main objective of the study is to investigate the presence of weak form efficiency in Nigerian stock market. The specific objectives include:

1. To examine the normality of distribution of stock prices in Nigerian stock market.
2. To ascertain the extent to which current values of the stock prices are related to various lags of the past stock prices.

The period of the study is divided into four clusters, viz, 1985 – 1992, 1993 – 1999, 2000 – 2008 and 2009 – 2015 to help the researcher evaluate the relationship between stock market efficiency and the structure of the market. The rest of the paper is organised in the following sections: review of related literature, methods of study and summary of findings, conclusion and recommendations.

Review of Related Literature

Conceptual Review

The definition of the stock market efficiency is based on the level of information available at the stock market. The efficient-market hypothesis implies that stock markets are efficient with regards to a set of information, thereby rationally reflecting all new information in securities prices in terms of magnitude and direction of such movements (Kojien & Nieuwerburgh, 2007). This means that stock prices move with the influx of information (McMinn, 2009). Hirschey and Nofsinger (2008) state that the efficient-market hypothesis is the situation where security prices fully reflect all available information. That is to say, “if stock and bond markets are perfectly efficient and current prices fully reflect all available information, then neither buyers nor sellers have an information advantage”.

Worthy of note from these definitions is that an efficient market is one in which prices fully reflect available information. If all the information is reflected, it means that all the parties are aware of the actual price of the stock such that normal price shall prevail. Thus, a market is efficient with respect to publicly available information if it is impossible to make an economic profit by trading on the basis of the information set (Jensen, 1978). One implication of an efficient market is that no abnormal returns can be made from this transaction because current prices already reflect the information. However, abnormal returns (if any) should not be statistically significant from zero (Fox and Opong, 1999, Fama, 1970). As it has been noted that information efficiency is the hallmark of market efficiency, surfaces that market efficiency depends on the ability of traders to devote time and resources to gathering and disseminating information.

From the above definitions and explanations, one can say that an efficient stock market is one that reflect available information so much so that no one among the players can have additional information above any other players and no one can use additional information acquired to profit from the market. The concept of market efficiency has a number of implications for three categories of persons (players). These are the investing community, the corporate world and the regulatory authorities (Mensah, 2003). For investors; both technical and fundamental analyses are meaningless, and rationality demands that an investor hold a well-diversified portfolio. Also, it is necessary for high investor networks to demand for timely release of adequate information in order to steer the market towards semi-strong form efficiency. In the case of the companies, it is pointless to fine tune the timing of new issues, and can consider prices of own stocks as an indication of market perception of virility or a lack of it. For regulators, when the market is efficient, the professional accounting bodies and capital market regulations should only be geared towards boosting investors' confidence through the prevention of insider trading; protection of investors from abuse; minimizing systematic risk; enthronement of fairness; and enhancing market efficiency.

Types of Stock Market Efficiency

There are three types of market efficiency; they are Operational efficiency, Allocation efficiency and pricing efficiency.

Operational efficiency: According to Mensah (2003), operational efficiency implies that all transactions in securities are carried out instantly, correctly, and at a low cost. This may be promoted through enhancing competition between exchanges for secondary market transaction.

Allocation efficiency: This refers to mechanism which allocates scarce resources to where they can be most productive.

Pricing efficiency: A market that is price efficient is one in which an investor can only expect to earn a risk-adjusted returns from an investment as prices move instantaneous and in an unbiased manner to any news. A capital market is described as efficient if security prices are timely and accurately reflects all available information about the current and future likely worth of the assets (Adelegan, 2003).

However, financial economics tends to focus on informational efficiency when discussing market efficiency. Generally, the efficient market hypothesis states that markets are efficient if the prices of securities fully reflect all available information. That is, the prices of securities observed at any point in time are based on a correct evaluation of all information available in that given time period.

Forms of Stock Market Efficiency

Robert (1991) identifies the followings as the three levels of market efficiency: weak form, semi-strong form and strong form.

Weak form efficiency: Okwoli and Kpelai (2008) defined weak form efficiency as a situation where the security prices reflect all the past information as reported by the press. It is therefore, not possible for an investor to predict future security price by analyzing historical prices, and achieve a performance (return) better than the stock market index. It is so because the capital market has no memory, and the stock market index has already incorporated past information about the security prices in the market price (Pandey, 2005). Therefore, investigating the presence of any statistically significant dependence or any recognizable trend in share prices changes, is traditionally used to directly test weak form efficiency. The weak form of the efficient market hypothesis is such in which the present stock price is as a result of all the past information in the history of the market.

Semi-strong efficiency: This level of efficiency assumes that all publicly available information about a given security has been accurately factored into the present price of that security (Russel & Violet, 2002). Okwoli and Kpelai (2008) looked at semi-strong efficiency as a situation where the security prices reflect not only past information but all other published information. This form is concerned with both the speed and accuracy of the market's reaction to information as it becomes available. Event studies that examine how stock prices adjust to specific significant economic events have been used to directly test semi-strong form efficiency. Events normally tested are stock splits, initial public offerings (IPO), company announcements (especially earnings and dividend announcements) and other unexpected economic and other world events. The semi strong form of market efficiency deduces that the share prices reflect all available information both publicly and privately existing. Various other methods have been employed to test the semi-strong efficiency.

Strong-form efficiency: This is a situation where the security prices reflect not only public information but all information that can be acquired by painstaking analysis of the company and the security (Okwoli & Kpelai, 2008). According to Pandey (2005), in strong-form efficiency, the security prices reflect all published and unpublished, public and private information. It seems to be more concerned with the disclosure efficiency of the information market than the pricing efficiency of the securities market. Tests for the strong form efficiency are mainly centred on finding whether any group of investors, especially those who can have access to information otherwise not publicly available, can consistently enjoy abnormal returns. This implies that no one ' having private or public information can out beat the market, because the market automatically anticipates in an unbiased manner the stock prices and incorporates the effect of all these information on the share prices (Reilly & Brown, 2003).

Theoretical Framework

Theory of market efficiency or the efficient market hypothesis provides an appropriate theoretical framework for the study. According to the theory, share prices on the market place react fully and instantaneously to all information available (Fama, 1991). According to the Efficient Market Hypothesis (EMH), an operationally efficient stock market is expected to be externally and informationally efficient; thus security prices at any point in time are an unbiased reflection of all the available information on the security's expected future cash flows and the risk involved in owning such a security (Reilly & Brown, 2003). Such a market provides accurate signals for resource allocation as market prices represent each security intrinsic worth. Market prices can at times deviate from the securities true value, but these deviations are completely random and uncorrelated.

According to Lo (1997) the market efficiency hypothesis stipulates that price changes are only expected to result from the arrival of new information. Given that there is no reason to expect new information to be non-random, period-to-period price changes are expected to be random and independent. In other words, they must be unforecastable if they are properly anticipated, that is, if they fully incorporate the expectations and information of all market participants. It is expected that the more efficient a market, the more random the sequence of its price movements, with the most efficient market being the one in which prices are completely random and unpredictable. In an efficient market information gathering and information based trading is not profitable as all the available information is already captured

in the market prices. This may leave investors with no incentive as to the gathering and analyzing of information, for they begin to realize that market prices are an unbiased estimate of the shares' intrinsic worth (Fama, 1965; Lo 1997).

Efficient Market Hypothesis (EMH) asserts that in an efficient market, prices at all times fully reflect all available information that is relevant to their valuation (Fama, 1970). Thus, security prices at any point in time are an unbiased reflection of all available information on the security's expected future cash flow and the risk involved in owning such a 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. Changes in the values of these variables result in changes in share values which change follow any definite pattern (an outcome of random walk behaviour). The existence of these unpredictable future values of shares caused by changes in values of its fundamentals, to Fama (1965), evidences the existence of efficiency in that stock market; concluding that the actual price of any security in that market at any point in time is always a good estimate of its intrinsic value, or the actual values of the securities wandering randomly about their intrinsic values.

The bane of the theoretical framework is that two conflicting theories exist to explain the movement of stock prices in the stock market. The random walk hypothesis and the fundamental analyses. Hence, on the cross roads the random walk says: no one can price the price of stock and therefore cannot make excess profit out of the market based on information from past records; then the other, fundamentalists, say one can use the information of the past records of a stock to profit from the market. This study hence aim to find out which of the theories prevail in Nigeria, especially in the face of conflicting extant literatures.

Empirical Review

Obayagbona and Igbinsosa (2014) investigated the weak-form market hypothesis in the emerging capital market of Nigeria from January 2006 to December 2011. It uses three tests of randomness based on autoregressive technique to check for the presence or otherwise of autocorrelation in daily stock prices and returns from the Nigerian Stock Market. All the tests including the Z-statistics for both stock prices and their returns show significant indications of dependence in return series and hence, of non-randomness. The overall results suggest that the emerging Nigerian Stock Market is not efficient in the weak form.

Gimba (2012) tested the Weak-form Efficient Market Hypothesis of the NSE by hypothesizing Normal distribution and Random walk of the return series. Daily and weekly All Share Index and five most traded and oldest bank stocks of the NSE are examined from January 2007 to December 2009 for the daily data and from June 2005 to December, 2009 for the weekly data. The empirical findings derived from the autocorrelation tests for the observed returns conclusively reject the null hypothesis of the existence of a random walk for the market index and four out of the five selected individual stocks. In general, it can be concluded that the NSE stock market is inefficient in the weak form. Given the empirical evidence that the stock market is weak-form inefficient, it is believed that anomalies in stock returns could be existent in the market and reduction of transaction cost so as to improve market activities and minimizing institutional restrictions on trading of securities in the bourse were therefore recommended.

Okpara (2010) investigated the whether Nigerian Stock Exchange (from the period 1984 to 2006) follows a random walk. To carry out the investigation, the Generalised Autoregressive Conditional Heteroskedasticity (GARCH) was employed. The results show that the Nigerian stock market follows a random walk and is therefore weak form efficient. However, the years 1987, the period of financial deregulation, 1988 when some public companies were privatised, 1995 the period of internationalisation of the Nigerian capital market and the years 2000 to 2006 recorded persistent volatility clustering suggesting weak form inefficiency in the market for these periods. Nevertheless, the parameter estimate of their conditional mean equations (except 1995) were insignificant. Besides these years, other years were conspicuously and significant found to exhibit weak form efficiency. Thus, the Nigerian stock market is weak form efficient and as such no investor can usurp any privileged information to bit the market and make abnormal profit.

Afego (2012) examined the weak-form efficient markets hypothesis for the Nigerian stock market by testing for random walks in the monthly index returns over the period 1984-2009. The results of the non-parametric runs test show that index returns on the Nigerian Stock Exchange (NSE) display a predictable component, thus suggesting that traders can earn superior returns by employing trading rules. The statistically significant deviations from randomness are also suggestive of suboptimal allocation of investment capital within the economy. The findings, in general, contradict the weak-form of the efficient markets hypothesis.

As the movement of stock prices has been found to be random in some capital markets across the world and in others non-random, Nwidobie (2014) further investigated the random walk hypothesis in Nigeria. Analysis of all-price-index (API) data of shares of listed firms on the Nigerian Stock Exchange from January 2000 to December 2012 using the Augmented Dickey-Fuller (ADF) test shows that share price movements on the Nigerian Stock Exchange do not follow the random walk pattern described by Fama (1965), and thus the random walk hypothesis is not supported by findings in the Nigerian capital market. Results also indicate the existence of market inefficiencies in the Nigerian capital market necessitating the inflow of cheap and free information about security fundamentals into the market for share pricing by the forces of demand and supply.

Udoka (2012) assessed the degree of information efficiency of the market and to suggest measures that could enhance market efficiency in Nigeria, with the help of monthly time series data and tested using the ordinary least square estimate procedure. The proposition was that for any of the parameters LSMP (-1), LSMP (-2), LSMP (-3) LSMP (-6) to be statistically significant, the market was weak-form efficient. Finding resulting from test of data has shown that the Nigerian Stock Market is weak-form efficient. Ezepue and Omar (2012) explored the weak-form efficient market hypothesis for the Nigerian Stock Market is using different statistical tests including Runs Test, Autocorrelation Function Test, Ljung-Box Q-Statistics (Box-Pierce Q [BPQ] Test), BDS (Brock-Dechert-Scheinkman) Test for Independence of Returns. The analyses use overall stock market returns collected over the period 2000–2010. It is shown that the NSM is not weak-form efficient which questions the benefits of the 2004 financial reforms. It is also shown that the degree of market inefficiency varies across the periods corresponding to the financial reforms and 2007 global financial crisis, for daily and monthly returns.

Emenike (2008) examined the Weak-Form Efficient Market Hypothesis across time for the Nigerian Stock Exchange (NSE) by hypothesizing Normal Distribution and Random walk in periodic return series. Monthly all share indices of the NSE are examined for three periods including January 1985 to December 1992, January 1993 to December 1999, and January 2000 to December 2007. Our Normality tests are conducted using Skewness, Kurtosis, Kolmogorov-Smirnov, and Q-Q Normal Chart; whereas Random walk is tested using the non-parametric Runs test. Results of the Normality tests show that returns from NSE do not follow normal distribution in all the periods. Runs test results reject the randomness of the return series of the NSE in the periods studied. Overall results from the tests suggest that the NSE is not Weak-Form efficient across the time periods of this study. The results however, show that improvements in NSE trading system have positive effect on efficiency. Relaxing institutional restrictions on trading securities in the market and strengthening the regulatory capacities of NSE and Nigerian Securities and Exchange Commission (NSEC) to enforce market discipline were recommended.

Ajao and Osayuwu (2012) aimed at testing the weak form of efficient market hypothesis in the Nigerian capital market. The scope of the study consist of all securities traded on the floor of the Nigerian Stock Exchange and the month end value of the All Share Index from 2001 – 2010 constitute the data analyzed. The serial correlation technique of data analysis was used to test for independence of successive price movement and the distributive pattern while runs test was used to test for randomness of share price movement. The result of the serial correlation showed that the correlation coefficients did not violate the two-standard error test. Furthermore, the Box-Ljung statistic showed that none of the serial correlation coefficients was significant and the Box pierce Q statistics showed that the overall significance of the serial correlation test was poor while the result of the distribution pattern shows that stock price movements are approximately normal. On the basis of this findings, the study concluded that successive price changes of stocks traded on the floor of the Nigerian Capital Market are independent and random therefore, the Nigerian Capital Market is efficient in the weak-form.

Review Summary

An ample of empirical studies have been done test weak form efficiency for Nigeria stock market. These studies have shown conflicting findings. Total of eleven (11) empirical works were reviewed, four (4) supported that Nigerian capital market is weak form efficient (Obayagbona & Igbinsosa, 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) posited weak form inefficiency. These shows 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 are adequately distributed among players and investors alike, the more efficient the market might be.

The empirical reviews show conflicting results. It is observed that the works of Obayagbona & Igbinsosa (2014), Okpara (2010), Udoka (2012) and Ajao, & Osayuwu (2012) posit weak form efficiency for Nigerian stock market.

However, similar studies of Gimba (2012), Afego (2012), Nwidobie (2014), Osazevaru, (2014), Ezepue & Omar (2012) and Emenike (2008) averred that Nigerian stock market are not efficient. It was noted that these used similar methodology, time frame, and type of data (daily, weekly or monthly). Thus, 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

The study adopts an ex post factor research design because the data is based on historical information obtainable from the official records of the stock exchange. This study used the monthly all share index data for the Nigerian stock exchange (NSE). The All share index includes all listings on the exchange. Given that using daily or weekly prices in a return series comprising of infrequently traded stocks may lead to significant biases in the results (Lo & MacKinlay, 1988), we use monthly price series because of the potential for thin trading in Nigerian equities (Olowe, 1999). Additionally, we use index prices, rather than individual stock prices, to provide market-wide evidence. The index is in local currency and the data consists of 360 observations spanning the period January 1985 to December 2014. The data was sourced from the Central Bank of Nigeria Statistical Bulletin, 2014. The monthly Stock market indices are converted into stock market returns using the formula below:

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

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.

The log transformation was employed in order to convert the data into continuously compounded rates. This practice is common rather than using discrete compounding (Simons & Laryea, 2015).

Method of Analyses

To check the weak form efficiency of Nigerian Stock Market (ASI), the study has relied on a number of statistical and econometric tools. The study has relied on descriptive statistics, runs test, Kolmogorov-smirnov test, and Augmented Dickey Fuller test for analyzing the data and realising the objective of the study.

Results and Interpretation

Determination of normality of distribution of stock prices in Nigerian stock market.

This objective is achieved using the test of normality techniques. The test of normality involved the use of descriptive statistic and Kolmogorov Smirnov one sample test. The tests (descriptive statistic and Kolmogorov Smirnov one sample) will be used to test for the hypothesis one that Monthly distribution of the Nigerian stock markets returns is normally distributed (DS). The result of the descriptive statistic and Kolmogorov Smirnov analyses are shown on Table 2 and 3 respectively.

Table 2: Descriptive Statistics: Monthly returns of NSE All Share Index (ASI)

	stock return (1985 to 1992)	stock return (1993 to 1999)	stock return (2000 to 2008)	stock return (2009 to 2015)	All Period stock return (1985 to 2015)
Mean	0.024183	0.018557	0.011726	0.006992	0.015988
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	108	84	371

The descriptive statistics of the stock market returns of the Nigerian Stock Market is presented on Table 2 above. Normality of distribution is one of the basic assumptions underlying the weak-form efficiency (Simons & Laryea, 2006). Thus, if NSE monthly returns follow normal distribution, it means that we cannot predict the future price or returns from the mean of today’s price or return. When this happens, we shall conclude that the NSE is weak-form efficient, otherwise, we say that the market is weak-form inefficient.

Mean and standard deviation, Skewness, kurtosis, and Jarque-Bera have been used to test the hypothesis of normality. The results show that the returns are not normally distributed. Mean stock returns are positive with large volatility (standard deviation) for all countries. This suggest that the stock 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) for the whole period (1985 to 2014) 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). These shows the presence of leptokurtic distribution in cluster 4 and platykurtic 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, this suggest that data are not normally distributed. Though, one may be tempted to accept the null hypothesis for cluster 4 with kurtosis very close to 3, we reject the null hypothesis of normality.

From the results of the calculated Jarque-Bera statistics and p-values in the table 2, the p-values for all the indices (except cluster 4) are less than (0.01) at the 1% level of significance imply that the null hypothesis cannot be accepted. 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 do not follow the theory of random walk.

To further investigate the presence of normality in the distribution of ASI of the NSE, we employ the non-parametric Kolmogrov-Smirnov (K-S) goodness of fit test. Kolmogorov-Smirnov (KS) Test compares the observed cumulative distribution function for a variable with a specified theoretical distribution which may be normal, uniform, exponential or Poisson. It test whether the observations have come from the specified distribution.

**Table 3: Kolmogrov-Smirnov (K-S) goodness of fit test
One-Sample Kolmogorov-Smirnov Test**

	stock return (1985 to 1992)	stock return (1993 to 1999)	stock return (2000 to 2008)	stock return (2009 to 2015)	All Period stock return (1985 to 2015)
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. The results clearly indicates that the frequency distribution of the monthly values of NSE for clusters 1,2, 3 and ALL do not fit normal distribution, while cluster 4 follows normal distribution. Therefore null hypothesis of normal distribution of the prices is rejected for all except cluster 4.

The summary of the analyses of objective one indicate that NSE is not normally distributed. However, taken the 2011 to 2014 alone, it appears that the market follows normal distribution. This means that the Nigerian Stock Market is generally weak form inefficient in all the periods as well as for the periods 1985 to 1992, 1993 to 1999 and 2000 to 2008. However, the market is weak form efficient in the period 2009 to 2015. This indicate that Nigerian stock market is predictable from the historical data of the ASI except for the period between 2009 and 2015.

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

This objective is achieved with the help of test of serial independence or randomness. Runs test is a non-parametric test that is designed to examine whether successive price changes are independent. The non-parametric runs test is applicable as a test of randomness for the sequence of returns. Accordingly, it tests whether returns in Nigerian stock market indices are predictable. The null hypothesis for this test is for temporal independence in the series (or weak-form efficiency): in this perspective this hypothesis is tested by observation the number of runs or the sequence of successive price changes with the same sign i.e. positive, zero or negative. Each change in return is classified according to its position with respect to the mean return. Hereby, it is a positive change when return is greater than the mean, a negative change when the return is less than the mean and zero when the return equals to the mean (Gupta, Rakesh & Maheshwari, 2010).

As pointed out by Guidi, Rakesh and Maheshwari (2010), when actual number of runs exceed (fall below) the expected runs, a positive (negative) Z values is obtained. A negative Z value indicates a positive serial correlation, whereas a positive Z value indicates a negative serial correlation. The positive serial correlation implies that there is a positive dependence of stock prices, therefore indicating a violation of random walk. The distribution Z is -3.197, -6.367, -3.320, -.729 and -6.289, for periods 1985 to 1992, period 1993 to 1999, period 2000 to 2008, period 2009 to 2015, and All Period stock return (1985 to 2015).

Table 4: Runs test

	stock return (1985 to 1992)	stock return (1993 to 1999)	stock return (2000 to 2008)	stock return (2009 to 2015)	All Period stock return (1985 to 2015)
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

The results of Runs test for the returns on markets under the study are indicating in the above Table 4. From the Table, the runs test shows that the successive returns for all the clusters except the stock return between 2009 to 2015, are not independent at 1% and 5% level of significance (significance value of ± 1.96) and the null hypothesis of return independence because our p-value is less than 0.05 at 5% level of significance. (Ho: The current values time series of the Nigerian stock markets prices are not related to the past stock prices; that is: The succeeding price changes are not dependent and move randomly) which indicate null hypothesis cannot be accepted in periods 1985 to 1992, 1993 to 1999, 2000 to 2008 and the whole period 1985 to 2015, all which indicated that these markets are inefficient, means not weak form efficient so investor can predict the markets returns. However, stock returns for period 2009 to 2015, we cannot reject null hypothesis, concluded that the market is efficient and follow random walk so investor cannot predict the market returns in the period.

Table 5: Unit Root Test Augmented Dickey-Fuller (ADF Test)

	At Level with Constant, No trend	
	t-Statistic	P. value
Stock return (1985 to 1992)	-12.45684*	0.0001
Stock return (1993 to 1999)	-3.343005*	0.0160
Stock return (2000 to 2008)	-9.834589*	0.0000
Stock return (2009 to 2015)	-5.618203*	0.0000
All Period stock return (1985 to 2015)	-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 non-stationary. According to Shafi (2014), "if the series is found to be non-stationary, then the null hypothesis of the market being random will be accepted". He further proposed that the ADF test is given as a t-statistic which is generally negative and that the more negative the t-statistic, higher are the chances of rejecting the null hypothesis.

The results give as t-statistic is compared with the critical values calculated at particular level of significance. The test critical values are calculated at 1%, 5%, 10%. If the t-statistic is less than the critical value calculated at a given critical level, the Researcher has to reject the null hypothesis of the series being random.

The Augmented Dickey Fuller 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 (1985 to 1992) is -12.45684, Stock return (1993 to 1999) is -3.343005, Stock return (2000 to 2008) is -9.834589, Stock return (2009 to 2015) is -5.618203 and All Period stock return (1985 to 2015) is -6.149308. At a significance level of 5%, the null hypothesis of the data being non-stationary is rejected because the ADF t-statistic is too negative. All in all, both the Unit Root Test (i.e. the ADF test) revealed that the input series of data is not non-stationary and so the null hypothesis of the Nigerian Stock Markets being random has to be rejected.

Conclusion

The study has investigate the presence of random walk theory in the Nigerian stock market and thus test whether the NSE is weak form efficient using All Share Index (ASI) converted to stock market returns. The findings from the study have shown that the NSE was not efficient in the weak form between 1985 to 2008 but seem to improve into weak form efficient in the recent times 2009 to 2015. This means that share price movements on the Nigerian Stock Exchange which previously do not follow the random walk pattern described by Fama (1965), has improved and is becoming efficient. This indicate that the price changes of the securities was not independent before 2009 and therefore technical analysis was very much viable. The result in the 2009 to 2015 periods suggest Nigerian stock market is no longer easily exploitable, making it difficult for arbitrage portfolios to be constructed based on trading rules in the recent times.

Equally, the results show that the old trends where there was availability of little information about securities in the market, high cost of accessing of market information, hoarding of information by privileged few and non-imputation of these information in stock market decision seem to have reduced as from 2009. Thus, the arbitragers can hardly make risk-less profit from the Nigerian stock market as from 2009. Therefore, the practice of looking for undervalued assets and selling the same simultaneously at higher prices without using any resources is relatively not feasible in Nigeria.

That stock market was inefficient between 1985 and 2008 seem to suggest possible inherent characteristics, such as low liquidity, thin and infrequent trading, and lack of experienced market participants. The findings of the 2009 to 2015 show that there is improvement in these characteristics in Nigeria. 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.

Recommendations

To further improve the efficiency of the Nigerian stock market, the following recommendations are preferred:

1. The Securities and Exchange Commission 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. These problems could be addressed by the SEC.
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;
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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