Efficiency across Time: Evidence from the Nigerian Stock Exchange

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Abstract

This paper examines 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.

Key Words: Weak-Form Efficiency, Random Walk, Normal Distribution, Nigerian Stock Exchange, Trading System
JEL Classification: G14

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1. Introduction

Efficient Market Hypothesis (EMH) casts a long shadow of doubt on every attempt to predict financial assets prices. It asserts that prices of financial assets, at all times, fully reflect all available information used in forming the market prices. This assertion implies that simple share picking techniques are not likely to yield abnormal returns. In other words, the price of a share should reflect the fundamentals of the company. Reflecting the fundamental value of the company therefore means incorporating all available information in pricing such share. The EMH assumes that share prices incorporate all information such that changes in prices are only due to news or unanticipated events. In addition, unanticipated information is incorporated instantaneously. As a result, investors cannot use information available today to forecast tomorrow's stock prices in an efficient stock market.

Efficiency is categorized into three different levels according to the information item reflected in the prices. The three levels of EMH are expressed as follows: Weak-Form, Semi-Strong Form, and Strong Form Efficiency. The Weak-Form version of EMH, which is the lowest level, asserts that prices of financial assets already reflect all information contained in the history of past prices, trading volume or short interest. This form of efficiency implies that historical prices and volume traded cannot be used to predict future price movements. Semi-Strong version postulates that share prices already reflect all the publicly available information regarding the prospects of a firm. This means that market participants cannot consistently outperform the market by analyzing published information, because such information is adjusted into prices once they are released. Lastly, the Strong-Form posits that the prices of financial assets reflect, in addition to information on past prices and publicly available information, information available only to company's insiders (Fama, 1970). This paper is concerned with Weak-Form version of EMH.

Over the years, a number of empirical studies of the Weak-Form efficiency have been performed on the Nigerian Stock Exchange (NSE). These studies offered mixed evidence. For instance, Samuels and Yacout (1981) and Olowe (1999) provide evidence to support Weak-Form efficiency. In contrast, Akpan (1995) and Appiah-kusi and Menya (2003) found the market Weak-Form inefficient. The study by Jefferis and Smith (2005) found, amongst others, that the NSE became Weak-Form efficient from early 2001, suggesting that efficiency is evolving. Rahman and Hossain (2006) conclude that stock market efficiency changes overtime. Thus, indicating that the contrasting evidence in a stock market may occur as a result of changing efficiency.

Campbell, Lo and Mackinlay (1997) posit that testing the absolute efficiency of a market does not seem to be the most informative way of gauging the efficiency of a market. They proposed relative efficiency – the efficiency of one market or one index measured against another. A more useful way of ascertaining changing Weak-Form efficiency will be the measurement of one stock market price series or index across time to determine whether it is efficient in all the time periods measured or not and/or whether the level of efficiency changes overtime or not.

Market efficiency is important because the prices paid for shares absorb all available information and thus reflect the fundamental value of share and result in optimal allocation of resources. Efficiency eliminates market distortions and arbitrage opportunities based on asymmetric information. Therefore there are no opportunities for earning abnormal returns and no systematic attempts at deriving financial forecasts. Market efficiency also aids an investor in formulating investment strategy to be adopted in trading shares in the capital market.

This paper therefore tests Weak-Form efficiency across time to ascertain if the mixed evidence from NSE is a result of changing efficiency. It is different from earlier studies which studied the absolute efficiency of the NSE – efficiency at a given period. Also, unlike earlier studies which did not specify the version of Random walk tested this paper tests Random walk two. The remainder of the paper is organized as follows: section 2 presents the literature review. Section 3 embodies hypotheses and model. Section 4 describes the data and variables. Section 5 describes the methodology. Section 6 presents the empirical findings. Section 7 concludes the paper and recommends policy actions.

2. Literature Review and Conceptual Framework

2.1 Conceptual Framework of EMH

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). EMH argues that competition between investors seeking abnormal profits drives prices to their 'fair' value. This implies that prices should incorporate information in the market. The ability of a stock market to incorporate information into prices determines its level of efficiency. Fama (1970) stated that the sufficient but not necessary conditions for efficiency are: (i) there are no transaction costs in trading securities; (ii) all information is costlessly available to all market participants, and (iii) all agree on the implication of current information for the current price and distribution of future prices of each security. The EMH can be more specifically defined with respect to the information item available to market participants. Fama (1970) classified the information items into three levels depending on how quickly the information is impounded into prices: (1) Weak-Form EMH, (2) Semi-Strong Form EMH, and (3) Strong-Form EMH **(see definitions of the levels of EMH in section one).**

2.2 Random Walk Models

The Random walk model states that the current market price of any security fully reflects the information content of its historical sequence of prices (Okafor, 1983:186). The financial asset's price series is said to follow a random walk if the successive price changes is independent and identically distributed (Fama, 1970). Consequently, knowledge of the historical prices and volume traded of a security and/or detailed analysis based on this knowledge would not enhance abnormal returns from such security.

Campbell, Lo and Mackinlay (1997) summarize various versions of Random walk model as the following three models based on the distributional characteristics of increments. Random walk 1 implies that price increments are independent and identically distributed (IID), in which case the process P_t is given by:

$$P_t = \mu + P_{t-1} + \varepsilon_t \ , \quad \varepsilon_t \sim IID\left(0, \sigma^2\right) \ldots\ldots\ldots\ldots\ldots (2.1)$$

Where, μ is the drift parameter or the expected price change and IID $(0,\sigma^2)$ denotes that ε_t is independent and identically distributed with Zero (0) mean and constant variance. The independence of increments (ε_t.) implies not only that ε_t is uncorrelated but any nonlinear functions of the increments are also uncorrelated. Fama (1970) stated that the statement that security prices fully reflect all available information was assumed to imply that successive price changes are independent. It was also assumed that successive returns are identically distributed. However, the assumption of identically distributed increments has been questioned for financial assets prices over long periods of time because of changes in probability distributions of stock returns resulting from changes in economic, technological, institutional and regulatory environment surrounding the asset prices.

Random walk 2 assumes independent but not identically distributed increments and thus allows for heteroscedasticity in ε_t. Random walk 2 is estimated as:

$$P_t = \mu + P_{t-1} + \varepsilon_t, \quad \varepsilon_t \sim \text{INID}(0,\sigma^2) \quad \ldots\ldots\ldots\ldots\ldots (2.2)$$

Where, NID denotes that the error term is *Not Identically Distributed*. Relaxing of the identical distribution assumption in Random walk 2 does not change the main economic property of ε_ts, that is, prediction of future price increments cannot be estimated using past price increments.

Random walk 3 is obtained by relaxing the independence assumption of Random walk 2 to include processes with dependent but uncorrelated increments. It only imposes lack of correlation between subsequent ε_ts. A case in which Random walk 3 will hold but not RW1 and RW2 is any process where Cov[$\varepsilon_t, \varepsilon_{t+k}$] = 0 for all K, but where Cov[$\varepsilon_t^2, \varepsilon_{t+k}^2$] ≠ 0 for some K, in both cases K ≠ 0. This process has uncorrelated increments but is evidently not independent because its squared increments are correlated.

The import of the Random walk model is that price changes during period *t* are independent of the sequence of price changes during previous time periods.

2.3 Overview of the NSE

The Nigerian Stock Exchange (NSE) started operation on 5th June 1961 as the Lagos Stock Exchange (LSE). The LSE was reorganized and renamed the Nigerian Stock Exchange (NSE) in 1977 following the Okigbo Financial Review Committee's recommendation in 1976. The NSE has a head office in Lagos and nine (9) functional trading floors which are located in: Port Harcourt, Kaduna, Uyo, Yola and Benin. Others are, Ibadan Onitsha, Kano and Abuja. In line with global developments, the NSE changed from Call-over system of trading to Automated Trading System (ATS) in 1998. Thus, the NSE is a fully automated bourse with online trading floors. Before 2007, transaction cost on equities in the primary market was 6.92%, while that of bonds was 7.03%. But on April 24, 2007, they were reduced to 4.32% and 4.97% respectively. Similarly, transaction costs on equities in the secondary market were reduced on the buy side from 4.07% to 2.36%, while the sell side fell from 4.12% to 2.65% (Chuks, 2007; Nwaora 2007). Clearing and settlement is done electronically through the Central Securities Clearing System (CSCS). CSCS, provided by NSE, is the Central Securities Depository (CSD) for the Nigerian capital market. CSCS was incorporated on 29th July 1992 and commenced operation on April 14, 1997 (NSE, July 2007). CSCS operates a T+3 cycle from March 1, 2000. From inception to December 2006, CSCS cleared and settled 120.3 billion units of shares and dematerialized 5.4 million share certificates representing 134.7 billion units of shares. 5143 shareholder used their shareholding in CSCS as collateral for loan in the same period (NSE, Jan. 2007). Trade Guarantee Fund was established by the dealing member firms on the NSE to ensure all financial settlement of share transactions. By convention, the size of a country's stock market is assessed by its capitalization relative to GDP (Nnanna et al., 2004). The size of NSE increased from 6.9% in 1993 to 28.1 in 2006; liquidity also increased from 0.7% to 7.8% in the same period.

Information is disseminated to market participants through the NSE daily official list, the NSE CAPNET (an intranet facility), NSE website (www.nigerianstockexchange.com), and newspapers, as well as on the stock market page of the Reuter Electronic contributor System. The NSE became internationalized in 1995 with the abrogation of the Exchange Control Act of 1962 and the Nigerian Enterprises Promotion Decree of 1989. These two laws constrained foreign participation in the Nigerian capital market. Consequent on their abrogation, foreigners now participate in the market both as operators and investors. Also, there are no more limits to the percentage of foreign holding in any company registered in Nigeria. Transaction on the Exchange is regulated by the NSE, as a self regulatory organization, and the Nigerian Securities and Exchange Commission (NSEC). Giving these improvements in the NSE, it can be conjectured that there should be commensurate improvements in its weak form efficiency.

2.4 Empirical Review

The research findings on Weak-Form Efficient Market Hypothesis of the Nigerian Stock Exchange (NSE) are mixed. Samuel and Yacout (1981) used serial correlation test to examine weekly price series of 21 listed Nigerian firms from July 1977 to July 1979. The results show that the stock price changes are not serially correlated but follow a random walk, thus accepting the notion of Weak-Form market efficiency. In 1984, Ayadi tested the price behaviour of 30 securities quoted on the NSE between 1977 and 1980, using Monday closing prices of these shares after adjusting for cash dividends and script issues. The results show that the share price movements on the NSE follow a random walk. Anyanwu (1998) investigates the efficiency of the NSE from the perspective of the market's relationship to economic growth of the nation. He used indices of stock market development – liquidity, capitalization, market size, among others –

to construct an aggregate index of stock market development and related it to the long-run economic growth index, emphasizing the GDP growth rate. The results show a positive association between the two indices and he therefore concludes the NSE is efficient to the extent that it affects the economic development of the Nation. Olowe (1999) examined evidence of Weak-Form efficiency of the NSE using correlation analysis on monthly returns data of 59 individual stocks listed on the NSE over the period January 1981 to December 1992. The results provide support for the work of Samuels and Yacout (1981) and Ayadi (1984), that is, the NSE is efficiency in the Weak-Form.

In contrast to the works of Samuel and Yacourt, Ayadi and Olowe, Akpan (1995) studied the informational efficiency of the NSE including the risk implications of investing in the market, using time series data of stock market price indices covering the period 1989 to 1992. His results show evidence to reject the hypothesis of Weak-Form efficiency of the NSE. In 2003, Appiah-Kusi and Menya apply the GARCH–M (Generalized Autoregressive Conditional Heteroscedasticity) model to examine the Weak-Form efficiency in weekly price series of eleven African stock markets indices. Their results provide evidence showing that the stock markets in Egypt, Kenya, Morocco, Mauritius and Zimbabwe are Weak-Form efficient, while those of Botswana, Ghana, Ivory Coast, Nigeria, South Africa, and Swaziland are not consistent with Weak-Form efficiency. Jeffris and Smith (2005) investigate the changing efficiency of seven stock market indices from South Africa, Egypt Morocco, Nigeria, Zimbabwe, Mauritius and Kenya. Using a GARCH approach with time-Varying parameters, a test of evolving efficiency (TEE) is conducted for period starting from February 1990 and ending in June 2001. This Tee test detects changes in Weak-Form efficiency through time and it finds that the Johannesburg

Stock Exchange is Weak-Form efficient throughout the period, and three stock markets become Weak-Form efficient towards the end of the period: Egypt and Morocco from 1999 and Nigeria from early 2001. These contrast with Kenya, Zimbabwe and Mauritius which show no tendency towards Weak-Form efficiency.

From the review above, it is glaring that most of the earlier studies which found the NSE Weak-Form efficient (Samuels and yacout, 1981; Ayadi, 1984 and Olowe, 1999) studied individual price series of shares listed on the bourse, whereas the studies which found the NSE Weak-Form inefficient (Akpan, 1995 and Appiah-kusi and menya, 2003) studied stock indices. The possible explanations of the variety of evidence provided by the prior studies is that the individual price series studied are not representative of the whole market or that efficiency changes across time on the NSE. If the latter is the case, then it is theoretically surprising that the NSE which was found Weak-Form efficient by prior studies when shares are traded on a call-over trading system should become inefficient now that shares are traded using the Automated Trading System. Also, the NSE which was efficient when ownership of shares are transferred manually – lasting up to 3 months to complete a transfer – should become Weak-Form inefficient now that the Central Securities Clearing System (CSCS) clears and transfers ownership in a T+3 days.

Furthermore, market microstructure existing evidence suggests that improvement in trading system, market capitalization, membership; value and volume traded lead to improvements in liquidity and market efficiency (Amihud et al, 1997; & Suzuki and Yasuda, 2006). The NSE has shown considerable improvements in trading system (see 2.4 above). Hence, the NSE should be

Weak-Form efficient after these market microstructure events since evidence suggests efficiency before them.

3. Hypotheses and Model

3.1 Hypothesis

This paper tests two hypotheses to determine the Weak-Form efficiency of the NSE across time. The first hypothesis involves determining whether the stock returns follow a normal distribution or not. The null and alternative hypotheses are:

Ho The stock returns in NSE are normally distributed in all the three periods under study.

H_1 The stock returns in NSE are not normally distributed in all the three periods under study.

The second hypothesis involves determining whether the stock returns are random across the three sub-periods. The null and alternative hypotheses are:

Ho The stock returns in NSE are random across the three sub-periods of this study.

H_1 The stock returns in NSE are not random across the three sub-periods of this study.

Though the hypotheses of normality and randomness are complementary, we use them together in order to make our analyses robust.

3.2 Random Walk Model

If stock returns follow an identifiable pattern from historical prices and volume traded, it implies that such bourse is not Weak-Form efficient. This is so because in a Weak-Form efficient stock market, stock returns follow a random walk. Hence, Random walk 2 model is used to model the process of price formation so as to test Weak-Form efficiency across the three time periods of this study. The Random walk 2 model is estimated as:

$$P_t = \mu + P_{t-1} + \varepsilon_t, \qquad \varepsilon_t \sim INIDN\ (0,\ \sigma^2) \ \ldots\ldots\ldots\ldots\ldots\ldots\ (3.1)$$

Where:

P_t = All Share Index at $Month_t$

P_{t-1} = All Share Index at $Month_{t-1}$

μ = Drift parameter (i.e. the expected price change)

ε_t = Random error term (residual)

$INIDN\ (0,\sigma^2)$ = Independent and not identically distributed as a normal distribution with zero mean and homoscedastic variance.

This model indicates that the returns of a share at time (month) *t* is equal to the return of the share at time (month) *t-I* plus given value that depends on new (unpredictable) information arriving between time *t-1* and *t*.

4. Data and Description of Variables

4.1 Data

The data for this study primarily consist of Monthly All Share Index (ASI) of the NSE. The ASI is a value weighted index made up of all listed equity on the NSE. There are three periods under consideration. Period1 begins from January 1985 to December 1992; period2 starts from January 1993 and ends on December 1999; and period3 begins from January 2000 to December 2007. These yield 95, 83, and 95 time series observations respectively. The data is downloaded from

Securities and Exchange Commission (SEC) databank in its website: http://www.databank.sec.gov.ng

4.2 Description of Variables

This study uses Monthly Market returns as individual time series variables. Market returns are proxied by the log difference change in all share price indices of the NSE and are computed as:

$$R_{mt} = Ln(P_t - P_{t-1}) \text{ .... } (4.1)$$

Where:

R_{mt} = Monthly returns for All Share Index for period $_t$

P_t = All Share 1ndex for Month $_t$

P_t = All Share 1ndex for Month $_{t-1}$.

Ln= Natural Logarithm

A key assumption underpinning our use of logarithm is that stock returns are not only log-normal, but also are traded on a continuous basis (Simons and Laryea, 2004; Bodie et al, 1999:170).

5. Methodology

The techniques of data analysis involve Normality tests and non-parametric Runs test.

Normality Tests: Normality of share returns distribution is one of the basic assumptions of Weak-Form Efficient Market Hypothesis (Simons and Laryea, 2004; Ntim et al., 2007). It is therefore necessary to investigate whether the return series in NSE approximates a normal distribution. Normality tests are performed using Skewness, Kurtosis, Kolmogorov-Smirnov test and Q-Q probability plot.

The skewness of a symmetric distribution, such as the normal distribution, is zero (0). Positive skewness means that the distribution has a long right tail and negative skewness implies that the distribution has a long left tail.

$$Skewness = E(\Delta Y_i - \Delta \bar{Y})^3 / \sigma^3 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (5.1)$$

The kurtosis of a normal distribution is 3. If the kurtosis exceeds 3, the distribution is peaked (Leptokurtic) relative to the normal; if the kurtosis is less than 3, the distribution is flat (Playtykurtic) relative to normal.

$$Kurtosis = E(\Delta Y_i - \Delta \bar{Y})^4 / \sigma^4 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (5.2)$$

Kolmogorov-Smirnov (K-S) goodness of fit test is a non parametric test which compares the observed cumulative distributional function of the returns with a normal distribution to determine if they are identical. The null hypothesis of normality in return distribution will be accepted if K-S statistic is greater than or equal to the *p* value.

Q-Q probability plots are charts which examine data to see if they are from a normal distribution. The observed values of single numeric variables are plotted against the expected values. If the sample is from a normal distribution, points will cluster around a straight line. All these normality tests will be tested on the three sub-samples' return series to determine whether they follow the normal distribution, and hence Weak-Form efficient.

Runs Test is a non parametric test designed to examine whether or not an observed sequence is random. It has, extensively, been used by former researchers of Weak-Form efficiency in emerging markets (see for example, Barnes, 1986; Claessens et al., 1995; Dickinson and Muragu, 1994; Simon and Laryea 2004; Rahman and Hossain, 2006). It is based on the premise that if a series of data is random, the observed number of runs in the series should be close to expected number of runs. If there are too many runs, it would mean that the residuals change signs frequently, thus indicating negative serial correlation. Similarly, if there are too few runs, they may suggest positive autocorrelation (Gujarati, 2003:465). Positive autocorrelation infers predictability of returns in the short horizon, while negative autocorrelation reflects predictability in the long horizon (Fama, 1988, and 1991). Implicitly, too many runs and or few runs indicate evidence against the hypothesis of Random walk (Spiegel and Stephens, 1999: 405). Under the null hypothesis of independence in share returns, the expected number of runs is estimated as:

$$M = \frac{2N_1N_2}{N} + 1 \quad \text{……………………………….} \quad (5.3)$$

Where:

N = Total number of observation (N_1+N_2)

N_1 = Number of + symbols (i.e. + residuals)

N_2 = Number of – symbols (i.e. - residuals)

M = Expected number of runs

For a large number of observations (N > 30), the sampling distribution of *M* is approximately normal and the variance (σ^2_m) is given by:

$$\sigma^2_m = \frac{2N_1N_2\,(2N_1N_2 - N)}{(N)^2\,(N - 1)} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (5.4)$$

The Standard Normal Z statistics is used to test whether the actual number of runs is consistent with the hypothesis of independence. The Run test converts the total number of runs into a Z statistics. For a large sample, the Z statistics gives the probability of the difference between the actual and expected runs. The Z statistics is estimated as:

$$Z = \frac{R - M}{\sigma^2_m} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (5.5)$$

Where: R = the actual number of runs.

We will accept the null hypothesis of randomness with 95% confidence if the Z value falls within ±1.96 in any of the periods, and reject otherwise.

6. Empirical Results and Discussion of Findings

This section presents, analyzes and discusses the results of our econometric tests. To streamline the analyses, the order of the hypotheses formulated in section 3.1 is followed. The normality tests are presented first, followed by the Runs tests for the periods. The major data for this paper is the Monthly All Share Indices (ASI) of the NSE and covers the period from January 1985 to December 2007 as presented in table 6.1 in appendix 4.

(INSERT TABLE 6.1 HERE)

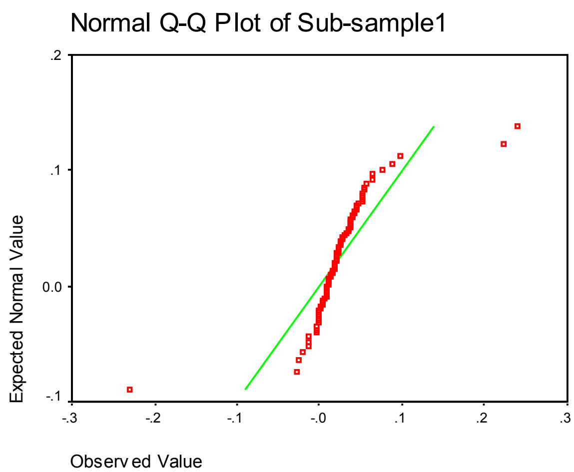
6.1 Test of Normal Distribution for the NSE Returns

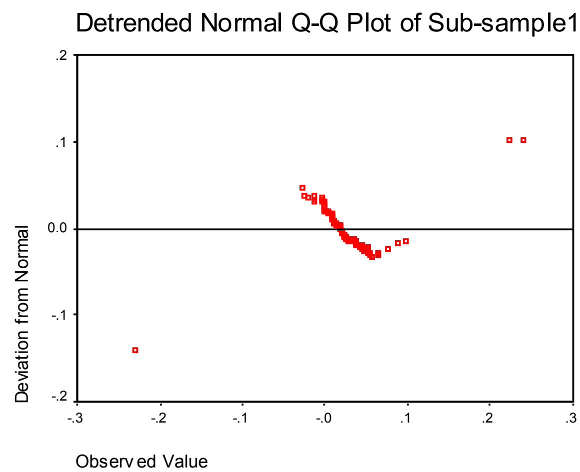
The first hypothesis posits that stock returns in NSE follow the normal distribution in all the three periods under study. Skewness, Kurtosis, Kolmogorov-Smirnov test and Q-Q charts have been used to test the hypothesis of normality. The descriptive statistics of the market returns are calculated and presented in Table 6.2 in appendix 4. The result shows that returns in all the periods are not normally distributed. In a symmetrical distribution the value of the mean, median and the mode are alike (Spiegel and Stephens, 2008:65). As the value of mean is greater than the mode in the periods under study, the market return series do not follow symmetric distribution. Generally, values for skewness (zero) and kurtosis (3) represents that the observed distribution is perfectly normally distributed. However, period1 displays positive skewness (.198) and peaked distribution (16.9), period2 shows a negative tail (-.136) with a leptokurtic distribution (4.2), whereas period3 is positively skewed (.033) with a flat distribution (.141). Thus, negative skewness, leptokurtic and playtykurtic distribution of stock return series in the NSE reject our null hypothesis of normality in the three periods as well as contradict the Random walk model.

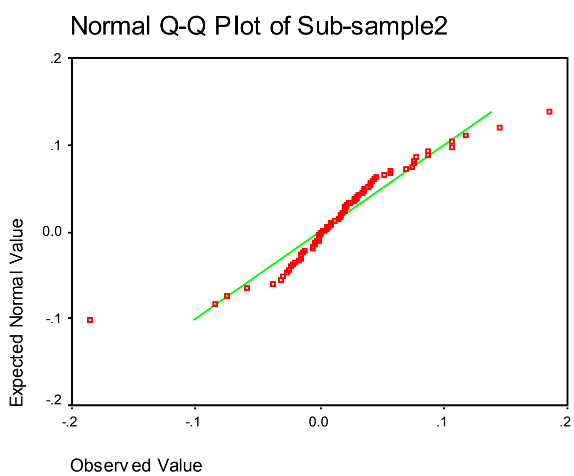
Results of the Kolmogorov-Smirnov goodness of fit test show a probability of 0.002 for period1, 0.248 for period2 and 0.784 for period3. Hence, period1 rejects the null hypothesis of normality since p value < 0.05, whereas periods 2 and 3 accept normality as p value > 0.05. However, we cannot accept normality in NSE returns based only this evidence.

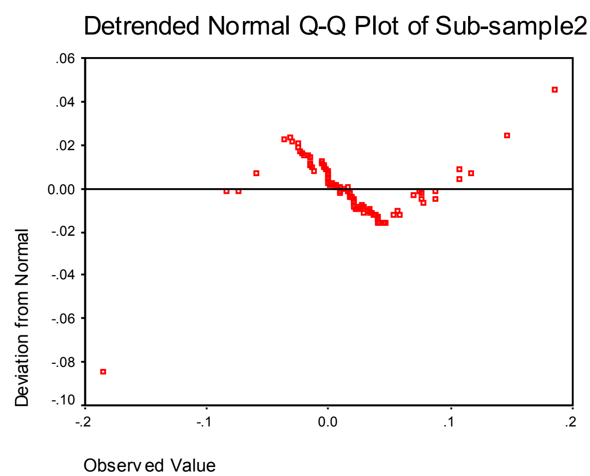
(INSERT TABLE 6.2 HERE)

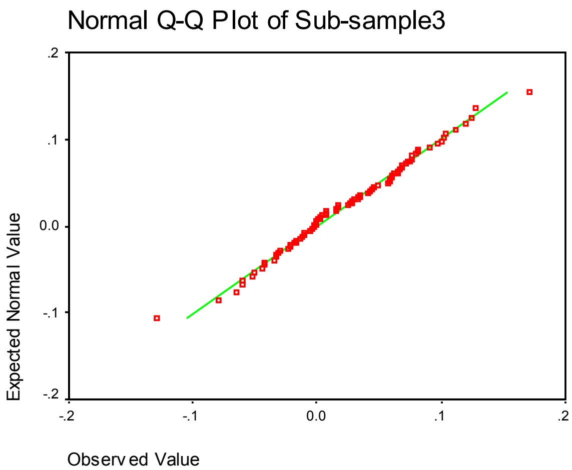
We further justify the hypothesis of normality in stock returns distribution with the Q-Q probability plot. Under the null hypothesis of normality in distribution, points will cluster around a straight line. Q-Q charts demonstrate that the stock returns in NSE are not from normal distribution. Returns data do not cluster around the thin straight line in period1 and 2. However, the returns data in period3 shows more clustering around the tin straight line than in other periods. This suggests that period 3 is nearer normal distribution than the other periods.

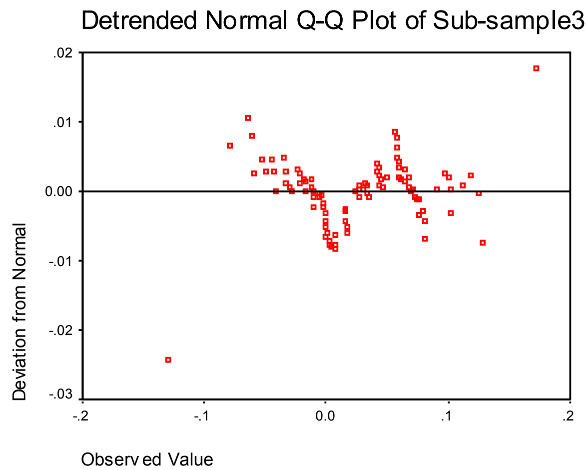












The scenario represents a deviation from the assumption of normality in distribution and random walk. These results are in line with Mlambo et al, (2003) conclusion that emerging market returns are not normally distributed. Even in developed markets, stock returns have been found to be either leptokurtic or playtykurtic (see for example, Kendal, 1953; Fama, 1965). Mlambo et al, suggest that when there is a strong deviation from normality, correlation analysis should be done using non-parametric testing methods, such as the runs test, since they do not assume a specific distribution. The following section will lead the discussion in depth of Random walk by testing randomness of the distribution.

6.2 Test of Randomness for the NSE Returns

The second hypothesis postulates that stock returns in the NSE are random in the three periods under study. Table 6.3 in appendix 4 presents three sets of results. The first set is the results of Runs test for period1 which starts from January 1985 to December 1992. The second set of result is the results of the Runs test for period2 which starts from January 1993 to December 1999.The last result is the result of period3 which starts from January 2000 and ends on December 2007.

(INSERT TABLE 6.3 HERE)

The results show that the Z statistics of period1 (-2.980), period2 (-5.842) and (-2.784) for period3 are lesser than -1.96 and negative, which show that their actual number of runs fall short of the expected number of runs at 5% significance level. From Table 6.3, we see that the actual runs are 70% of the expected runs in period1, 38% of expectation in period2 and 72% of expectation in period3. Negative Z value and few observed runs indicate positive serial correlation in returns.

In addition to above evidence, the positive mean value of .0242 in period1, .0187 in period2 and .0243 in period3 contradict the random walk model which postulates zero mean. In a Weak-Form efficient stock market, the positive returns cancel out the negative returns so that their average effect on investment returns is zero. The positive mean value indicate evidence against the null hypothesis of independence in NSE return series.

More so, the asymptotic significance (2-tailed), which is the *p*-value corresponding to the Z value, show a probability of (0.003) for period1, (0.000) in period2 and (0.005) for period3. Under the null hypothesis of random walk in return series, asymptotic significance corresponding to the Z value should be greater than or equal to significance level, in this case 5%. Thus, we can accept the alternative hypothesis that the NSE is not weak form efficient across time, since Z statistics for period1, period2 and period3 < significance level (0.05).

In brief, the results of Runs tests on the NSE indicate that the stock returns are not random as the Z statistics do not fall in between ±1.96 in any of the periods examined. The returns in all the periods appear to fit a momentum process.

6.3 Effect of Changes in Trading System on the NSE Efficiency

The existing evidence on market microstructure studies suggests that improvements in trading system, market capitalization, membership, value and volume traded lead to improvements in liquidity and market efficiency (Amihud et al, 1997; Suzuki and Yasuda, 2006). From the results of the Runs tests for period2 (Jan 1993 - Dec 1999) and period3 (Jan 2000 – Dec 2007) in Table 6.3 (see appendix 4), improvements in trading system of the NSE have positive effect on market efficiency. This is evidenced in the higher percentage of expected runs in period3 (72%) than in period2 (38%), which shows that the former has greater tendency towards weak form efficiency than the latter. Similarly, the Z value of period3 (-2.84) shows significant improvement over the Z statistic for period2 (-5.842) at 5% critical value, which is -1.96. Also the asymptotic significance of period3 (0.005) indicates increase in market efficiency over that of period2 (0.000).

Generally, the effect of improvements in trading system is positive on the Weak-Form efficiency of the Nigerian Stock Exchange. This finding supports existing evidence that there are positive gains in terms of efficiency when stock exchanges adopt advanced trading technology (see, Ngugi, Murinde and Green, 2003). Whether the positive impact is statistically significant or not is left for further studies.

7 Conclusions and Recommendations

7.1 Conclusions

This paper examined the Weak-Form efficiency across time for the NSE using stock returns for three periods including January 1985 to December 1992, January 1993 to December 1999, and January 2000 to December 2007. Normality of the return series and Random walk assumptions were tested. The results indicate that the stock return series do not follow normal distribution. As a result, null hypothesis of normality in return series was rejected and alternative hypothesis remained in effect. Runs test results reject the randomness of the return series of all the periods studied and the alternative hypothesis of non-randomness in periodic return series is accepted. Evidence from this study, however, suggests that improvements in trading system have positive effect on efficiency of the NSE.

Overall results from the study suggest that the NSE is not efficient in the Weak-Form across time. The rejection of Weak-Form efficiency across time is inconsistent with some of the prior studies (see for example, Jefferis and Smith, 2005). The empirical literature points to the existence of Weak-Form efficiency in returns of sample of individual price series (see, Samuels and yacout, 1981; Ayadi, 1984; Olowe, 1999) and not, in most cases, in share index (see, Akpan,1995; Appiah-kusi and Menya, 2003), suggesting that the samples of price series studied do not represent the market. More so, illiquidity and paucity of instruments traded dominate the NSE. For instance Apampa (2008) observes that of the 200 odd listed securities, only about 40 are liquid. Because there so few liquid instruments, supply and demand of those instruments control prices and investment decisions more than the fundamentals of the company in question. This suggests that the mixed evidence on the NSE efficiency is not as a result of changing efficiency but supply and demand imbalances, illiquidity and paucity of instruments. Also, associated high average cost of transaction results in limited market activity. Nevertheless, these are only persuasive rather than empirical arguments. These arguments, although not sufficient, explain the rejection of the Weak-Form efficiency across time for the NSE.

A major economic implication of this evidence for investors of the NSE is that stock returns are predictable, in the short horizon, from historical returns and volume traded, but whether exploitation will be profitable after transaction costs is unknown.

7.2 Recommendations

The policy implications of this analysis are that the NSE, as an emerging market, must be closely monitored to achieve an optimal maturity level. Greed and bad choices should not take the place of risk management capacity and market discipline. Investors must be aware that, in inefficient stock markets, heavy gains are just as likely as heavy losses. Furthermore, 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. Several policy challenges need to be confronted to enhance the efficiency of the NSE, including (and not limited to):

- Increase market activities through reduction in transaction cost and increase in membership of the NSE.
- Establishing a stock exchange news service, which will be responsible for early, equal and wide dissemination of price sensitive news such as financial results and other

information that are material to investors' decision. This will ensure that participants and investors have equal access to high quality and reliable information.

- Minimize institutional restrictions on trading of securities in the bourse. This will allow the market to flow as a deregulated market.
- The NSE and SEC also need to strengthen their regulatory capacities to enhance market discipline and investor confidence. This will involve training personnel to enforce financial regulations, perform market surveillance, analytical and investigative assignments.

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Appendices

Appendix 1

THE COMPUTATION OF MONTHLY STOCK RETURNS FOR PERIOD1 (JAN.1985 -DEC. 1992)

Date	Indices Level, Pt	Ln Pt	LnPt-LnPt-1
31/12/1992	1107.6	7.009951	0.008705
30/11/1992	1098	7.001246	0.019775
31/10/1992	1076.5	6.98147	0.051954
30/9/1992	1022	6.929517	0.052943
31/8/1992	969.3	6.876574	0.096993
31/7/1992	879.7	6.779581	0.010398
30/6/1992	870.6	6.769183	0.011669
31/5/1992	860.5	6.757514	0.019361
30/4/1992	844	6.738152	0.005823
31/3/1992	839.1	6.73233	0.034432
28/2/1992	810.7	6.697898	0.020815
31/1/1992	794	6.677083	0.013951
31/12/1991	783	6.663133	0.018042
30/11/1991	769	6.645091	0.015067
31/10/1991	757.5	6.630024	0.027029
30/9/1991	737.3	6.602995	0.034777
31/8/1991	712.1	6.568218	0.03443
31/7/1991	688	6.533789	0.054051
30/6/1991	651.8	6.479738	0.004305
31/5/1991	649	6.475433	0.037681
30/4/1991	625	6.437752	0.039157
31/3/1991	601	6.398595	0.07603
29/2/1991	557	6.322565	0.052144
31/1/1991	528.7	6.270421	0.028587
31/12/1990	513.8	6.241834	0.022039
31/11/1990	502.6	6.219795	0.045384
31/10/1990	480.3	6.174411	0.025515
30/9/1990	468.2	6.148896	0.009873
31/8/1990	463.6	6.139022	0.040049
31/7/1990	445.4	6.098973	0.064928
30/6/1990	417.4	6.034045	0.087839
31/5/1990	382.3	5.946206	0.054561
30/4/1990	362	5.891644	0.016713
31/3/1990	356	5.874931	0.019
28/2/1990	349.3	5.855931	0.018201
31/1/1990	343	5.83773	0.052061
31/12/1989	325.6	5.78567	0.045234
30/11/1989	311.2	5.740436	0.042001
31/10/1989	298.4	5.698435	0.064002
30/9/1989	279.9	5.634432	-0.00392
31/8/1989	281	5.638355	0.0429
31/7/1989	269.2	5.595455	0.037855
30/6/1989	259.2	5.5576	0.008135
31/5/1989	257.1	5.549465	-0.00155
30/4/1989	257.5	5.55102	0.002333
31/3/1989	256.9	5.548687	0.023234

29/2/1989	251	5.525453	0.046065
31/1/1989	239.7	5.479388	0.025778
31/12/1988	233.6	5.45361	0.009462
30/11/1988	231.4	5.444148	0.012612
31/10/1988	228.5	5.431536	0.019444
30/9/1988	224.1	5.412092	0.029434
31/8/1988	217.6	5.382659	0.028434
31/7/1988	211.5	5.354225	0.026349
30/6/1988	206	5.327876	0.033567
31/5/1988	199.2	5.294309	-0.00451
30/4/1988	200.1	5.298817	0.023257
31/3/1988	195.5	5.27556	0.021195
28/2/1988	191.4	5.254365	0.00314
31/1/1988	190.8	5.251226	-0.00052
31/12/1987	190.9	5.25175	-0.01301
30/11/1987	193.4	5.264761	0.222627
31/10/1987	154.8	5.042134	-0.23035
30/9/1987	194.9	5.272487	0.009796
31/8/1987	193	5.26269	-0.00207
31/7/1987	193.4	5.264761	-0.01386
30/6/1987	196.1	5.278625	0.240374
31/5/1987	154.2	5.03825	-0.02117
30/4/1987	157.5	5.059425	-0.02632
31/3/1987	161.7	5.085743	-0.02745
29/2/1987	166.2	5.113192	-0.0042
31/1/1987	166.9	5.117395	0.018749
31/12/1986	163.8	5.098646	0.003057
30/11/1986	163.3	5.095589	0.014806
31/10/1986	160.9	5.080783	0.037358
30/9/1986	155	5.043425	0.026145
31/8/1986	151	5.01728	0.000662
31/7/1986	150.9	5.016617	0.023467
30/6/1986	147.4	4.99315	0.021949
31/5/1986	144.2	4.971201	-0.01377
30/4/1986	146.2	4.984976	0.037635
31/3/1986	140.8	4.94734	0.007843
28/2/1986	139.7	4.939497	0.03719
31/1/1986	134.6	4.902307	0.055761
31/12/1985	127.3	4.846547	0.021438
30/11/1985	124.6	4.825109	0.045145
31/10/1985	119.1	4.779963	0.018645
30/9/1985	116.9	4.761319	-0.00086
31/8/1985	117	4.762174	-0.00171
31/7/1985	117.2	4.763882	0.007709
30/6/1985	116.3	4.756173	-0.00172
31/5/1985	116.5	4.757891	0.007755
30/4/1985	115.6	4.750136	0.019215
31/3/1985	113.4	4.730921	0.010638
29/2/1985	112.2	4.720283	0.008054
31/1/1985	111.3	4.712229	

Runs Test 2

	VAR00001
Test Value[a]	.0242
Cases < Test Value	56
Cases >= Test Value	39
Total Cases	95
Number of Runs	33
Z	-2.980
Asymp. Sig. (2-tailed)	.003

a. Mean

One-Sample Kolmogorov-Smirnov Test

		VAR00001
N		95
Normal Parameters[a,b]	Mean	.0242
	Std. Deviation	.04619
Most Extreme Differences	Absolute	.194
	Positive	.173
	Negative	-.194
Kolmogorov-Smirnov Z		1.886
Asymp. Sig. (2-tailed)		.002

a. Test distribution is Normal.

b. Calculated from data.

Appendix 2

COMPUTATION OF MONTHLY RETURNS FOR PERIOD2 (JAN.1993-DEC.1999)

Date	Indices Level, Pt	Ln Pt	LnPt-LnPt-1
		8.56910	0.02561
31/12/1999	5266.4	2	8
		8.54348	0.01981
30/11/1999	5133.2	5	2
		8.52367	0.02856
31/10/1999	5032.5	2	1
		8.49511	
30/9/1999	4890.8	1	-0.0149
		8.51000	
31/8/1999	4964.2	7	-4E-05
		8.51004	
31/7/1999	4964.4	8	-0.18578
		8.69582	0.11740
30/6/1999	5977.9	5	5
31/5/1999	5315.7	8.57842	0
30/4/1999	5315.7	8.57842	-0.02609
31/3/1999	5456.2	8.60450	0.01471

		8	5
29/2/1999	5376.5	8.589793	-0.02178
31/1/1999	5494.9	8.611576	-0.03184
31/12/1998	5672.7	8.64342	-0.00273
30/11/1998	5688.2	8.646149	0.003028
31/10/1998	5671	8.643121	-0.0047
30/9/1998	5697.7	8.647818	-0.01705
31/8/1998	5795.7	8.664872	-0.00367
31/7/1998	5817	8.66854	-0.01283
30/6/1998	5892.1	8.681368	-0.02378
31/5/1998	6033.9	8.705149	-0.01317
30/4/1998	6113.9	8.71832	-0.02975
31/3/1998	6298.5	8.748067	-0.02007
28/2/1998	6426.2	8.768139	-0.00146
31/1/1998	6435.6	8.7696	-0.00076
31/12/1997	6440.5	8.770361	0.006965
30/11/1997	6395.8	8.763397	-0.02456
31/10/1997	6554.8	8.787953	-0.08423
30/9/1997	7130.8	8.872179	-0.07446
31/8/1997	7682	8.946635	-0.05899
31/7/1997	8148.8	9.005626	-0.0374
30/6/1997	8459.3	9.043022	-0.0156
31/5/1997	8592.3	9.058622	-0.01588
30/4/1997	8729.8	9.074498	0.019479
31/3/1997	8561.4	9.055019	0.106134
29/2/1997	7699.3	8.948885	0.057607
31/1/1997	7268.3	8.891278	0.038741
31/12/1996	6992.1	8.852536	0.031453
30/11/1996	6775.6	8.821083	0.020999
31/10/1996	6634.8	8.800084	0.020234

30/9/1996	6501.9	8.77985	0.057107
31/8/1996	6141	8.722743	0.036753
31/7/1996	5919.4	8.68599	0.020601
30/6/1996	5798.7	8.665389	0.016449
31/5/1996	5704.1	8.64894	0.052493
30/4/1966	5412.4	8.596448	0.027384
31/3/1996	5266.2	8.569064	0.016427
28/2/1996	5180.4	8.552638	0.008783
31/1/1996	5135.1	8.543855	0.008389
31/12/1995	5092.2	8.535465	-0.00059
30/11/1995	5095.2	8.536054	0.005353
31/10/1995	5068	8.530702	0.042299
30/9/1995	4858.1	8.488403	0.040645
31/8/1995	4664.6	8.447757	0.078067
31/7/1995	4314.3	8.36969	0.184758
30/6/1995	3586.5	8.184932	0.145517
31/5/1995	3100.8	8.039415	0.107233
30/4/1995	2785.5	7.932183	0.087903
31/3/1995	2551.1	7.84428	0.069508
28/2/1995	2379.8	7.774772	0.040519
31/1/1995	2285.3	7.734253	0.03577
31/12/1994	2205	7.698483	0.039642
30/11/1994	2119.3	7.658841	0.046307
31/10/1994	2023.4	7.612535	0.033878
30/9/1994	1956	7.578657	0.021654
31/8/1994	1914.1	7.557003	-0.00635
31/7/1994	1926.3	7.563356	0.003745
30/6/1994	1919.1	7.559612	0.022981

		7.53663	0.01607
31/5/1994	1875.5	1	1
			0.02902
30/4/1994	1845.6	7.52056	6
		7.49153	0.04419
31/3/1994	1792.8	4	1
		7.44734	0.02898
28/2/1994	1715.3	3	2
		7.41836	0.07635
31/1/1994	1666.3	1	9
		7.34200	0.08747
31/12/1993	1543.8	2	1
		7.25453	0.07606
30/11/1993	1414.5	1	2
		7.17846	0.07407
31/10/1993	1310.9	9	9
		7.10439	0.01807
30/9/1993	1217.3	1	1
			0.01237
31/8/1993	1195.5	7.08632	2
		7.07394	
31/7/1993	1180.8	7	-0.00566
		7.07960	0.00050
30/6/1993	1187.5	6	5
			0.03393
31/5/1993	1186.9	7.0791	4
		7.04516	0.01475
30/4/1993	1147.3	7	1
		7.03041	0.00942
31/3/1993	1130.5	5	1
		7.02099	0.00582
29/2/1993	1119.9	5	1
		7.01517	
31/1/1993	1113.4	4	

Runs Test 2

	VAR00001
Test Value[a]	.0187
Cases < Test Value	44
Cases >= Test Value	39
Total Cases	83
Number of Runs	16
Z	-5.842
Asymp. Sig. (2-tailed)	.000

a. Mean

One-Sample Kolmogorov-Smirnov Test

		VAR00001
N		83
Normal Parameters[a,b]	Mean	.0187
	Std. Deviation	.04949
Most Extreme Differences	Absolute	.112
	Positive	.112
	Negative	-.098
Kolmogorov-Smirnov Z		1.021
Asymp. Sig. (2-tailed)		.248

a. Test distribution is Normal.

b. Calculated from data.

Appendix 3

COMPUTATION OF MONTHLY STOCK RETURNS FOR PERIOD3 (JAN. 2000-DEC.2007)

Date	Indices Level, Pt	Ln Pt	LnPt-LnPt-1
31/12/2007	57990.2	10.96803	0.067779
30/11/2007	54189.9	10.90025	0.076444
31/10/2007	50201.8	10.82381	-0.00054
30/9/2007	50229	10.82435	-0.00124
31/8/2007	50291.1	10.82558	-0.05287
31/7/2007	53021.7	10.87846	0.032416
30/6/2007	51330.5	10.84604	0.027659
31/5/2007	49930.2	10.81838	0.057844
30/4/2007	47124	10.76054	0.081031
31/3/2007	43456.1	10.67951	0.064769
29/2/2007	40730.7	10.61474	0.101906
31/1/2007	36784.5	10.51283	0.102849
31/12/2006	33189.3	10.40998	0.016919
28/11/2006	32632.5	10.39306	-0.00034
31/10/2006	32643.7	10.39341	0.002733
30/9/2006	32554.6	10.39067	-0.01651
31/8/2006	33096.4	10.40718	0.171497
31/7/2006	27880.5	10.23568	0.057746
30/6/2006	26316.12	10.17794	0.06153
31/5/2006	24745.7	10.11641	0.060147
30/4/2006	23301.2	10.05626	-0.00152
31/3/2006	23336.6	10.05778	-0.02147
29/2/2006	23843	10.07925	0.006885
31/1/2006	23679.4	10.07236	-0.01702
31/12/2005	24085.8	10.08938	-0.01115
30/11/2005	24355.9	10.10053	-0.06046
31/10/2005	25873.8	10.16099	0.049026
30/9/2005	24635.9	10.11196	0.071523

31/8/2005	22935.4	10.04044	0.045693
31/7/2005	21911	9.994744	0.015926
30/6/2005	21564.8	9.978818	0.003842
31/5/2005	21482.1	9.974975	-0.02208
30/4/2005	21961.7	9.997055	0.060017
31/3/2005	20682.4	9.937038	-0.05964
28/2/2005	21953.5	9.996682	-0.04997
31/1/2005	23078.3	10.04665	-0.03266
31/12/2004	23844.5	10.07931	0.024367
30/11/2004	23270.5	10.05494	-0.00362
31/10/2004	23354.8	10.05856	0.02669
30/9/2004	22739.7	10.03187	-0.04449
31/8/2004	23774.3	10.07636	-0.12953
31/7/2004	27062.1	10.20589	-0.06527
30/6/2004	28887.4	10.27116	0.040862
31/5/2004	27730.8	10.2303	0.072441
30/4/2004	25793	10.15786	0.119123
31/3/2004	22896.4	10.03873	-0.07976
29/2/2004	24797.43	10.1185	0.11187
31/1/2004	22172.88	10.00663	0.096711
31/12/2003	20128.94	9.909914	0.041054
30/11/2003	19319.3	9.86886	0.030258
31/10/2003	18743.5	9.838602	0.127456
31/9/2003	16500.5	9.711146	0.067336
31/8/2003	15426	9.64381	0.099715
31/7/2003	13962	9.544095	-0.04232
30/6/2003	14565.5	9.586411	0.033453
31/5/2003	14086.3	9.552958	0.043402
30/4/2003	13488	9.509556	-0.00319
31/3/2003	13531.1	9.512746	-0.01013
28/2/2003	13668.8	9.522871	0.027442
31/1/2003	13298.8	9.495429	0.091357
31/12/2002	12137.7	9.404072	0.043356
30/11/2002	11622.7	9.360715	0.014839
31/10/2002	11451.5	9.345876	-0.03096
30/9/2002	11811.6	9.376837	-0.04278
31/8/2002	12327.9	9.41962	-0.01051
31/7/2002	12458.2	9.430134	0.001406
30/6/2002	12440.7	9.428729	0.079784
31/5/2002	11486.7	9.348945	0.007664
30/4/2002	11399	9.341281	0.016327
31/3/2002	11214.4	9.324954	0.058054
29/2/2002	10581.9	9.2669	-0.00641
31/1/2002	10650	9.273315	-0.02898
31/12/2001	10963.1	9.30229	-0.01866
30/11/2001	11169.6	9.320951	0.007026
31/10/2001	11091.4	9.313925	0.076534
31/9/2001	10274.2	9.237391	-0.00532
31/8/2001	10329	9.242711	-0.02367
31/7/2001	10576.4	9.26638	-0.03355

30/6/2001	10937.3	9.299934	0.074331
31/5/2001	10153.8	9.225603	0.05696
30/4/2001	9591.6	9.168643	0.046063
31/3/2001	9159.8	9.12258	-0.00226
28/2/2001	9180.5	9.124837	0.042989
31/1/2001	8794.2	9.081848	0.080871
31/12/2000	8111	9.000976	0.124097
30/11/2000	7164.4	8.87688	-0.03442
31/10/2000	7415.3	8.911301	0.015822
30/9/2000	7298.9	8.895479	-0.01296
31/8/2000	7394.1	8.908438	0.06906
31/7/2000	6900.7	8.839378	0.064957
30/6/2000	6466.7	8.774421	0.059132
31/5/2000	6095.4	8.71529	0.033803
30/4/2000	5892.8	8.681487	-0.01238
31/3/2000	5966.2	8.693865	0.001761
29/2/2000	5955.7	8.692104	0.034645
31/1/2000	5752.9	8.657459	

Runs Test 2

	VAR00001
Test Value[a]	.0243
Cases < Test Value	47
Cases >= Test Value	48
Total Cases	95
Number of Runs	35
Z	-2.784
Asymp. Sig. (2-tailed)	.005

a. Mean

One-Sample Kolmogorov-Smirnov Test

		VAR00001
N		95
Normal Parameters[a,b]	Mean	.0243
	Std. Deviation	.05224
Most Extreme Differences	Absolute	.067
	Positive	.067
	Negative	-.060
Kolmogorov-Smirnov Z		.655
Asymp. Sig. (2-tailed)		.784

a. Test distribution is Normal.

b. Calculated from data.

Appendix 4

List of Tables

Table 6.1 Monthly All Share Index of the NSE

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
1985	111.3	112.2	113.4	115.6	116.5	116.3	117.2	117	116.9	119.1	124.6	127.3
1986	134.6	139.7	140.8	146.2	144.2	147.4	150.9	151	155	160.9	163.3	163.8
1987	166.9	166.2	161.7	157.5	154.2	196.1	193.4	193	194.9	154.8	193.4	190.9
1988	190.8	191.4	195.5	200.1	199..2	206	211.5	217.6	224.1	228.5	231.4	233.6
1989	239.7	251	256.9	257.5	257.1	259.2	269.2	281	279.9	298.4	311.2	325.3
1990	343	349.3	356	362	382.3	417.4	445.4	463.6	468.2	480.3	502.6	513.8
1991	528.7	557	601	625	649	651.8	688	712.1	737.3	7575	769	783
1992	794	810.7	839.1	844	860.5	870.8	879.7	969.3	1022	1076.5	1098	1107.6
1993	1113.4	1119.9	1130.5	1147.3	1186.9	1187.5	1180.8	1195.5	1217.3	1310.9	1414.5	1543.8
1994	1666.3	1715.3	1792.8	1845.6	1875.5	1919.1	1926.3	1914.1	1956	2023.4	2119.3	2205
1995	2285.3	2379.8	2551.1	2785.5	3100.8	3586.5	4314.3	4664.6	4858.1	5068	5095.2	5092.2
1996	5135.1	5180.4	5266.2	5412.4	5704.1	5798.7	5919.4	6141	6501.9	6634.8	6775.6	6992.1
1997	7268.3	7699.3	8561.4	8729.8	8592.3	8459.3	8148.8	7682	7130.8	6554.8	6395.8	6440.5
1998	6435.6	6426.2	6298.5	6113.9	6033.9	5892.1	5817	5795.7	5697.7	5671	5688.2	5672.7
1999	5494.9	5376.5	5456.2	5315.7	5315.7	5977.9	4964.4	4964.2	4890.8	5032.5	5133.2	5266.4
2000	5752.9	5955.7	5966.2	5892.8	6095.4	6466.7	6900.7	7394.1	7298.9	7415.3	7164.4	8111
2001	8794.2	9180.5	9159.8	9591.6	10153.8	10937.3	10576.4	10329	10274.2	11091.4	11169.6	10963.1
2002	10650	10581.9	11214.4	11399	11486.7	12440.7	12458.2	12327.9	11811.6	11451.5	11622.7	12137.7
2003	13298.8	13668.8	13531.1	13488	14086.3	14565.5	13962	15426	16500.5	18743.5	19319.3	20128.9
2004	22172.8	24797.4	22896.4	25793	27730.8	28887.4	27062.1	23774.3	22739.7	23354.8	23270.5	23844.5
2005	23078.3	21953.5	20682.4	21961.7	21482.1	21564.8	21911	22935.4	24635.9	25873.8	24355.9	24085.8
2006	23679.4	23843	23336.6	23301.2	24745.7	26316.1	27880.5	33096.4	32554.6	32643.7	32632.5	33189.3
2007	36784.5	40730.7	43456.1	47124	49930.2	51330.5	53021.7	50291.1	50229	50201.8	54189.9	57990.2

Source: www.databank.sec.gov.ng

Table 6.2 Results of Normality Tests for the NSE Stock Returns

Variable	Description	Sub-sample1	Sub-sample2	Sub-sample3

(R_{mt})	Observation	95	83	95
	Mean	0.0242	0.187	0.0243
	Median	0.0198	0.0164	0.0244
	Mode	-0.23	-.19	-0.13
	Variance	0.00231	0.00245	0.00273
	Std. Dev	0.04619	.04949	0.5224
	$Minimum_{Rt}$	-0.23	-.19	-0.13
	$Maximum_{Rt}$	0.24	.18	0.17
	Range	0.47	-.37	0.30
	Skewness	0.198	-.136	0.033
	Kurtosis	16.901	4.2332	0.141
	K-S Z	1.886	1.021	0.655
	K-S Asympt.sig	.002	.248	.784

Table 6.3 Results of Runs Tests for the NSE Stock Returns

Periods	Observations	Actual Runs	Expected Run	Test Value	Z-Statistics	Asymp.sig (2-tailed)
Sub1 (Jan. 1985-Dec.1992)	95	33	47	.0242	-2.980	.003
Sub2 (Jan1993-dec1999)	83	16	42	.0187	-5.842	.000
Sub3 (Jan 2000-Dec 2007)	95	35	48	.0243	-2.784	.005