TITLE PAGE

MARKOV CHAIN AND STOCK PRICE MOVEMENT IN NIGERIA (1985-2013)

BY

IROHA, NNAH MADUABUCHI

PG/M.SC/08/49533

BEING A PROJECT SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE AWARD OF MASTER OF SCIENCE (M.Sc.) IN STATISTICS

DEPARTMENT OF STATISTICS

UNIVERSITY OF NIGERIA NSUKKA

AUGUST, 2015

CERTIFICATION

I Iroha, Nnah Maduabuchi with registration number PG/ M.Sc./ 08/ 49533 of the Department of Statistics, University of Nigeria, Nsukka certify that this work is original and that it has not been in substance for any other degree in this University or any other University.

Supervisors: _____ _____

Ass. Prof. W.I.E Chukwu Signature Date

_____

Head of Department

Prof. F.I. Ugwuowo

_____

External Examiner

DEDICATION

To the Almighty God and to my dear wife.

ACKNOWLEDGEMENT

I give thanks to the Almighty God who made it possible for me to finish this project. I acknowledge the unfailing love bestowed on me by my supervisors Ass. Prof. W.I.E Chukwu.

I acknowledge Prof. J.N. Adiche for his words of encouragement and fatherly role he played in the completion of this project. I thank all the professors and lecturers in the department of statistics, Prof. P.I. Uche, Prof. P.E. Chigbu, Prof. F.C. Okafor and Prof. F.I. Ugwuowo Dr. E. O. Ossai for their encouragement. I thank my friend Dr. A.U. Udom and Dr. T.E. Ugah for their assistance. Moreso, I thank my sister Dr. A.V. Oladugba for all her efforts. I also thank S. S. Sani for helping me. I will not forget my late friend Mrs. Virginia Ifeyinwa, may her soul rest in perfect peace Amen.

I will not forget Dr. Nick Obitte of pharmacy department for his assistance on the completion of this project. I appreciate Dr. Charles Manasseh for his help. I thank all my course mates Kenneth, Sola, Uduak, Kelechi, Uju, Nitah, Sony, Austin. I thank my siblings, Livinus, Chioma, Ejike, Jude and Chimuanya for their understanding. I thank Prof and Prof. (Mrs). T.U Nwabueze for their encouragement. I appreciate Prof. (Mrs). G.E. Ugwuonah for her motherly care, and to Dr. Okey Chikeleze and Pastor Julius Iroha for their encouragement. I appreciate my motherôs encouragement. I appreciate my dear wife Mrs. Amaka Iroha for her patience and encouragement and her insistence that I should complete this project even when things were difficult. I appreciate my children, Chinemerem, Chidiebere, Chimezirim and Chisom.

TABLE OF CONTENTS

ABSTRACT

The share prices of the stock market are volatile in nature. Investors are at risk without an in-depth knowledge of the operations of the stock market. We used regression analysis to ascertain the relationship between the movement of share prices and economic growth. A regression model was developed to capture the effect of the movement of share prices in the Nigerian stock exchange market on economic growth. Markov chain was used to find effect of the share prices. The results show that in the long run the increase and decrease in the share prices will become stable with probability of 0.665and 0.335 respectively.

Chapter One: Introduction:

1.1 Background of the Study:

There has been so much controversy on the relevance of stock market as a tool to stabilize the economic activities of a country in the contemporary society. Movement of share prices of listed companies on the Nigerian stock exchange has been a deterministic factor in the performance of the market. However, an appreciation of share prices is an indication of how valuable and viable the firms which form part of the private sector are. Furthermore, when share prices rises, it translates to an increase in market capitalisation which measures the market performance and the financial market development. Though, some increase in share prices are not market driven but caused by speculators whose aim lies on beaten the market so as to make abnormal profit. In this situation, the investorsô confidence is deterred, reducing the level of investment and economic activities in the country. Be that as it may, there is a significant and positive relationship between financial performance and the market value of share prices of the listed firms in the stock exchange (Uwalomwa *et al*, 2014).

In like manner, the success or failure of the individuals firms, corporate bodies or organizations in the stock market depend on the choice of decision made, which to a very large extent depends on the level of information an investor has. Therefore symmetric information or rather equitable information dissemination to the market actors is relevant to mitigate and as well reduce the predictability of share price movement in Nigeria. This brought to fore the argument between the fundamental school of thought and technicalist/chartist. The former is of the view that current share prices can be predicted using past information on share prices and fundamental issues such as bonuses, dividend among others while the later emphasis more on predictive power using past information on share prices only.(Anvwar and Philip, 1997).In view of the postulate of the two schools of thought, (Milan and Ladislav, 2012) opined that the prediction of stock market is a complex task since the distribution of financial time series is changing over periods of time. There is also never ending debate as to whether share prices are predictable or not. In an efficient market, investors are rational. This entails that the share prices are determined by the interaction of demand and supply. However, any attempt by investors will end up yielding zero abnormal revenue. This is because, it is assumed that in an efficient market, current prices of shares reflect both past and present information publicly announced. Unfortunately, most domestic investors lack practical knowledge of inherent benefit of stock market. Hence, investing in

stock market is an activity that has enabled investors build huge wealth in any economy. The stock market offers great opportunity to turn oneôs savings into wealth. But this benefit has not been properly enhanced in Nigeria due to ignorance and fear of the unknown. However, there is need to observe certain key events in the stock market, one of such is the movement or trend of shares in this market (Michael, 2004).

In the recent years, investors have started to show interest in trading on stock markets indices as it provides an opportunity to hedge their market risks, and at the same time it offers a good investment opportunity for speculators and arbitrageurs. It is evident that any investor would want to know the future asset prices and/or any financial instrument, e.g. stock exchange index. Basically, traders use several different approaches for prediction based upon fundamental analysis, technical analysis (TA) and psychological analysis. Furthermore, outside these views, movement of stock prices may equally be determined by Central Bank monetary policies.

Sequel to the foregoing, since banks dominate the Nigerian stock market, increase in reserve requirements of Deposit Money Bank, could affect share movement directly or indirectly. Hence, as reserve requirement of Central Bank of Nigeria (CBN) increases, there will be a decrease in the liquidity of banks resulting to less credit/cash available for lending to the private sector. This would lead to a fall in the credit and could affect the level of investment. Thus, the stability of stock market is vital to enhance growth which serves to be a sole responsibility of the authorities. More so, the development of stock market which is the central hub of every economy is paramount for economic development. (Manasseh et al 2012) argued that stable share price is bedrock for building a formidable, transparent and efficient stock market that could support the mobilization of domestic and foreign savings for investment. Conversely, it deepens and broadens financial intermediation which promotes increase in business activities due to high level of confidence yielded.

Outside the influence of monetary policy instruments, macroeconomic instability has been a threat in the movement of share prices as well. An increase/decrease in the exchange rate could cause a proportional increase/decrease in share prices. Frequent changes in share prices could deter investorsô confidence and cross listing of stocks thereby affecting the total values of shares traded and market capitalization of Nigeria stock exchange. Be that as it may, it could be said that, developed and efficient stock market is an embodiment of healthy financial sector reforms. This is because, the primary aim of most of the reforms among emerging economies of the world lies on the attainment of economic growth which mostly dwells on a viable macroeconomic environment and property right of the investors, geared

towards creating a friendly and competitive business environment that can promote the level of confidence, financial soundness and economic growth (Manasseh et al, 2012).

Before 1986 consolidation policy reforms, the Nigerian stock market was nothing to write home about given the poor rating and performance of the market. A year after, the market took a different direction. Even though, the market was a bit better compared to its performance prior to the reforms, the problem of bank failure and financial distress became the order of the day. Between 1994 and 2000, a total of about 35 financial institutionsô licenses were revoked by the Central Bank of Nigeria (CBN); and the Nigeria Deposit Insurance Corporation (NDIC) was ordered by the Federal High Court of Nigeria to liquidate the said institutions. Hence, this became an issue of concern to the policy makers. Given the above discuss, this study investigates the movement of share prices of the All Share Index in the Nigeria stock exchange market using Markov chain model for the analysis.

1.2 DEFINITIONS OF BASIC CONCEPTS

Stochastic Process: A stochastic process is a mathematical model that evolves over time in a probabilistic manner.

Markov Chain: A sequence of trials of an experiment is a Markov Chain if the outcome of each experiment is one of a set of discrete states and if the outcome of an experiment depends only on the present state and not on any past state.

Probability Vector: A probability vector is a Matrix of only one row, having non negative entries with the sum of the entries in the row equal to one (1).

Regular Transition Matrix: A Transition Matrix is regular if some power of the matrix contains all positive entries.

State Space: A state space in a stochastic process defines the set of all possible values that the random variables X (t) assumes.

A *stock market* is an exchange market where security trading is conducted by professional stockbrokers. It is a public market in which shares of different companies are bought and sold.

The *opening price* refers to the price of each individual share on the beginning of that trading day.

The *closing price* refers to the price of each individual share at the end of that trading day.

A **stock index** or **stock market index** is a measurement of the value of a section of the stock market. It is computed from the prices of selected stocks.

1.3 Statement of Problem:

The stability of the stock market is a sine qua non for economic growth thereby providing individuals and corporate organizations with a level playing ground for investment. The onus lies on the government to create a legal framework and an enabling business environment to encourage participation in the purchase of shares from the stock market. It is a clear fact that an organized, developed and efficient stock market provides individuals and corporate investors with an additional financial instrument that can stimulate the quality of transactions and investments in the country (Manasseh, et.al 2014). The development of the stock market would be a major source of economic development. In view of the above, studies have shown that the ability of the stock market to play its role of accelerating economic growth has been punctuated by its vulnerability to distress in the system, insecurity, unfriendly business environment, weak institutional and regulatory framework, uneven supervision and enforcement, inadequate disclosure and transparency about the financial position of companies listed in the stock exchange, lack of investor and consumer sophistication (Sanisu,2012 and Kama, 2006). Also, the ugly trend of inaptitude behaviour of the authorities, high level of corruptions and massive pursuit of individual interest have always questioned the relevance of the stock market as a veritable tool to promote growth in the Nigerian economy (Manasseh et.al, 2012).There is no gainsaying of the fact that movement in share prices affect domestic credit and that of individual earnings which definitely affect investment pattern. The negative impact of share price movement on the total value of shares traded on the floor of the stock market demoralizes the investorôs interest. In the light of these, the researcher investigates the movement of share prices in the Nigerian stock exchange market using Markov chain

1.4 Objectives of the Study:

The broad objective of the study is to forecast the movement of share prices of the Nigeria stock exchange using Markov Chain. The specific objectives are as follows:

i.) To determine the movement of share prices in the Nigeria stock exchange.

ii.) To examine the effect of share price movement on economic growth in Nigeria.

iii.) To investigate the long run relationship between movement of share prices and economic growth in Nigeria.

1.5 Motivation for the Study

There have been several studies on share price movement in Nigeria such as Davou et al (2013) and (Afolabi and Dada (2014).To the best of the knowledge from the literature reviewed so far, many studies focused more on first-tier market of Nigerian stock exchange. In those studies, there was no inclusion of firms listed in the second tier market. Further, these studies made use of the daily closing price of shares in the stock market. In addition, emphasis was led more on transition probabilities of Markov chain, which enables the authors to forecast the intended share prices of the selected companies in future. Though, some studies (e.g. Eseoghene (2011) concluded that share prices of Nigerian stock market are stable while others are in support of the instability of the stock prices (e. g. Christian and Timothy (2014)). These findings may be misleading because; one may not draw a general conclusion by studying only one tier of a market. Furthermore, another departure from the existing literature lies on the investigation of the impact of share price movement on economic growth and as well, the examination of the long run relationship between share price movement and economic growth in Nigeria. Also, other studies (e. g) used closing price as a proxy for share prices while our study used All Share Index (ASI) which covered the price indices of all the listed companies in the stock exchange

1.6 Significance of the Study:

The outcome of this study will enhance the understanding of the relevance of stock market in Nigeria and enable the economic actors to explore the inherent opportunities created by the market. However it will extend the idea and as well change the perception of investors about the Nigerian stock market. Also, it equips investors with the knowledge of stock market in Nigeria and exposes the consequences of investing on volatile stock even though the prices of volatile stock are usually higher than the one with steady price. In addition, investors will find this work valuable as this will expose them to the operations of the stock market and awaken or arouse their curiosity to invest in the stock market in future.

1.7 Scope of the Study:

This study covered the monthly All Share Index (ASI) of the Nigerian stock exchange. To capture share price movement, the study used all share index from January 1985 to December 2013.

Chapter Two: Literature Review

2.1 Review of Relevant Literature:

In this section, some relevant theoretical and empirical studies were reviewed. The essence of the review of theory in this study is to enable us understand the postulate of different theories in share price movement and Markov chain. Firstly, the study discussed theories such as random walks, rational expectation and Markov chain theory as it relates the investorôs behaviour and predictability of future share prices. This is followed by the review of empirical studies in Nigeria and other emerging and developed economies.

2.1.1 Random Walk Theory:

The **random walk hypothesis** is a financial theory which states that stock market prices evolve according to a random walk and thus cannot be predicted. It is consistent with the efficient market hypothesis. The theory that stock prices move randomly was earlier proposed by Kendall (1953).The random walk theory is the occurrence of an event determined by a series of random movements - in other words, events that cannot be predicted. Applying the random walk theory to finance and stocks suggests that stock prices change randomly, making it impossible to predict stock prices. The random walk theory corresponds to the belief that markets are efficient, and that it is not possible to beat or predict the market because stock prices reflect all available information and the occurrence of new information is seemingly random as well. The random walk theory is in direct opposition to technical analysis, which contends that a stock's future price can be forecasted based on historical information through observing chart patterns and technical indicators. Academics cannot conclusively prove or agree on whether the stock market truly operates via a random walk or based on predictable trends because there are published studies that support both sides of the issue (Fama 1965)

2.1.2 Rational Expectation Theory:

The Rational Expectation Theory was propounded by Muth (1961). It asserts that the economy generally does not waste information and that expectations depend specifically on the structure of the entire system. Moreso, he stated that movement in asset prices affect the wealth of consumers and businesses. This has an important influence on the way people invest in shares expecting high returns. Rational expectation refers to investorôs expectation. Expectation is all about predictions of future events. Investors based their investment on their expectation or their knowledge of the future. The two major conclusions from studies of expectation are: That average expectations in an industry are more accurate than naive models and as accurate as elaborate systems, although there are considerable cross-sectional differences of opinion: That reported expectations generally underestimate the extent of changes that actually take place.

2.1.3 Markov Theory

Markov theory is seen to be relevant to the analysis of stock prices in two ways: As a useful tool for making probabilistic statements about future stock price levels and secondly as an extension of the random walk hypothesis. Markov theory is concerned with the transition of a system from one state to another. In the case of a sequence of observations on stock prices, the states of the system may be thought of as the set of all possible prices that might be observed for a given stock. Since the number of states so defined is virtually infinite, it is sometimes convenient to group prices into price ranges, or price classes. The security prices in question may be viewed as a Markov process that enables us answer certain questions concerning the future price level of a given stock.

2.2 The Review of Empirical Literature:

This section reviews the empirical studies of works done in Nigeria and other countries of the world. The researcher reviewed some of the empirical works done on the movement of share prices in the Nigerian stock market and some of those done in other parts of the world.

2.2.1 Review of studies in Nigeria:

The researcher reviewed some of the works done on the empirical study of the movement of share prices in the Nigerian stock market. It was discovered that some scholars argued that share prices are on the increase while some are of the opinion that share prices remain stable in the long run. Eseoghene (2011) studied the long run prospects of security prices in Nigeria. He examined five securities randomly selected from the banking sector of the Nigerian stock exchange for the period spanning January 2005 through June 2008. His findings suggested that the price levels are likely to remain relatively stable in the long run irrespective of the current price and global economic meltdown.

Uwalomwa *et al* (2012) examined the determinants of share prices in the Nigeria stock exchange market. They modelled the effects of financial performance, dividend payout and financial leverage on the share price of thirty listed firms operating on Nigerian stock exchange market for the period 2006 through 2010. They used regression analysis method. They found out that there is a significant positive relationship between firmôs financial performance and the market value of share prices of the listed firms in Nigerian stock exchange. This means that as the debt content in the capital structure of a firm decreases, its share prices rise and vice versa. They concluded that firmôs financial performance, dividend payouts and financial leverages are strong determinants of the market value of share prices in Nigeria.

Christian and Timothy (2014) examined the long run behavior of the closing prices of Nigerian bank stocks using Markov chain. Eight Nigerian banks were randomly selected and data on their daily closing prices between January 2004 through May,2013. The closing prices were classified into three states, rise, stable and drop. Their result indicated that despite the market situation, there is still hope for Nigerian banks as some of them tend to experience an increase in price in the long run as shown by the result of steady state probability. It was discovered that there is a disparity between Christian and Timothy (2014) and Eseoghene (2011). In Christian and Timothy (2014), the stock prices tend to rise while in Eseoghene (2011), the price tends to be stable.

Chukwu (2000) developed a stochastic bargaining model for a typical open market setting. His interest was on a market setting where pure competition prevails or exists. He developed a theory for the existence of an optimal policy and methods of determining when a customer

is to sell an article to maximize profit. He assumed that successive offers for a particular article by series of customers are independent random variables. He demonstrated that the point of agreement must always be above the cost price.

Manasseh *et al* (2012) investigated the Causality Effect of Stock Market Development, Financial Sector Reforms and Economic Growth in Nigeria: The Application of Vector Autoregressive and Error Correction Model. The study was designed to investigate the causal link between stock market development and economic growth in Nigerian. Time series econometric method of vector autoregressive (VAR) model of Sims (1980) and error correction model (VECM) was employed for the analysis. The study used quarterly time series data which covered the period 1981 Q1 to 2010 Q4. They discovered a bidirectional causality existing between stock market development and economic growth which suggest that economic growth and the market development promote each other. Furthermore, they equally argued that there is a bidirectional relationship between stock market and economic growth which show their interdependent. Their result also suggested a unidirectional relationship between financial sector and stock market development. Thus, they also investigated the influence of business environment and institutional/legal framework on stock market development.

Afolabi and Dada (2014) studied the roles, functions, rules and regulations of the capital market in share pricing. The paper examined the market capitalization effects on share prices while a negative relationship exist between share prices and inflation. The paper which is centered on trends of shares in Nigerian stock market between 1988 through 2011 showed that market capitalization and exchange rate are very good determinants of share price movement while inflation is not. Davou *et al* (2013) studied the Markov chain model application on share price movement in stock market. The Markov chain model was used to analyze and to make predictions on the three states that exist in stock price change which are share prices increase, decrease or remain unchanged. The two top banks used to illustrate are Guarantee Trust bank of Nigeria and First bank of Nigeria. The six years data used were obtained from 2005 to 2010. It was realized that regardless of a bank current share price, in the long run it could be predicted that its share price will depreciate with a certain probability, remain unchanged with a probability and appreciate with a certain probability. The probability of each of the two banks appreciating is on the increase, with GT bank taking the lead.

Manasseh et al (2014) studied Economic growth in Nigeria, an evidence from the appraisal of financial sector reforms and its casual effects. The study investigated the causal relationship between financial sector reforms and economic growth in Nigeria. The study also established the impact of financial sector reforms on economic growth to ascertain if financial sector reforms in Nigeria promote growth. However**,** from the findings, banking sector domestic credit and foreign direct investment are the major policy variables that can be adjusted for economic growth. Finally, the estimated regression results show that the explanatory variables accounted for approximately 63.45 percent variation in economic growth. Hence, financial sector reform promotes economic growth in Nigeria.

Akpan and Macaulay (2013) studied an empirical analysis of the impact of share pricing on the performance of the Nigerian stock market. The method of data analysis used in this study is the time series analysis and the multiple regression analysis technique. In order to examine and evaluate share prices and the performance of the Nigerian economy, the researcher concentrated on the regulatory and supervisory frame work, which is measured by; All share index, market capitalization, Gross Domestic product (GDP), pricing mechanisms and on site examination of trading activities in the Nigerian Stock Exchange (NSE). The study examined the activities of the Nigerian stock Exchange with respect to share price and the performance of the Nigerian economy between 1990 through 2013 by the use of notable stock market development indicators. The relationship between the values of shares traded on the Nigerian stock Exchange and its market capitalization was found to be positive. The result shows that within the period reviewed, there was an increase in the value of shares traded on the exchange but having less impact on the total output of the Nigeria economy.

2.2.2 Review of other studies:

Qing-xin (2014) studied the stock price of China sport industry and the theory of weighted Markov chain was applied to forecast the stock price. The historical data of the stock closing price was tested for Markov property. After testing that the stockôs price of China industry satisfies Markov property, state transition matrix was constructed using the data. The weighted values of every state were calculated with the method of weighted Markov chain theory and prediction intervals of the industryôs future stock prices were obtained. The stock closing prices of 70 weeks from February 2012 through June 2013 were used. The closing price in the 71st week was found to be consistent with the prediction block. Mettle *et al* (2014) studied the methodology for stochastic analysis of share prices as Markov chains with

finite states. They assumed that stock price fluctuations exhibit Markov dependence and time homogeneity. They specified a three state Markov process (i.e price decrease, no change and price increase.). They determined the mean return time for equity price increases and their respective limiting distributions using the generated state transition matrices. They replicated same in two states decrease and increase. They used the weekly historical data from Ghana stock exchange for selected stocks of five companies between January,2012 through December, 2013. The companies are Aluwork, Cal Bank, Ecobank Ghana, Ecobank Transnational incorporated and Fan Milk Ghana Limited. They discovered that equity with the highest state transition probability and least mean return time will remain the best choice for an investor.

Shuchi and Michael (2011) used Markov chain to predict the immediate future prices for Google. They found the moving average for the data and grouped them into four states. They found the difference between the closing price and the moving average. They used the difference between forecast prices and actual prices. They calculated the possible steady state or probability of the future of the difference prices. They applied moving average at three intervals, five intervals and ten intervals. By solving a system of equations, they found out that the steady state probabilities were virtually the same for all the three intervals. Otieno *et al* (2015) studied the application of Markov chain in modeling and forecasting stock market trend. They exemplified this in the study of Safaricom shares in Nairobi securities exchange, Kenya. The study was conducted through a longitudinal case study design. They obtained a secondary quantitative data on the daily closing share price of Safaricom from NSE website over a period covering 1st April, 2008 through 30th April, 2012 forming a 784 trading data panel. A Markov model was determined based on probability transition matrix and initial state vector. In the long run, irrespective of the current state of share price, the model predicted that the Safaricom share price would depreciate, remain stable or appreciate with probability 0.3, 0.1, and 0.5 respectively. This means that the company has a high percentage of share price appreciation.

Doubleday and Esunge (2011) studied the application of Markov chain to stock trends to Dow Jones Industrial Average (DJIA). They showed that a diverse portfolio of stocks will mirror the movements of the entire market. That is, the portfolio will show a great propensity to have small gains and losses and show probabilistic immunity to consecutive days of great loss and gain. Therefore, a portfolio of this nature will yield a slow steady growth as there are likely to be more days of gain than days of loss.

Adam and Sanni (2005) examined the role of stock market in Nigeriaôs economic growth using Granger-Causality test and regression analysis. The authors discovered one-way causality between GDP growth and market capitalization and a two-way causality between GDP growth and market turnover. They also observed a positive and significant relationship between GDP growth turnover ratios. The authors advised that government should encourage the development of the capital market since it has a positive relationship with economic growth. Obamiro (2005) investigated the role of the Nigerian stock market in the light of economic growth. The author reported a significant positive effect of stock market on economic growth. He suggested that government should create more enabling environment so as to increase the efficiency of the stock market, and to attain higher economic growth.

Osinubi and Amaghionyeodiwe (2003) also examined the relationship between the Nigerian stock market and economic growth during the period 1980-2000. Unfortunately, their results did not support the claim that stock market development promotes economic growth. Earlier, Nyong (1997) analyzed the relationship between capital market development and economic growth. The author used various indicators of stock market development (like market capitalization-GDP ratio, total value of transaction-GDP ratio, value of transaction-GDP and listings) to capture capital market development. He also included the degree of financial market depth in the growth model. The results revealed negative effect on economic growth of capital market development. Ezeoha *et al* (2009) investigated the natureof the relationship that exists between stock market development and the level of investment (domestic private investment and foreign private investment) flows in Nigeria. The authors discovered that stock market development promotes domestic private investment flows, thus suggesting the enhancement of the economyôs production capacity as well as promotion of the growth of national output. However, the results show that stock development has not been able to encourage the flow of foreign private investment in Nigeria. For other studies that confirmed the positive effect of stock market development to growth see, Atje and Jovanovic (1993), Demirguc-Kunt and Levine (1996), Aretis *et al* (2001), Mauro (2000), Rousseau and Wachtel (2000), Adjasi and Biekpe (2005), and Siliverstovs and Doung (2006).

Chapter Three: Methodology

Many researchers at various times have tried to model the movement of share prices with different statistical and economic method to forecast the movement of share prices in the stock market. Many of empirical studies on share price movement employ vector auto regression model and Markov chain. Some of these studies include Manasseh *et.al* (2012), Qing-Xin (2014), Mettle et.al (2014) and Shuchi *et.al* (2014). Furthermore, since the aim of this study lies on investigating the predictability of the future share prices of companies, the study therefore employ Markov chain transition probabilities method. This method will enable the researcher to forecast what the share prices of the companies may be in future. The essence is to ascertain if the share prices of the companies can be predicted or not. In addition, the study further investigates the impact of share price movement to economic growth, which is estimated using generalized linear regression model. This model is modified to capture the interest of the study. Further, the study also establishes the long run relationship between share price movement and economic growth. Finally, the methodology used for the evaluation of the study is discussed below:

3. 0 Share Price Movement and Economic Growth:

The stock market has become an indispensible part of financial market. The prosperity of every economy in recent time is partly dependent on the growth and development of the market. Stock market plays vital role in economic prosperity by fostering capital formation and sustaining economic growth in most economies across the world. Guglielmo *et al*. (2004) argue that the primary benefit of a stock market is that it constitutes a liquid trading and price determining mechanism for diverse range of financial instruments. This allow risk spreading by capital raisers and investors and matching of the maturity preferences of capital raisers (generally long-term) and investors (short- term).This in turn stimulates investment and lowers the cost of capital, contributing to the economic growth of a nation in the long term (Malaolu *et.al,* 2013). However, as reiterated by Udegbunam and Eriki, (2001), stock markets are more than a place to trade securities; they operate as facilitator between savers and users of capital by means of pooling of funds, sharing risk, and transferring wealth.

Stock markets are essential for economic growth as they ensure the flow of resources to the most productive investment opportunities. It is worthy of note that stock price all over the world including Nigeria is characterized by upward and downward movements. According to

work done by Meristem Securities Limited in 2008, the Nigerian stock market is described as a secular market driven by long period forces, resulting to prices of a particular stock or asset to rise or fall over a certain period. Consequently, high volatility of share prices in Nigeria has really affected the volume of shares traded and has raised many question on the contributions of the market to economic growth in Nigeria.

3.1 Markov Chain:

Markov chain is a random process that undergoes transitions from one state to another on a state space. Therefore a Markov chain is a collection of random variables (X_t), where the index t signifies different time periods. It is a stochastic process with the Markov property. The term "Markov chain" refers to the sequence of random variables, such a process moves through with the Markov property defining serial dependence only between adjacent periods. It can thus be used for describing systems that follow a chain of linked events, where what happens next depends only on the current state of the system. The Sequence of stochastic events is based on probabilities instead of certainties. In sequence of stochastic event, the current state of a variable or system is independent of all past states, except the current (present) state. Thus, this implies that the current movements of share prices and growth or decline in a firm's market shares is independent of all past share prices, except the present price or current price. However, this follow Random walks hypothesis. Hence, a sequence of random variables X_1, X_2, X_3, ..., X_n with the Markov property, can be illustrated below.

$$\Pr(X_{n+1} = x / X_1 = x_1, X_2 = x_2, X_3 = x_3, \ldots, X_n = x_n) = \Pr(X_{n+1} = x / X_n = x_n) \quad \text{- (1)}$$

$P\{X_{t-n} = j / X_t = i\} = P\{X_n = j / X_0 = i\}$ for all t = 0, 1, é é ----------(2)

Considering equations (1) and (2), the present state, future and the past are independent of each other. Therefore, the possible values of X_i form a countable set*s* which can be referred to as the state space of the chain in this study. The same information is represented by the transition matrix from time n to time $n+1$. However, Markov chains are frequently assumed to be time-homogeneous. in which case the graph and matrix are independent of n and so are not presented as sequences. (Hillier and Lieberman, 2001) .

3.1.1 Markov Chain One Step Transition Probabilities:

The one-step transition probabilities are said to be stationary if the conditional probability of an event given any past events and the present state is independent of the past events and depends only upon the present state. Thus, having **stationary transition probabilities** implies that the transition probabilities do not change over time. The existence of stationary (one-step) transition probabilities also implies that
A stochastic process $\{Xt\}$ is said to have the **Markovian property** if

$P\{X_{t-1}=j/X_0=k_0, X_1=k_1, \ldots, X_{t-1}=k_{t-1}, X_t=i\} = P\{X_{t+1}=j/X_t=i\}$, for i = 0, 1, . . . and every Sequence $i, j, k_0, k_1, \ldots, k_{t-1}$.

$P\{X_{t-n} = j/X_t = i\} = P\{X_n = j/X_0 = i\}$ for all t = 0, 1, é é ..

To simplify notation, assume that

$Pij = P\{X_{t+1} = j/X_t = i\}$,

$P_{ij}^{(n)} = P\{X_{t+n} \; j/X_t = i\}$.

The transition probability $p_{i,j}^{(n)}$ is called n-step transition probability. It is the conditional probability that the system will be in state *j* after exactly *n* steps (time units), given that it starts in state *i* at any time *t*. Note that $p_{i,j}^{(n)}$ are conditional probabilities, they must be non negative, and since the process must make a transition into some state, they must satisfy the properties

$P_{ij}^{n} \geq 0$ for all *i and j ;* n = 0, 1, 2, é .

$\sum P_{ij}^{n} = 1$ for all *i* ; n = 0, 1, 2é

A convenient way of showing all the *n*-step transition probabilities is the matrix Form $0,1,2,\ldots M$, Or, equivalently, the *n-step transition matrix*

$$\begin{array}{c} \text{State} \\ 0 \\ 1 \\ \vdots \\ M \end{array} \begin{array}{c} \begin{array}{cccc} 0 & 1 & \cdots & M \end{array} \\ \begin{bmatrix} p_{oo}^{(n)} & p_{o1}^{(n)} & \cdots & p_{oM}^{(n)} \\ p_{1o}^{(n)} & p_{11}^{(n)} & \cdots & p_{1M}^{(n)} \\ \cdots & \cdots & \cdots & \cdots \\ p_{M0}^{(n)} & p_{M1}^{(n)} & \cdots & p_{MM}^{(n)} \end{bmatrix} \end{array} \text{----------(3)}$$

Note that transition probability in a particular row and column is for the transition *from* the row *state* to the column state. When $n = 1$, we drop the superscript n and simply refer to this as the transition matrix. For $n = 0$, $P_{i,j}^{(0)}$ is just $P(X_o = j/X_o = i)$ and hence is 1 when $i = j$ and is 0 when $i \neq j$. The Markov chains to be considered in this chapter have the following properties and form:

(a) A finite number of states.

(b) Stationary transition probabilities.

The initial probabilities $P(X_o = i)$ for all 1, The (one-step) transition probabilities, i.e, the elements of the (one ï step) *transition matrix is*:

$$\begin{array}{c} \text{State} \quad 0 \quad\quad 1 \quad\quad 2 \quad\quad 3 \\ 0 \\ 1 \\ 2 \\ 3 \end{array} \begin{bmatrix} p_{oo} & p_{o1} & p_{o2} & p_{o3} \\ p_{10} & p_{11} & p_{12} & p_{13} \\ p_{20} & p_{21} & p_{22} & p_{23} \\ p_{30} & p_{31} & p_{32} & p_{33} \end{bmatrix} \text{----------} (4)$$

3.2 Chapman-Kolmogorov Equations:

The following Chapman- Kolmogorov equations provide a method for computing these *n*-step transition probabilities:

$$P_{ij}^{(n)} = \sum_{k=0}^{m} P_{ik}^{(m)} P_{kj}^{(n-m)} \qquad \text{For all } i = 0, 1, \text{é é M},$$

$$j = 0, 1, \text{é .M}, \qquad \text{é é é é é é é (5)}$$

$$\text{and any } m = 1, 2, \text{é ., n-1}$$

$$n = m+1, m+2, \text{é ..}$$

These equations point out that in going from state i to state j in n steps, the process will be in some state k after exactly m (less than n) states. Thus $p_{ik}^{(m)} p_{kj}^{(n-m)}$ is just the conditional probability that, given a starting point of state i, the process goes to state k after m steps and

then to state *j* in *n-m* steps. Therefore, summing these conditional probabilities over all possible *k* must yield $p_{ij}^{(n)}$.The special cases of *m*=1 and *m* = *n* -1 lead to the expressions

$$P_{I,J}^{(n)} = \sum_{k=0}^{m} P_{i,k} P_{k,j}^{(n-1)} \quad \text{----------} \quad (6)$$

and

$$P_{I,J}^{(n)} = \sum_{k=0}^{m} P_{i,k}^{(n-1)} P_{k,j} \quad \text{----------} \quad (7)$$

For all states *i* and *j*. These expressions enable the *n*- step transition probabilities to be obtained from the one-step transition probabilities recursively. This recursive relationship is best explained in matrix notation. For *n* = 2, these expressions become

$P_{i,j}^{(2)} = \sum_{k=0}^{m} P_{i,k} P_{k,j}$, for all states *i* and *j*, ---------- (8)

These equations also hold in a trivial sense when *m* = 0 or *m*=*n*, but *m* = 1, 2é , *n* ï 1 are the only interesting case. Where the $p_{ij}^{(n)}$ are the elements of a matrix $P^{(2)}$. Also note that these elements are obtained by multiplying the matrix of one transition probabilities by itself; i.e.,$P^{(2)} = P.P=P^2$.

In the same manner, the above expressions for $p_{ij}^{(n)}$ when m = n -1 indicate that the matrix of *n-step* transition probabilities is

$$P^{(n)} = PP^{(n-1)} = P^{(n-1)} P$$
$$= PP^{n-1} = P^{n-1} P$$
$$= P^n.$$

Thus, the *n*-step transition probability matrix P^n can be obtained by computing the *n*th power of the one-step transition matrix P**.**

3.3 Long- Run Properties of Markov Chains - Steady-state probabilities:

For any irreducible ergodic Markov chain

$\lim_{n\to\infty} P_{ij}^{(n)}$ exists and is independent of *i*. Furthermore,

$\lim_{n\to\infty} P_{ij}^{(n)} = \pi_j > 0$, Where the π_j uniquely satisfy the following steady-state equation

$$\pi_j = \sum_{i=0}^{m} \pi_i P_{ij} \quad , \quad \text{for j = 0, 1, é é M and } \sum_{j=0}^{m} \pi_i = 1 \quad \text{- - - - - - - - - - - - - - - - - - (9)}$$

The π_j ôs are called the steady-state probabilities of the Markov chain. The term *steady-state* means that the probability of finding the process in a certain state, say *j,* after a large number of transitions tends to the value π_j, independent of the probability distribution of the initial state. It is important to note that the steady-state probability does not imply that the process settles down into one state. On the contrary, the process continues to make transitions from one state to another and at any step *n,* the transition probability from state *i* to state *j* is still P_{ij}. The π_j can also be interpreted as stationary probability (not to be confused with stationary transition probabilities) in the following sense. If the initial probability of being in state *j* is given by π_j (that is, $P\{X_o = j\} = \pi_j$ for all *j*, then the probability of finding the process in state *j* at time *n* = 1, 2, é is also given by π_j (that is, $P\{X_n = j\} = \pi_j$).

Note that the steady- state equations consist of *M* + 2 equations in M + 1 unknown. Because it has a unique solution, at least one equation must be redundant and can, therefore, be deleted. It cannot be the equation

$$\sum_{j=0}^{m} \pi_j = 1,$$

because $\pi_j = 0$ for all *j* will satisfy the other *M* + 1 equations. Furthermore, the solutions to the other *M* + 1 steady-state equations have a unique solution up to a multiplicative constant, and it is the final equation that forces the solution to be a probability distribution.

The steady-state equations can be expressed as:

$\pi_1 = \pi_1 P_{00} + \pi_2 P_{01,}$

$\pi_2 = \pi_1 P_{10} + \pi_2 P_{11}$

$1 = \pi_{1,} + \pi_2$.

A Markov chain is defined as a Markov process with a discrete state space and a discrete set of time parameter. We also defined the Markov property as that which is possessed by a process whose future probability behaviour is uniquely determined solely by the present state of the system. That is, (X_n) is Markov

$P\{X_{t-1} = j / X_0 = k_0, X_1 = k_1, \ldots, X_{t-1} = k_{t-1}, X_t = i\}$

This gives

$= P\{X_{t+1} = j / X_t = i\}$, for i = 0, 1, . é . ---------- (10)

As a management tool, Markov analysis has been used as making decisions and for examining and predicting the behavior of customers in terms of their brand loyalty and their switching from one brand to another. Application of Markov analysis would not be fully completed in management without an extensive mathematical background.

3.4 Generalized linear regression model:

In statistics, the generalized linear model (GLM) is a flexible generalization of ordinary linear regression that allows for response variables that have error distribution models other than a normal distribution. The GLM generalizes linear regression related to the response variable through link function and by allowing the magnitude of the variance of each measurement to be a function of its predicted value. The advantage of this model is that it handles more complicated situations and analyzes the simultaneous effects of multiple variables, including mixtures of categorical and continuous variables. The structural form of the model describes the patterns of interactions and associations. The model parameters provide measures of strength of associations. The focus of the model is on estimating the model parameters. However, the objective is to model the expected value of a continuous variable *Y*, as a linear function of the continues predictor *X*, such that; $E(Y_t) = \beta_0 + \beta_1 X_t$.

The structural form of the model takes the following form;

$$Y_i = \beta_0 + \beta_1 X_i + e_t \quad (11)$$

Y is normally distributed, errors are normally distributed, $e_i \sim N(0, \mathring{u}^2)$, and independent, and *X* is fixed, and constant variance $\mathring{u}^2$. Therefore, Y_t is the vectors of economic growth measures and X_t is the vectors of stock market measures. To integrate these measures into the model, to enable us establish the impact of share price movement on economic growth, equation (11) is therefore transformed into equation (12) indicated below:

$$EGR_t = \beta_0 + \beta_1 SPM_t + \beta_2 CV_t + \varepsilon_t \quad (12)$$

Where EGR_t and SPM_t in the model, are vectors of economic growth measures and share price movement respectively, while CV_t are the measures of other control variables in the study. EGR_t is measured with gross domestic product growth rate ($GDPgr_t$). While SPM_t is proxied with all share index, CV_t controls for other variables such as market capitalization

(MC_t) as percentage of *GDP*, budget deficit ratio (BDR_t) and exchange rate (EXR_t). GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. β_0 and ε_t are the intercept and the error term respectively, while β_1 and $\beta_2$are the parameters that measures the coefficients of share price movement, market capitalization of companies listed on the exchange market.

Chapter Four: Presentation and Analysis of Results:

4.1 Diagnostic Tests: Pre and Post Estimation Tests:

The study discussed various diagnostic tests carried out on the data following the basic assumptions of ordinary least square (OLS). To test for the stationarity of the data sets, we employ the Augmented Dickey-Fuller for unit root test. The augmented Dickey-Fuller test addresses the issue of non stationarity by introducing lags of Δy_t as regressors in the test equation. However, the results for pre and post estimation tests are presented below

Table 4.1.1: Stationarity Tests Report Statistics:

Variables	Augmented Dickey Fuller	5% Critical Level		Remarks
		At Levels	First – Order	
GDPgr	**-4.085**	**-3.000**	**-**	**I~1(0)**
ASI	**-21.026**	**-3.000**	**-**	**I~1(0)**
MC	**-5.421**	**-**	**-3.000**	I~1(1)
BDR	**-7.936**	**-**	**-3.000**	I~1(1)
EXR	**-4.549**	**-**	**-3.750**	I~1(1)

From the above results, the exogenous variables are integrated of order one (i.e. I~1(1)) except all share index (ASI) that is integrated of order zero (I~1(0)). However, since the explanatory variables are integrated of different order with the endogenous variable (GDPgr), we suspected that the variables may not move together in the long run. To ascertain this claim, we conducted a unit root test on the generated residuals.

4.2 Testing for Cointegration:

Since one of the exogenous variables (i.e. ASI) is identified to be integrated of the same order with the endogenous variable as shown on table 4.1.1 above, it is possible that they may move together in the long run. This suggests that the variables may be related. Hence, to identify the actual influence of the individual variables on the endogenous variable, the suspected cointegration should be verified. Therefore, to investigate if actually the variables drift together in the long run, testing for cointegration becomes a necessary step to check if the variables in the model are meaningfully related or not. However, if the variables have different trends processes, they cannot stay in fixed long-run relation to each other, implying that we cannot model the long-run, and there is usually no valid base for inference based on standard distributions.

Table 4.1.2: Cointegration Tests Results:

H_0: The series does not have a unit root				
	Test Statistics	**1% Critical Value**	**5% Critical Value**	**10% Critical Value**
Z(t)	**-3.963**	**-3.750**	**-3.000**	**-2.630**
MacKinnon approximate p-value for Z(t) = 0.0016				

Before assessing the effect of share price movement on economic growth, other tests like post-estimation test such as heteroskedasticity, multicollinearity, specification autocorrelation and normality tests were carried out to ensure that the basic assumptions of ordinary least square (OLS) are satisfied. From the result, test statistic is greater than the critical value at 5%. This suggests that the variables move together in the long run.

Table 4.1.3: Heteroskedasticity, Autocorrelation, Multicollinearity and Normality Tests Results:

Heteroskedasticity Test: H_0: constant variance					
Cameron & Trivedi's decomposition of IM-test					
Source	**chi2**	**Df**	**p-value**		
Heteroskedasticity	20.48	14	0.1158		
Skewness	9.73	4	0.0452		
Kurtosis	1.44	1	0.2309		
Total	31.64	19	0.0343		
Multicollinearity Test: No linear relationship					
Variable	VIF		1/VIF		
BDR	**2.10**		**0.475192**		
EXR	**2.09**		**0.479082**		
MC	**1.50**		**0.666449**		
ASI	**1.21**		**0.826589**		
Mean VIF	**1.73**				
Autocorrelation Test: H_0: no serial correlation					
Durbin-Watson d-statistic(5, 24)		2.039179			
Normality Test: H_0: Distribution of Residual is Normal					
Jarque-Bera Skewness/Kurtosis:					
Variable	**Obs**	**Pr(Skewness)**	**Pr(Kurtosis)**	**Adj chi2(2)**	**Prob>chi2**
Residual	**24**	**0.2695**	**0.3075**	**2.51**	**0.2853**
Shapiro-Wilk test:					
Variable	**Obs**	**W**	**V**	**Z**	**Prob>z**
Residual	**24**	**0.94063**	**1.602**	**0.960**	**0.16845**

The presence of heteroschedasticity can invalidate statistical tests of significance which assume that the modeling errors are uncorrelated and uniform. Hence, while the ordinary least square estimator is unbiased in the presence of heteroschedasticity, it is inefficient because the true variance and covariance are underestimated. Therefore, to ascertain if the variables are homoschedastic, the study employ Whiteôs test by Cameron and Trivediôs decomposition.

However, since the overall p-value is less than 5% critical value (0.0343), we reject the null hypothesis of constant variance and accept the alternative. To resolve the problem of no constant variance in the model, we regress with either robust standard error or Newey-West HAC standard error. In addition, the study also investigates the presence of autocorrelation in the residual (prediction errors) from a regression analysis using Durbin-Watson (DW) tests. However, the results (DW=2.039179) shows no presence of autocorrelation.

There is presence of multicollinearity in a multiple regression model when two or more predictor variables are highly correlated. This implies that one variable can be linearly predicted from the other variables. In this situation, the coefficient estimates of multiple regressions may change erratically in response to small changes in the model. Though, multicollinearity does not reduce the predictive power and reliability of the model. Therefore, given the rule of thumb (VIF<10), the values of variance inflation factor (VIF) which quantify the severity of multicollinearity in ordinary least square regression analysis as shown on tables 4.1.2 are less than 10. This indicates that the variables are not linearly related.
Moreso, the study employs both Jarque-Bera Skewness/Kurtosis and Shapiro-Wilk W test to investigate if the residual is normally distributed. From the Jarque-Bera Skewness/Kurtosis test results, the residual is normally skewed with value 0.2695 while kurtosis and probability values are 0.3075 and 0.2853 respectively. Since the probability value is greater than 5%, it thus means that the residual is normally distributed. Following Shapiro-Wilk test, the results shows that the probability value (0.16845) is greater than 5%, confirming normality of the residual.

4.3 Share Price Movement and Economic Growth:

The stock market has become an indispensable part of financial market. The prosperity of every economy in recent time is partly dependent on the growth and development of the market. Stock market plays vital role in economic prosperity by fostering capital formation and sustaining economic growth in most economies across the world. Guglielmo *et al.* (2004) argued that the primary benefit of a stock market is that it constitutes a liquid trading and price determining mechanism for a diverse range of financial instruments. This allows risk spreading by capital raisers and investors and matching of the maturity preferences of capital raisers (generally long-term) and investors (short- term). This in turn stimulates investment and lowers the cost of capital, contributing to the economic growth of a nation in the long

term (Malaolu *et.al,* 2013). However, as reiterated by Udegbunam and Eriki, (2001), stock markets are more than a place to trade securities; they operate as facilitators between savers and users of capital by means of pooling of funds, sharing risk, and transferring wealth.

Stock markets are essential for economic growth as they ensure the flow of resources to the most productive investment opportunities. It is worthy to note that stock price all over the world including Nigeria is characterized by upward and downward movements. According to work done by Meristem Securities Limited in 2008, the Nigerian stock market is described as a secular market driven by long period forces, resulting to prices of a particular stock or asset to rise or fall over a certain period. Consequently, high volatility of share prices in Nigeria has really affected the volume of shares traded and has raised many question on the contributions of the market to economic growth in Nigeria. Therefore, this section discusses the effect of share price movement on economic growth in Nigeria using the estimated regression results shown on table 4.2 below.

Table 4.2: Estimated Results on Share Price Movement and Economic Growth:

Dependent Variable: Gross Domestic Product Growth Rate - GDPgr						
Variables	**Coef.**	**Robust Std. Err.**	**t-Stat**	**P>|t|**	**[95% Conf. Interval]**	
ASI	**.544475**	**.0948564**	**5.74**	**0.069**	**-.1298676**	**.2703916**
MC	**.5539639**	**.1225584**	**4.52**	**0.014**	**-.0727725**	**.4443788**
BDR	**-.0012527**	**.0010986**	**-1.14**	**0.270**	**-.0035705**	**.001065**
EXR	**-.0871632**	**.0488911**	**-1.78**	**0.092**	**-.015988**	**.1903144**
L1.resid	**-.3291654**	**.3409294**	**-0.97**	**0.348**	**-.3901327**	**1.048464**
_Cons	**-4.748378**	**4.041796**	**-1.17**	**0.256**	**-13.27582**	**3.779067**
F(5, 17)		**2.75**		**Prob > F**		**0.0435**
R-squared		**0.4024**		**Root MSE**		**5.977**

The estimated regression results on table 4.2 above shows the relationship between share price movement and economic growth in Nigeria. Share price movement proxies with all share index (*ASI*), which measures the overall behaviours of the common shares quoted on

the Nigerian Stock Exchange and the scope of price movements. It also, show the general market movement of all listed equities on the Exchange, including those listed on the Alternative Securities Market regardless of capitalization, calculated on a daily basis. Hence, economic growth is measured with gross domestic product growth rate (GDPgr). It is a measure of economic growth from one period to another in percentage terms. In other word, it measures the rate of change that a countryôs GDP goes through from one year to another in percentage terms. Therefore, the faster the growth of an economic, depend on how the GDP growth rate may be. From the results presented on table 4.2 above, R^2 (0.4024) shows the proportion of variance in the dependent variable that can be explained by the independent variables. This suggests that about 40% of the variability in GDP growth rate in Nigeria is accounted for by the variation in the explanatory variables. The regression model is statistically significant as indicated by F (5, 17) = 2.75 and Prob > F = 0.0435. This proves that the model applied can significantly predict GDP growth rate in Nigeria. The Root MSE (5.977) shows the standard deviation of the residual in our model, indicating that the model is absolutely fit to the data

In addition, the above results show that share price movement has a significant positive effect on GDP growth rate. In other word, an increase in share price movement leads to increase in GDP growth rate in Nigeria. This implies that a unit increase in share price movement result to 0.544475 increases in GDP growth rate (GDP*gr*) in Nigeria. The finding is inherent in the Nigeria stock exchange market, where every investor always aspires to make an abnormal profit by beating the market. The findings of this study is consistent with the works of Nurudum (2009), Adjasi and Biekpe (2005) and Obamiro (2005) among others. Contrary, the findings contradict the findings of Nyong (1997), and Osinubi and Amaghionyeodiwe (2003) etc. Furthermore, Market capitalization (*MC*) is found to be significant and positively related to *GDP* growth rate. This implies that a unit increase in market capitalization causes about 0.5539639 increases in *GDP* growth rate. However, the study also investigates if budget deficits ratio (*BDR*), which measures government deficit financing promote or discourages *GDP* growth rate (*GDPgr*). Hence, from the estimated results, the study observed an insignificant negative relationship between BDR and GDP growth rate in Nigeria. This suggests that as *BDR* increases, *GDP* growth rate decreases as well. Thus, a unit increase in *BDR* causes -0.0012527 decreases in GDP growth rate. Also, further investigation shows that exchange rate (*EXR*) has negative and insignificant relationship with GDP growth rate. This results presupposes that a unit increases in *EXR* is associated with -0.0871632 fall in GDP growth rate. The result from the error correction test (ECM = L1.resid) shows the rate at

which the series were corrected from disequilibrium in the short run. Hence, the findings evidence that about 32% of disequilibrium is corrected in the short run.

4.4 Presentation and Analysis of Results:

In the study of the methodology for stochastic analysis of share prices as Markov chains with finite states, Mettle et al (2014) discussed the increase and decrease of share prices in the stock market. In this study the researcher defines a decrease in All Share Index as state 0 and an increase as state 1. We assume that a decrease in the All Share Index is a failure and that an increase is a success. Consequently, we consider this as a Bernoulli distribution or Bernoulli trials of which the probability of a success or failure at each trial depends on the outcome of the precious trials. When the outcome at the nth trial is a failure, then the probability of a failure at the (n+1)th trial is 1ī Ŭand the probability of success at the (n+1)th trial is Ŭ. Similarly, when the outcome of the nth trial is a success, then the probability of a success at the (n+1)th trial is 1ī ɓ and the probability of a failure at the (n+1)th trial is ɓ. Put differently, if the system is in state 0 at time n then the probability of being in state 0 at n+1 is 1ī Ŭand the probability of being in state 1 at time n+1 is Ŭ. Furthermore, if the system is in state 1 at time n, then the probability of being in state 1 at n+1 is 1ī ɓ and the probability of being in state 0 at time n+1 is ɓ. These probabilities are called Transition Probabilities. This can be represented in a matrix form as follows

$$P = \begin{vmatrix} 1-\alpha & \alpha \\ \beta & 1-\beta \end{vmatrix} \qquad 0< Ŭ, ɓ<1$$

For a two-state Markov process

We define terms and set as

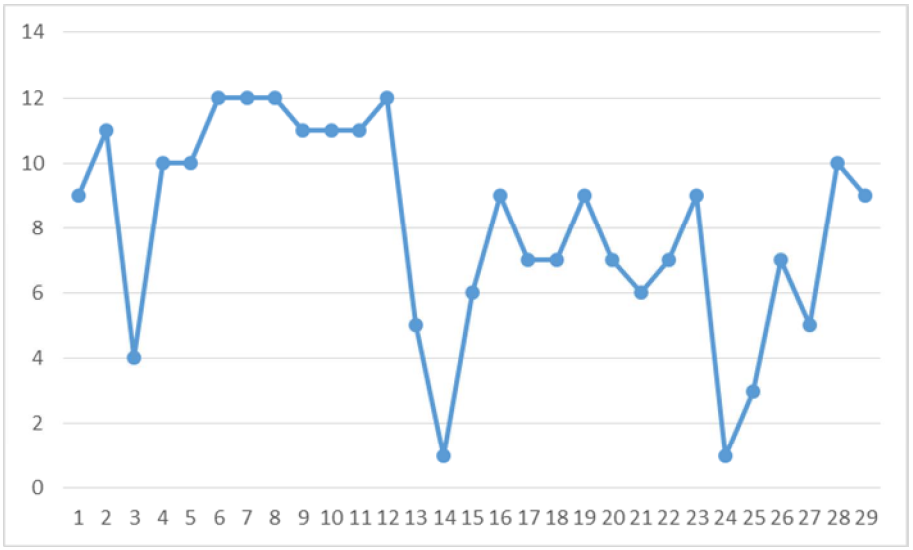
X = 0 if d_t Ò0 no increase in equity price from tī 1 to t

1 if $d_t > 0$ increase in equity price from time tī 1 to t

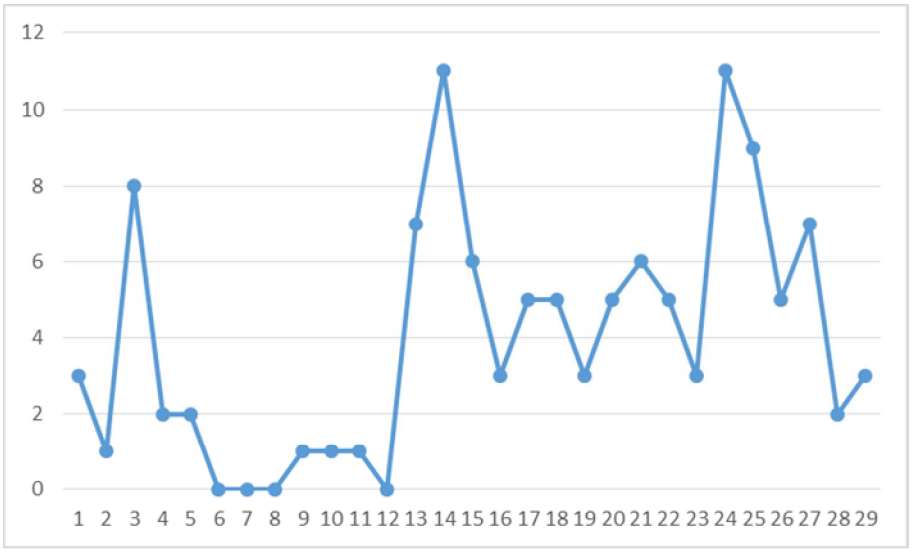
We obtain a two by two matrix

State	0	1
0	p_{oo}	p_{01}
1	p_{10}	p_{11}

Graph of the number of monthly increases in share prices



Graph of the number of monthly decreases in share prices



The Number of Monthly Share Price Movement of the Nigeria Stock Exchange (1985-2013).

	Decrease in share price (D)	Increase in share price (I)	
Decrease in share price (D)	68	47	115
Increase in share price (I)	48	185	233
	116	232	348

$$p = \begin{vmatrix} 0.591 & 0.409 \\ 0.206 & 0.794 \end{vmatrix}$$

From the above one step probability matrix, the researcher estimates the probability of increase in a month given that there was a decrease in all share index for twenty-nine years as 0.409. Further, the probability of a decrease given that there was an increase was also estimated to be 0.206. The probability of a decrease followed by a decrease is 0.591 and the probability of an increase followed by an increase is 0.794.

The model assumes exponential distribution. The length of decrease is given as α Ȧ$^{-\alpha t}$ and the length of an increase is given as ɓȦ$^{-ɓt}$. Considering the monthly All Share Index as the unit of time, the mean length of a decrease in all share index is $1/\alpha$ and the mean length of an increase in all share index is 1/ɓ. We denote the mean length or the Expectation of a decrease and increase in the all share index as E (D) and E (I) respectively. Therefore

E (D) = $1/\alpha$ = 1/0.409

=2.44499

= 3 months (aprox.).

E (I) = 1/ɓ = 1/0.206

= 4.85437

=5 monthly

We define a decrease instant in all share index as a month that starts with a decrease and an increase instant as a month that starts with an increase. A decrease instant can be represented by a d and an increase instant can be represented by an I.

$$d = \frac{\beta}{\alpha+\beta}$$

$$= 0.206/\ 0.409 + 0.206$$

$$= 0.335.$$

$$I = \frac{\alpha}{\alpha+\beta}$$

$$= 0.409/\ 0.409 + 0.206$$

$$= 0.665.$$

Considering the above result, the probability that a month starts with a decrease is 0.335 and the probability that a month starts as an increase is 0.665.

Moreso, we also found the difference probabilities and conditional probabilities of increase and decrease of stock prices. P (I) and P (D) are the probabilities for increase and decrease respectively. P (I/D), P (I/I), P (D/D) and P (D/I) are the conditional probabilities. (See Appendix.)

We can find the expectation of an increase in the All Share Index

α = 0.409

ɓ = 0.206

n = total number of months = 348

I_n = total number of monthly increases.

D_n = total number of monthly decreases.

P_1 (I) = probability of increase = 0.665

P_2 (D) = probability of decrease = 0.335

Therefore,

$$E(I_n) = n \times \frac{\alpha}{\alpha+\beta}$$

$$= 348 \times 0.409 / 0.206 + 0.409$$

= 142.332 / 0.615

= 231.434

E (I_n) = 231 increase in share prices

E (D) = n ï E (I_n)

=348 ï 231

= 117 decreases in share prices

Corollary

E (I_n) = np_1 = 348 x 0.665

= 231.42.

= 231

E (D) = np_2 = 348 x 0.335

= 116.58

= 117

To find the standard deviation of increase, we find the variance and then take the square root of the variance.

Var (I_n) = $n \alpha (б) (1 + (1 ï б) ï \alpha) / (1 ï (1 ï б) + \alpha)^3$

= 348 x 0.409 x 0.206 (1+ 0.385)/ (1 ï (0.794) +0.409)^3

= 40.60874292/0.232608375

= 174.579883119

Std Dev = ã174.579883119

= 13.2129

= 13

Moreso, we also found the difference probabilities and conditional probabilities of increase and decrease of stock prices. P (I) and P (D) are the probabilities for increase and decrease respectively. P (I/D), P (I/I), P (D/D) and P (D/I) are the conditional probabilities. (See Appendix.)

4.5 STEADY STATE TRANSITION PROBABILITIES

For the steady state probabilities

$$\pi_j = \sum_{i=0}^{m} \pi_i P_{ij} \quad , \quad \text{for j = 0, 1, é é M and } \sum_{j=0}^{m} \pi_i = 1$$

$$[\pi_1, \pi_2] \quad \begin{bmatrix} 0.591 & 0.409 \\ 0.206 & 0.794 \end{bmatrix}$$

$$\pi_1 = \pi_1(0.591) + \pi_2(0.206)$$
$$\pi_2 = \pi_1(0.409) + \pi_2(0.794)$$
$$\pi_1 + \pi_2 = 1$$

Solving these set of equations, we obtain the steady state probabilities.

$$(\pi_1 = 0.335, \pi_2 = 0.665)$$

We assume that row vector $P^{(n)} = P_0^{(n)}, P_1^{(n)}$. This is the probability of the system being in state 0 or 1 at time n. Having the initial probabilities of the two states given as P (o) = ($P_o^{(o)}$, $P_o^{(o)}$), we consider the event of being in state 0 at time n. The event can usually occur in two mutually exclusive ways, it is either that state 0 was occupied at time n-1, and there was no transition out of state 0 at time n. This occurs with probability $P_o^{(n-1)}(1 - \alpha)$. Conversely, state 1 can occur at time n-1 and there is transition from state 1 to state 0 at time n. Again, this happens with $P_1^{(n-1)}$ß.These considerations culminate to the following recurrent relations.

$P_o^{(n-1)} = P_o^{(n-1)}(1 - \alpha) + P_1^{(n-1)}$ß

$P_1^{(n)} = P_o^{(n-1)}\alpha + P_1^{(n-1)}(1 -$ ß)

To obtain the matrix form of the above equation, we have

$P^{(n)} = P_1^{(n-1)} P$

In solving the iteration, we have

$P^{(n)}=P^{(n-2)}P^2 = P^{(n-3)}P^3 =$ é é $= P^{(n-j)}P^j =$ é é $= P^{(o)}P^n$

Consequently, having known the initial probabilities and the transition probability matrix, the state transition probabilities at any time n can be deduced. The transition probability matrix is given as

$$p = \begin{vmatrix} 0.591 & 0.409 \\ 0.206 & 0.794 \end{vmatrix}$$

$$\text{pp} = \begin{bmatrix} 0.591 & 0.409 \\ 0.206 & 0.794 \end{bmatrix} \begin{bmatrix} 0.591 & 0.409 \\ 0.206 & 0.794 \end{bmatrix}$$

$$p^2 = \begin{bmatrix} 0.436 & 0.566 \\ 0.286 & 0.715 \end{bmatrix}$$

$$p^2 p^2 = \begin{bmatrix} 0.436 & 0.566 \\ 0.285 & 0.715 \end{bmatrix} \begin{bmatrix} 0.436 & 0.566 \\ 0.285 & 0.715 \end{bmatrix}$$

$$p^4 = \begin{bmatrix} 0.350 & 0.650 \\ 0.327 & 0.673 \end{bmatrix}$$

$$p^4 p^4 = \begin{bmatrix} 0.350 & 0.650 \\ 0.327 & 0.673 \end{bmatrix} \begin{bmatrix} 0.350 & 0.650 \\ 0.327 & 0.673 \end{bmatrix}$$

$$p^8 = \begin{bmatrix} 0.335 & 0.665 \\ 0.335 & 0.665 \end{bmatrix}$$

$$p^8 p^8 = \begin{bmatrix} 0.335 & 0.665 \\ 0.335 & 0.665 \end{bmatrix} \begin{bmatrix} 0.335 & 0.665 \\ 0.335 & 0.665 \end{bmatrix}$$

$$p^{16} = \begin{bmatrix} 0.335 & 0.665 \\ 0.335 & 0.665 \end{bmatrix}$$

This can be interpreted to mean that assuming that January 1985 had an increase in the share price, then the probability that January 2013 will have an increase is 0.665 and considering also that January 1985 had a decrease in the share price, then the probability that the share price of January 2013 will decrease is 0.335. Put differently, one can assert that there will 67percent and 33 percent assurance that there will be an increase and a decrease in the share prices respectively.

It can be observed that in the long run the state transition probabilities converge to a system of statistical equilibrium in which the state transition probabilities become independent of the initial conditions.

$$\begin{bmatrix} 0.5, & 0.5 \end{bmatrix} \begin{bmatrix} 0.335 & 0.665 \\ 0.335 & 0.665 \end{bmatrix}$$

$$= \begin{bmatrix} 0.335 & 0.665 \end{bmatrix}$$

CHAPTER FIVE

CONCLUSION AND SUGGESTIONS

5.1 Conclusion

The Markov Process provides a credible approach for successfully analyzing and predicting time series data which reflect Markov dependency. The probabilities α and ɓ were estimated from the data of Nigerian Stock Exchange. The expectation of the monthly increase of the share price index, E (I) was obtained as 5 months and the expectation of the monthly decrease E(D) was obtained as 3 months.

The steady state probabilities $´_1$ and $´_2$ were obtained as 0.335and 0.665 respectively and they are independent of the initial conditions. It can be observed from the data that as the years roll, the monthly share prices continue to increase as a result of an increase in the activities at the stock market. It was also observed that there is no stability in the share prices. This is as a result of the volatile nature of the stock market.

The estimated regression results on table 4.2 above shows the relationship between share price movement and economic growth in Nigeria. Share price movement proxies with all share index (*ASI*), which measures the overall behaviours of the common shares quoted on the Nigerian Stock Exchange and the scope of price movements. It also shows the general market movement of all listed equities on the Stock Exchange, including those listed on the Alternative Securities Market regardless of capitalization, calculated on a daily basis. Hence, economic growth is measured with gross domestic product growth rate (GDPgr). It is a measure of economic growth from one period to another in percentage terms.

5.2 Suggestions

Further research on this problem can be carried out by considering the movement of the daily or weekly share prices in the Nigerian stock exchange market. The use of Markov chain to determine the movement of share prices in the stock market will enable investors to make wise decisions in order to maximize their profit and minimize losses

REFERENCES

Adam, J. A and Sanni, I. (2005). Stock Market Development and Nigeriaôs Economic Growth. Journal of Economics and Allied Fields, Vol.2, pp. 116-132.

Adjasi, C. K. D., and Biekpe, N. B. (2005). Stock Market Development and Economic Growth. The Case of Selected African Countries. Working Paper, ADB.

Afolabi, Matthew B and Dada, Olusegun D (2014) Trends of Share Pricing in the Nigeria Stock Market. Research Journal of Finance and Accounting Vol. 5. No. 14

Akaninyere U Akpan and Kingsley Macaulay (2013). An Empirical Analysis of the Impact of Share Pricing on the Performance of the Nigerian Stock Market. International Journal of Economics, Business and Finance. Vol. 1 No. 8 pp189- 202.

Anvwar, B. and Philip, S. (1997). Quantitative Methods for Business Decision 14th Edition. International Thompson Business Press, Canada.

Aretis, P., Demetriades, P., and Luintel, K. (2001). Financial Development and Economic Growth: The Role of Stock Markets. Journal of Nigeria Money, Credit and Banking 33, pp. 16-41.

Atje, R., and Jovanovic, B. (1993). Stock Markets and Development. European Economic Review, pp. 632-640.

Christian Elendu Onwukwe and Timothy Kayode Samson (2014), On predicting the Long Run Behaviour of Nigerian Bank Stocks Prices: A Markov Chain Approach. American Journal of Applied Mathematics and Statistics Vol. 2 212-215.

Chukwu, W.I.E (2000). A Stochastic Bargaining Model in a Typical Open Market. Uniswa Research Journal Volume 14, (47-50).

Davou, Nyap Choji; Samuel Ngbede Eduno, Gokum Titus Kassem (2013). Markov Chain Model Application on Share Price Movement in Stock Market. Computer Engineering and Intelligent Systems Vol. 4 No.10

Demirguc-Kunt, A., and Levine, R. (1996). Stock Market and Financial Intermediaries: Stylized Facts. The World Bank Economic Review, Vol. 10, pp. 291-321.

Doubleday K. J and Esunge J. N (2011). Application of Markov Chains to Stock Trends Journal of Mathematics and Statistics 7 (2): 103-106

Eriki Peter O and IdolorEseoghene J (2010) The behavior of Stock Prices in the Nigerian Capital Market: A Markovian Analysis. Indian Journal of Economics and Business. Indian Journal of Economics and Business Audience Academy Dec.2010.

Eseoghene Joseph Idolor (2011) The Long Run Prospect of Stocks in the Nigerian Capital Market: A Markovian Analysis. Jorind (9)1 388-400

Ezeoha, A., Ebele, O., and Ndi Okereke, O. (2009). Stock Market Development and Private Investment Growth in Nigeria. Journal of Sustainable Development in Africa, Vol. 11, No. 2.

Fama, Eugene F. (1965). ñRandom Walks In Stock Market Pricesò. *Financial Analysts Journal* 21 (5): 55ï 59. doi:10.2469/faj.v21.n5.55. Retrieved 2008-03-21.

Hillier, F . S and Lieberman (2001) . Introduction to Operations Research. McGraw-Hill, New York, NY, 10020. Inc. 7th Edition

GuglielmoMariaC.,PeterG.A.Howells,and Alaa M.Soliman.(2004).StockMarketDevelopment and EconomicGrowth:TheCausalLinkage.JournalofEconomicDevelopment33(29).

John F. Muth (1961) Rational Expectations and the Theory of Price Movement. Econometrica. Journal of the Econometric Society. Vol. 29 no .3 vol. pp315- 335

Kama, U (2006). Recent Reforms in the Nigerian Banking Industry: Issues and Challenges. *CBN* Bullion 30 (3)

Kendall, M. G. (1953). The analysis of economic time-seriesð Part I: Prices, Journal of the Royal Statistical Society. Vol. 116(1), 11ï 25.

Malaolu, A. V; Ogbuabor, J. E.andOrji Anthony (2013),ò Determinants of Stock Price Movements in Nigeria: Evidence from Monetary Variablesò Journal of Economics and Sustainable Development. Vol.4,No.14.

Manasseh, Charles Osondu, Asogwa, Fredrick Onyebuchi; Agu, David Onyinyechi and Aneke, Gladys. C.Economic Growth in Nigeria: Evidence from the Appraisal of Financial Sector Reforms and its Causal Effects. *IOSR Journal Of Humanities And Social Science (IOSR-JHSS) Volume 19, Issue 5, Ver. II (May. 2014), PP 01-10*

Manasseh, Charles Osondu; Asogwa, Fredrick Onyebuchi; Agu, David Onyinyechi (2012).The Causality Effect of Stock Market Development, Financial Sector Reforms and Economic Growth in Nigeria: The Application of Vector Autoregressive and Error Correction Model. *Paper Presented at Global Development Finance Conference, 20-22 November 2012.*

Mauro, P. (2000). Stock Returns and Output Growth in Emerging and Advanced Economies. IMF Working Paper No. 89.

MeristemResearch(2008).StockMarketSentiments.MeristemSecuritiesLimited,124Norman Williams,IkoyiSouth/WestLagos,August15.

Mettle, Felix Okoe; Enoch Nii Boi Quaye and Ravenhill Adjetey Laryea (2014). A Methodology for Stochastic Analysis of Share Prices as Markov Chain with Finite States. Springer Plus.

Michael A.U (2004) How to Buy and Sell Shares in Nigeria. A Practical Guide. Lagos, Draft Trust Consult.

Milan Svoboda and Ladislav Lukáġ (2012). Application of Markov Chain Analysis to Trend Prediction of Stock Indices: Proceedings of 30th International Conference Mathematical Methods in Economics.

Muth, John. F. (1961) Rational Expectations and the Theory of Price Movement. Econometrica. Journal of the Econometric Society. Vol. 29 no .3 vol. pp315- 335

Nurudeen, Abu. (2009). ó Does Stock Market Development Raise Economic Growth: Evidence from Nigeriaô. The Review of Finance and Banking. Vol. 01, Issue 1, pp. 015-025.

Nyong, M. O. (1997). Capital Market Development and Long-run Economic Growth: Theory, Evidence and Analysis. First Bank Review, pp. 13-38.

Obamiro, J. K (2005). Nigeria Economy: Growth and the Role of Stock Market. Journal of Economic and Financial Studies Vol. 2 No. 2. Ojong, C.M, Ekpuk, A

Osinubi, T. S., and Amaghionyeodiwe, L. A. (2003). Stock Market Development and Long-run Growth in Nigeria. Journal of African Business, Vol. 4, No. 3, pp. 103-129.

Pongsit Twichpongtorn (2011) Information Theory and Stock Market. University of Illinois at Chicago

Qing-Xin Zhou (2014) Application of Weighted Markov Chain in Stock Price Forecasting. Advanced Science and Technology Letters Vol. 53 pp241- 244.

Rajan, R. G., and Zingalas, L. (1998). Financial Dependence and Growth. American Economic Review, 88, pp. 559-586.

Rousseau, P. and Wachtel, P. (2000). Equity Markets and Growth: Cross Country Evidence on Timing and Outcomes, 1980-1995. Journal of Banking and Finance, 24, pp.1933-1957.

Sanusi L. S. (2012). Banking Reform and its Impact on the Nigerian Economy. Being a Lecture delivered at the University of Warwickôs Economic Summit, UK. 17th February. Research Department, Abuja, CBN

Shushi S. Mitra and Michael J. Riggieri (2011) Predicting Stock Prices. MPP HS 3699

Siliverstovs, B., and Doung, M.H. (2006). On the Role of Stock Market for Real Economic Activity: Evidence for Europe. DIW Berlin Discussion Paper No. 599.

Otieno, Simeyo; Dr. Edgar O Uko Otumba and Robert Nyamao Nyabwanga. (2015). Application of Markov to Model and Forecast Stock Market Trend. A study of Safaricon Shares in Nairobi Securities Exchange, Kenya. International Journal of Current Search Vol. 7 pp14712 ï 14721.

Sims, Christopher .A (1980). ñMacroeconomics and Realityò. Econometrica **48** (1): 1ï48. JSTOR

Udegbunam, R.I., and P. O. Eriki. (2001). Inflation and Stock Price Behavior: Evidence from Nigerian Stock Market. *Journal of Financial Management & Analysis*, XX (14).

Uwalomwa Uwuigbe, Olowe Olusegun and Agu Godswill (2012) An Assessment of the Determinants of share Price in Nigeria: A Study of Selected Listed Firms. ACTA Universitatis Danubius (Economica Vol. 8 No. 6)

Yadirichukwu, E and Ogochukwu O.J (2014) Evaluation of the weak form of Efficient Market Hypothesis: Empirical Evidence from Nigeria. International Journal of Development and Sustainability Vol. 3 No. 5 pp1199-1244.

APPENDIX

Summary statistics on the monthly trading price change over the study period 1985-2013.

NUMBER OF MONTHLY PRICE CHANGE

YEAR	INCREASE	DECREASE
1985	9	3
1986	11	1
1987	4	8
1988	10	2
1989	10	2
1990	12	-
1991	12	-
1992	12	-
1993	11	1
1994	11	1
1995	11	1
1996	12	-
1997	5	7
1998	1	11
1999	6	6
2000	9	3
2001	7	5
2002	7	5
2003	9	3
2004	7	5
2005	6	6
2006	7	5
2007	9	3
2008	1	11
2009	3	9
2010	7	5
2011	5	7
2012	10	2
2013	9	3
TOTAL	233	115

Table

All Share Index on the Nigerian Stock Exchange

YEAR	JAN	FEB	MAR	APR	MAY	JUN.	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
1985	111.3	112.2	113.4	115.6	116.5	116.3	117.2	117.0	116.9	119.1	124.6	127.3
1986	134.6	139.7	140.8	146.2	144.2	147.4	150.9	151.0	155.0	160.9	163.3	163.8
1987	166.9	166.2	161.7	157.5	154.2	196.1	193.4	193.0	194.9	154.8	193.4	190.9
1988	190.8	191.4	195.5	200.1	199.2	206.0	211.5	217.6	224.1	228.5	231.4	233.6
1989	239.7	251.0	256.9	257.5	257.1	259.2	269.2	281.0	279.9	298.4	311.2	325.3
1990	343.0	349.3	356.0	362.0	382.3	417.4	445.4	463.6	468.2	480.3	502.6	513.8
1991	528.7	557.0	601.0	625.0	649.0	651.8	688.0	712.1	737.3	757.5	769.0	783.0
1992	794.0	810.7	839.1	844.0	860.5	870.8	879.7	969.3	1022.0	1076.5	1098.0	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	1956.0	2023.4	2119.3	2205.0
1995	2285.3	2379.8	2551.1	2785.5	3100.8	3586.5	4314.3	4664.6	4858.1	5068.0	5095.2	5092.2
1996	5135.6	5180.4	5266.2	5412.4	5704.1	5798.7	5919.4	6141.0	6501.9	6634.8	6775.6	6992.1
1997	7268.3	7699.3	8561.4	8729.8	8592.3	8459.3	8148.8	7682.0	7130.8	6554.8	6395.8	6440.5
1998	6435.6	6426.2	6298.5	6113.9	6033.9	5892.1	5817.0	5795.7	5697.7	5671.0	5688.2	5672.7
1999	5494.8	5376.5	5456.2	5315.7	5315.7	5977.9	4964.4	4946.2	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**	**8111.0**
2001	8794.2	9180.5	9159.8	9591.6	10153.8	10937.3	10576.4	10329.0	10274.2	11091.4	11169.6	10963.1
2002	10650.0	10581.9	11214.4	11399.1	11486.7	12440.7	12458.2	12327.9	11811.6	11451.5	11622.7	12137.7
2003	13298.8	13668.8	13531.1	13488.0	14086.3	14565.5	13962.0	15426.0	16500.5	18743.5	19319.3	20128.9
2004	22712.9	24797.4	22896.4	25793.0	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	21911.0	22935.4	24635.9	25873.8	24355.9	24085.8
2006	23679.4	23843.0	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	47124.0	49930.2	51330.5	53021.7	50291.1	50229.0	50201.8	54189.9	57990.2
2008	54189.9	65652.4	63016.6	59440.9	58929.0	55949.0	53110.9	47789.2	46216.1	36325.9	33025.8	31450.8
2009	21813.8	23377.1	19851.9	21491.1	29700.2	26861.6	25286.6	23009.1	22065.0	21804.7	21010.3	20827.2
2010	22594.9	22985.0	25966.3	26453.2	26183.2	25384.1	25844.2	24268.2	23050.6	25042.2	24764.7	24770.5
2011	26830.7	26016.8	24621.2	25041.7	25866.6	24980.2	23827.0	21497.6	20373.0	20935.0	20003.4	20730.6
2012	20875.8	20123.5	20652.5	22045.7	22066.4	21599.6	23061.4	23750.8	26011.6	26430.9	26494.4	28078.8
2013	31853.2	33075.1	33536.3	33440.6	37794.8	36164.3	37914.3	36248.5	36585.1	37622.7	38920.9	41329.2

Source: Nigerian Stock Exchange

Note: All Share Index started in January 1985 - December 2013

PROBABILITY OF ALL THE MONTHLY SHARE PRICES

MONTH	NUMBER	$P^1(I)$	$P^1(D)$	$P^1(I/D)$	$P^1(I/I)$	$P^1(D/D)$	$P^1(D/I)$
JANUARY	29	N=25 P=0.862	N=4 P=0.138	N=3 P=0.104	N=21 P=0.724	N=1 P=0.035	N=3 P=0.104
FEBRUARY	29	N=23 P=0.793	N=6 P=0.207	N=4 P=0.138	N=18 P=0.621	N=2 P=0.069	N=3 P=0.104
MARCH	29	N=23 P=0.793	N=6 P=0.207	N=3 P=0.104	N=18 P=0.621	N=2 P=0.069	N=4 P=0.138
APRIL	29	N=23 P=0.793	N=6 P=0.207	N=4 P=0.138	N=17 P=0.586	N=2 P=0.069	N=4 P=0.138
MAY	29	N=22 P=0.759	N=7 P=0.241	N=3 P=0.104	N=18 P=0.621	N=4 0.138	N=3 P=0.104
JUNE	29	N=23 P=0.793	N=6 P=0.2-7	N=3 P=0.104	N=19 P=0.655	N=3 P=0.104	N=3 P=0.104
JULY	29	N=23 P=0.793	N=6 P=0.207	N=4 P=0.138	N=18 P=0.621	N=2 P=0.069	N=4 P=0.138
AUGUST	2-	N=23 P=0.793	N=6 P=0.207	N=4 P=0.138	N=17 P=0.586	N=3 P=0.104	N=4 P=0.138
SEPTEMBER	29	N=24 P=0.828	N=5 P=0.172	N=3 P=0.104	N=19 P=0.655	P=0.069	N=3 P=0.104
OCTOBER	29	N=23 P=0.793	N=6 P=0.207	N=3 P=0.104	N=19 P=0.655	N=3 P=0.104	N=3 P=0.104
NOVEMBER	29	N=23 P=0.793	N=6 P=0.207	N=3 P=0.104	N=19 P=0.655	N=3 P=0.104	N=3 P=0.104
DECEMBER	29	N=23 P=0.793	N=6 P=0.207	N=3 P=0.104	N=19 P=0.655	N=3 P=0.104	N=3 P=0.104

Year	GDPgr	ASI	Mc	BDR	EXR
1990	12.8	258.3230016	7.1	131	21.9
1991	-0.6	4.120598128	10.2	142	21.5
1992	0.4	5.687437916	10.2	153	30.8
1993	2.1	7.35419476	9	174	39.2
1994	0.9	11.345072	8.2	177	46.4
1995	-0.3	22.69271289	7.1	181	21.9
1996	5	33.7370749	10.2	183	21.5
1997	2.8	42.09456114	10.2	182	30.8
1998	2.7	31.28737495	9	186	39.2
1999	0.5	28.10949774	8.2	194	46.4
2000	5.3	2.830366326	9.1	195	10
2001	4.4	4.087773078	12.2	194	19.3
2002	3.8	4.651146726	9.7	195	19.5
2003	10.4	5.525632558	14	200	21.2
2004	33.7	6.606182746	16.5	207	11.7
2005	3.4	5.842507497	17.2	214	8.6
2006	8.2	6.609711484	22.6	202	4.9
2007	6.8	10.77549499	51.9	212	19.2
2008	6.3	10.48302555	23.9	213	26.6
2009	6.9	4.488330114	19.7	214	37.1
2010	7.8	4.466537226	13.8	215	18.8
2011	4.9	4.02088492	9.5	196	22.1
2012	4.3	3.862303833	12.2	192	20.8
2013	5.4	6.463458007	28.92	200	21.9