SHARE PRICE BEHAVIOURS IN NIGERIAN STOCK MARKET: AN EMPIRICAL TEST OF THE RANDOM WALK HYPOTHESIS

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D E D I C A T I O N

TO

My Father, Mr. Nathaniel Orinya Ogaba
and
My Mother, Mrs. Janet Enadah Ogaba
with great thanks
for so many years of love and care.

DECLARATION

The idea generation, conduct of the research and presentation of this project report are my personal efforts. It has never before at any time been presented wholly in this form by any individual or group in any institution for any purpose whatsoever. Materials and other works which have been used in this study, but not my original ideas, have been clearly and appropriately acknowledged to the credits of the respective authors.

..J.O.Orinya.....29/8/94

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CERTIFICATION

This project report entitled SHARE PRICE BEHAVIOURS IN NIGERIAN STOCK MARKET: AN EMPIRICAL TEST OF THE RANDOM WALK HYPOTHESIS by ORINYA JOHN OGBU (G92BAF7072) meets the regulations governing the award of the Degree of MASTERS IN BUSINESS ADMINISTRATION of Ahmadu Bello University, Zaria, and is approved for its contribution to knowledge and literary presentation.

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A B S T R A C T

Several theories, representing professional schools of thought, have been developed to explain the stochastic processes underlying security price behaviours in Stock Markets. These schools differ in approach and are not agreed in their conclusions. Although no one of them has been accepted as conclusive, the random walk model represents profound Interest and impact among financial analysts. The model maintains that highly competitive and organized markets create prices which accurately reflect all current information. In effect, price changes will assimilate new Information and thus approximate a random walk.

If this theory is valid, past prices provide no information useful in estimating future prices. The next price change is independent of all past moves. Acceptance of this model has been based on empirical evidence provided by studies of the industrialized markets, particularly those of the United States. Studies of non-U.s. markets present evidence that do not altogether refute or support the theory. The present study focused on share price behaviours in the Nigerian stock market.

The purpose of the study is to test the simple random walk hypothesis that successive price changes are independent and to view the results of its application to the behaviours of ordinary share prices in the Nigerian Stock Market. The results obtained show that though these prices move according to some discernible patterns, there is small dependence in successive changes within the period covered by the study. It is concluded therefore, that the random walk model is probably a valid description of stock price behaviours in the Nigerian Stock Market.

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CHAPTER ONE
I N T R O D U C T I O N

1.1 PREVIEW

Academicians and financial analysts have devoted a great deal of time and effort to the study of price behaviours in both commodity and financial markets, the later being of primary interest. Early studies centred on equity securities and utilized data from the developed markets of the West. From these studies three Orthodox Schools of thought concerning security valuation and the behaviours of security prices have emerged. These are technical analysis school, fundamental analysis school and efficient market school.

The technical analysis school maintain that share prices have "memory" and fluctuate according to a discernible pattern. That is the technicians believe that future price movements can be predicted fairly accurately by observing historical and volume data. They assert that this cannot only be done but also that investors can exploit the information to improve their performance. The fundamental analysis school argues that a security's price fluctuates around its intrinsic value. This value is theoretically equal to the capitalized value of the future stream of income from that security. Prices of individual securities, therefore, vary with variations in these basic factors which themselves are subject to new information. Thus, the fundamentalists attempt to estimate the true value of assets by examining significant economic and financial facts so as to design appropriate investment strategies.

The third school of thought had been a revolution. To the consternation of believers in both technical and fundamental approaches, the theory of efficient markets (EMH) is diametrically in opposition. The EMH maintains that current prices reflect all information about that security and are

affected only by unpredictable news, for old news is already discounted. Each price change, the theory posits, follows a "random walk" and is independent of its predecessor. Therefore, it is impossible to at any moment predict what prices will be a moment later. This theory has since been the subject of an interesting and highly provocative debate, trascending simple academic dissent.

Empirical tests of the EMH on data obtained from the United States (US) stock markets largely support the independence assumption of the theory (Moore (1964); Cootner (1962); King (1966); and Fama (1985). This success encouraged other researchers to investigate non-U.S. markets. However, results are less decisive either in disproving the EMH or in accepting it as a valid description of price behaviours in those markets (Nichols (1993). Whereas Niarchos (1972), Dryden (1970), and Rao and Makharjee (1971) found little evidence contrary to the EMH, the studies of Dryden (1970ii) and Conard and Juttner (1973) provide evidence refuting the theory. Lately, even the U.S. markets have become the subject of serious crisis among critics. As Ridley (1993) explained, "the efficient marketeers went too far and a reaction was inevitable" p. 7. These reactions have culminated in a new development variously called mathematics of the markets frontiers of finance, or beating the market.

The object of these renewed efforts is to discover anomalies in an otherwise efficient market that can be exploited to consistently make "excess returns". Ridley (1993) listed four important developments which encouraged the revisionists to condemn the EMH. These are (1) empirical proof that persistent predictability exists in financial markets; (2) growing evidence that a set of new mathematical techniques can discover this predictability; (3) sophistication in computer technology to make this feasible, and (4) availability of a way to keep the trick working (Ridley, 1993) p. 6. Notwithstanding, the argument is still far from settled.

Acdemicians are trying to reconcile the EMH with available evidence of inefficiencies. While not discounting the fact that no market is perfectly efficient and that there are ways to beat the market, the mediators argue that there is no such thing as free lunch. Making really big money requires really hard work and assuming rather more risk. An investor who invests in an asset and later sells that asset at a price in excess of the cost, has not necessarily beaten the market. The residual of a supposed excess return could be a reward of hedging. And the money could have been invested in a safe deposit at moderate returns. Furthermore, for every successful fool there is always an unlucky fool who unfortunately does not talk. Stevenson (1993) reports evidence of these in the performance of index funds. This underscores an important caveat: a fool and his money are quickly parted.

Obviously, this debate presents interesting reading and serves as an important challenge for us to examine the Nigerian market. That is a major motivator for the present study.

1.2 STATEMENT OF THE PROBLEM

There are three forms of the EMH: Strong form, Semi-strong form, and weak form (Lorie and Brealay, 1972). Strong efficiency means that all information-published or not - is reflected in prices. This means that it is impossible to predict the future price of a security from any information at all. By implication, even those who have access to privileged information cannot consistently make use of it to earn above average returns. The semistrong form says that it is impossible to predict the future price of a security on the basis of publicly available fundamental data. This implies that current security prices reflect all publicly available informantion about the security only unpredictable news can cause a change in the prices. Until recently (Lorie and Hamilton, 1973), both these forms of the EMH have been tested indirectly by accumulating contrary evidence.

The third form of the EMH has been called the random walk hypothesis (RMH). It seeks to determine whether a security's future price can be predicted from its past prices. It says that in a market that assimilates information efficiently, it is impossible to predict the future price of a security from its past price. The current price already reflect all information implied by previous movements of the price. This means that a series of stock price changes has no memory and the past history of the series cannot be used to predict the future meaningfully. Is this true of the Nigerian stock market? Does the Nigerian stock exchange (NSE) assimilate information efficiently. Do prices of securities traded on the exchange follow a random walk? In other words, do prices of securities traded in the market behave as if each price change is unaffected by its predecessor?

These are pertinent questions that cannot be disposed off in brief note. Attempt to answer these questions may vary, but conclusions on the behaviours of stock prices in the Nigerian stock market is informed by empirical evidence. Quantitative data on the Nigerian stock market can be obtained with a little effort. Little serious attempt has been made by academicians to study price behaviours in the NSE. The present study is not only an academic endeavour in that regard, but also an attempt to provide investors with important information for their investment decisions. Thus, the study attempts to determine the pattern (or patterns) of security price behaviours in the NSE. The aim is to decide whether the market is weakly efficient by testing the random walk hypothesis.

Strictly, the RWH includes a certain probability distribution (Fama, 1965). The particular shape of this distribution is however not defined. Given this vagueness, this aspect of the hypothesis will not be examined in the present study. The part of the RWH to be tested in this study will be stated as follows: successive changes in the prices of equity shares traded in the NSE are independent.

1.3 OBJECTIVES OF THE STUDY

The purpose of this study is to determine the pattern of share price behaviours in the Nigerian stockmarket. The study involves an empirical test of the random walk hypothesis concerning security price behaviours. The attempt is to examine the price data of equity shares quoted on the Nigerian stock market. The object is to find out whether the market is efficient. If the empirical evidence obtained from the NSE supports the RWH, as stated above, it is proof enough that the market is efficient.

It is hoped that the study will thus provide empirical evidence about the stochastic processes underlying the behaviours of equity shares in the Nigerian stock market.

1.4 SCOPE OF THE STUDY

This study would cover only equity shares listed in the NSE. Equity shares are the ordinary shares of a company which carry a voting power and a right to residual profits of the company. The weekly price data of these shares will be examined. Price refers to the quoted prices published in in the NSE Daily Official List. Distintion will not be made between bid and offer prices. By a serial correlation analysis it would be possible to test the randomness of fluctuations in the prices. This test has been found appropriate for testing the random walk hypothesis.

The central theme of the study is the behaviours of securty prices in stock markets. It concentrates on the weekly average changes in successive prices of selected listed equity shares. The study accepts that there are other approaches used by other researchers to test the same hypothesis. But this approach is most feasible in the present circumstances.

The study covers the period from 1991 to 1993. These years witnessed increased volume of activities in the financial markets in the history of Nigerian economy. They fall within the period of the structural adjustment programme, which involves the privatisation and commercialisation exercises

and deregulation policies. As such it is possible that the volume of supply of securities in the market caused by this factors may affect the behaviour of prices within the period.

1.5 SIGNIFICANCE OF THE STUDY

This study is important for a number of reasons, particularly for the objectives already stated. Primarily, the study will make great contribution to any existing knowledge about the behaviour of security prices in the Nigerian Stock market. Results of the study can provide a basis for more comprehensive work. This will generate further reactions, thereby creating a data base for the benefit of both investors and investigators.

Furthermore, the study is an exciting and challenging academic exercise. What the experience will contribute to the researcher's future endeavours cannot be expressed in just a few words. It is hoped that success of the study will not only bolster the confidence of the researcher, but also equip him with a wealth of profitable knowledge and skills.

It must also be mentioned that clear understanding of the underlying patterns of stock price behaviours is essential for appropriate investment decisions. For instances if it is known that prices follow dissernible trends, an investor can profit from the discovery. An investor who discovers that at certain times of the year and on certain days of the week prices predictably rise or fall, would do better than one who just follow the crowd. On the other hand, if prices are known to follow a random walk, the investor may be compensated for not being unduely speculative. This study is an attempt to provide such fundamental information.

1.6 PLAN OF THE STUDY

This study is organised into five chapters, chapter one provides the general basis for the whole study. It is the introductory chapter. Literature review will be comprised in chapter two. It provides the theoretical framework that is

important for the empirical analysis. The chapter is necessary for the understanding of the approaches followed by this study and the methodology used in testing the hypothesis. The research procedures and analytical techniques used are described in chapter three. The sampling procedure is well explained in the chapter. In chapter four, the empirical results and test of the basic hypothesis are presented. The summary, conclusion and recommendations of the study are contained in the last chapter.

1.7 SUMMARY

Basically, this study is aimed at determining the patterns of share price behaviours in the Nigerian stock market. The works of various researchers have led to the emergence of three traditional schools of thought concerning the behaviours of security prices. The technicians maintain that future prices of securities can be predicted by discovering the underlying trend in past movements. The fundamentalists argue that prices fluctuate around an intrinsic value and attempt to fix this value by analysing fundamental economic facts. Directly opposed to these views, the efficient marketers say that prices follow a random walk and the future cannot be predicted from the past. Reactions to these theories caused the development of novel models claiming the possibility of beating the market. The next chapter will provide detailed discussion of these theories.

In attempt to determine the patterns of price behaviours in the Nigerian stock market, data on ten randomly selected equity shares will be observed for a period of three years. Serial correlation analysis will be applied. Results will then be used to make appropriate conclusion regarding the validity of the random walk hypothesis in the Nigerian context.

This study is not only significant as an academic exercise but also for the invaluable information it will provide other investigators and investors interested in the stock market.

CHAPTER TWO
LITERATURE REVIEW

2.1 INTRODUCTION

The review of literature is an important aspect of any informed study of a problem. The aim of the survey is principally for the researcher to gain an in depth knowledge of the problem in question. This will not only provide reasons for cont inuing the research but will help in the design of appropriate procedures for collecting and analysing necessary data. Various important data sources, including basic texts and books, journals, other publications, lecture handouts, and notes are being examined carefully as part of the attempt to achieve the objectives of this study.

In chapter one an indication of the findings from these sources was made. This present chapter is more detailed and extensive in the coverage. From a macro perspective the discussion continues into an examination of various theories relating to securities price behaviours.

2.2 THE NIGERIAN STOCK EXCHANGE

2.2.1 History

Formal attempt to establish a stock market in Nigeria began in May, 1958 with the formation of the Barback Committee (Alile, 1986). The mission of the committee was to assess the feasibility of "fostering a shares market in Nigeria "(Ibid, p.20). Among others, the committee recommended the creation of facilities for dealing in shares within prescribed regulations, as well as strategies for encouraging savings and securities issue. This report, coupled with an experience of the Central Bank of Nigeria (CBN) in 1959, led to the establishment of the Lagos stock exchange (LSE) in 1960.

In December, 1977 the LSE became known as the Nigerian stock exchange (NSE). Since then, the Exchange has expanded and five more

branches have been opened in Kaduna (1978), Port Harcourt (1980), Kano (1989), Onitsha (1990) and Ibadan (1990). From a low of only 19 securities traded initially on the floors of the LSE, nearly 300 securities are currently quoted on the NSE. These securities are made up of Federal, State, and Local Government stocks, Corporate and Industrial Debentures and preference stocks, and equity shares. Most of the quoted companies have branches abroad and cover various sectors of the economy. As at end of 1993, the NSE daily official list contains 157 equity shares listed in the first-tier and 23 in the second-tier markets.

2.2.2 Structure of the Exchange

The NSE forms the secondary market within the Nigerian Capital Market. However, it is also involved in the primary market which deals with new issues of capital assets.

New capital issues can be raised through one of four methods. These are offer for subscription, offer for sale, rights issues, and private placement. Offer for subscription involves a sale of the security to investors by the issuing company or government. An offer for sale is usually made by an existing holder of the security to the public. the proceeds of the sale accrue to the individual seller. Most operations of the Technical committees on privatisation and commercialisation (TCPC) are offers for sale, since it is the Government - a share- holder - who is selling the shares and not the companies involved. Rights issues refer to the sale of new securities to only existing stockholders at a reduced price. By private placement, the shares are sold to few privileged individuals and institutions.

The secondary market operates after the issue has been completed and the securities are listed in the stock market. Basically, it is a vehicle for providing liquidity to investors. Licensed stock brokers carry out secondary market transactions on behalf of their clients on the Nigerian stock exchange. As mentioned earlier, securities traded in the NSE

include Government stocks, debenture stocks, preference shares and equities.

Each branch of the NSE has a council which is subject to the National Council. Stock broking firms operate as dealers. The director of the branch is also a member of the council and he is eligible to represent the branch at the national level. Operations of the NSE is subject to regulations by the securities and Exchange Commission (SEC), the CBN and the Federal Ministry of finance. A high degree of honesty is expected of dealers in the NSE. Every member is bound by the motto: "My word is My bond". Dealings on the exchange follow the call-over system. This is done every business day till all offers and bids have been executed.

2.2.3 Objectives of the NSE

The Memorandum and Articles of Association of the NSE detail its major objects and how these should be achieved. Briefly, these objectives include the following:

1 To provide facilities for raising capital through the issue of securities.

2 To regulate the operations of dealing members

3 To control securities listing on the Exchange

4 To prescribe appropriate fees and other charges members can demand from their clients.

5 To organise and coordinate all activities on the Exchange for the mutual benefit of all participants.

6 To liaise with appropriate foreign institutions

7 To provide necessary machineries for settling disputes

8 To promote, support, or propose relevant legislations and other measures for achieving these objectives.

To some extent these objectives have been achieved. But there are still rooms for improvement.

2.2.4 Functions of the Exchange

The NSE was started as an arrangement to enable otherwise illiquid assets to become liquid in the most efficient manner. As it develops its activities assume wider implications. The Exchange now provides the facilities for distributing the countries capital resources. It's main function, therefore, is the mobilization of the country's limited capital resources among several competing ends. This allocative function can often become critical in determining the overall growth of the economy.

An efficient capital market should allocate a greater proportion of scarce financial assets to those sectors that provide the highest prospective rates of return. The aim is to ensure that the market mechanisms allocate resources according to the aggregate needs of the nation. This explains the great role of the nation's policy makers in the conduct of the Exchange. The need to increase the growth rate of outputs must be reconciled with the need to improve the distribution of income, wealth and economic power to reflect the nation's priorities adequately. The following functions have, therefore, been identified for the NSE.

1 The Exchange provides a means for raising funds to assist companies expand and improve their operations.

2 It provides a means for allocating the country's real and financial resources among various industries and companies.

3 It provides liquidity for the individual investor.

4 It's index serves as an important barometer for the economy and a source of attraction for individual and institutional investors to use the facilities of the Exchange.

5 It provides industrial management with some idea of the current cost of capital. This is done through pricing mechanisms and is important in determining the level and rate of investment in the country.

6 It can act as a reliable medium for broadening the ownership base from the erstwhile family dominated firms.

2.2.5 Security Pricing on the Exchange

Prices of securities traded on the exchange are initially determined by the securities and Exchange Commission. Subsequent prices are fixed by the interaction of buyers and suppliers in the market. The market forces of supply and demand may operate to raise or lower the prices of such securities. This is necessary for the market to serve as a barometer of the economy. Increased demand shows an anticipation of a buoyant and viable economy, a fall is an indication of a depressed outlook for the the industries and a decrease in investors' confidence.

Although the forces of supply and demand directly affect prices, several factors influence investors' reactions to the shares of a company. Any factor that are pertinent to the performance of the company, or the industry, is bound to reflect in the prices of securities of that company. The extent to which the price falls or rises is dependent on what Shiller (1993) called " investors variable tendencies". These tendencies are brought to bear on the market during the call-over sessions. Unreasonable specualtion is not encouraged, however.

All shares index is computed daily and quoted prices of securities traded on the Exchange are published in the Daily Official List. Under the current deregulation exercise, pricing and other forms of control bythe authorities are being reduced. This should make the market more competitive.

2.3 THE CAPITAL ASSET PRICING MODEL

The capital asset pricing model (CAPM) sets forth a theory of the relationship between the risk of an asset and the required risk adjustment factor. The model is examined in this study because of its important implication for investment decisions. A discussion of the formal mathematical derivation of the CAPM is, however, beyond the scope of this study. Weston and Brigham (1981, pp. 107-110) provides detailed mathematical analysis of the model for interested individuals.

The CAPM is premised on the assumption that return is commensurate with risk. Beta is taken as a good measure of that risk (Sharpe, 1963). This model underlies modern portfolio theory. It maintains that an efficient portfolio is one that secured the maximum return for the given level of risk or the minimum risk for the given level of return (Markowitz, 1952). Thus, it implies that: (1) investors are rational, and (2) rational investors trade only on new information, not on intuition (Fama, 1965). It presumed that while noise traders are necessary for the markets to function, they do not dominate these markets. The model argues that rational investors will seek premium for risky investments and attempts to define the risk of one stock in relation to the market. The main idea is that prices include discounts for certain sorts of risks, which explains consistently higher returns on certain investments.

The more volatile a portfolio of securities, the lower its price for a given expected return. Sharpe (1963) developed a model relating the propensity of an asset's price to move with returns on that asset. According to him the market is an efficient portfolio.

The model attempts both to predict market behaviours and to serve as a tool to help corporate managers to invest in those assets that the market will value positively. Implict in the works of Markowitz (1952) and Sharpe (1963) is the main idea that an investor who diversifies will do better than one who does not. Along with the EMH, this basic prediction spawned a range of investment products, including index funds. According to Nichols (1993), the underlying logic is: if it is impossible to beat the market, rational investors should be Markowitz efficient diversifiers. That is, investors should invest in the basket of stocks with maximum returns while trying to diversify away the unsystematic risk.

Based on Markowitz's work, Sharpe (1963) defined both the systematic and unsystematic risks. He says that beta is a good measure of the systematic risk. It is the measure of the volatility of one stock in relation to the market as a whole. Beta is conventionally set at 1.00. Riskier or aggressive stocks have betas greater than 1.00. Less risky or defensive stocks have betas less than 1.00. This model has an important implication for investors: the more risk a security has that cannot be diversified away, the more return investors will require to induce them to hold that security in their portfolio. The part of the risk of a portfolio that can be reduced through diversification is defined as unsystematic risk. It is not market-related but inherent in the individual stocks.

Although these concepts have had profound impact on security pricing and valuation, the CAPM has been seriously

criticised, Nichols (1993) effectively captured the situation when he stated that "Beta has been pronounced dead, revived, and pronounced dead again, many times" p. 54. Armed with better and more sophisticated computers, academicians have found evidence contradicting the logic of the CAPM. From a study, Fama and French (1992) found that the CAPM does not describe the last 50 years of average stock returns in the U.S. market. Their conclusion: beta is the wrong measure of risk. This means that risk is not related to returns as believed.

Interpreting this result, Nichols (1992) noted that that would mean: (1) that the markets are not efficient as they are assumed to be, (2) that the CAPM is the wrong model, or (3) that both the EMH and the CAPM are wrong. These findings are controversial and have resulted in "an academic holy war unlikely to be resolved soon" (Nichols, 1992) p. 54. Foremost among actors in the war are Bass (1985), Lowenstein (1985) Peters (1991) and Shiller (1992).

The important issues raised by these critics can be summarized. Taking beta as a measure of a firm's cost of capital management fixes hurdle rates, which are used as bases to evaluate proposed projects. Therefore, if the CAPM rarely fixes the right beta, the managers are misled into making safe investments with clear short term returns, rather than invest for the long-run.

It is further held that if the EMH is true and the CAPM is also true, then all stocks with the same beta are "fungible", that is the model reduced stocks to simply another group of commodities to be bought and sold, and that trading in stocks is not more than speculation. But markets are more complex than theories would suggest. They comprise investors who are not completely rational. Investors' variable tendencies

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could cause price spirals that may enter a vicious circle. In a completely efficient market this would be impossible. But if the market is not efficient it is sending the wrong signal and failing to allocate capital properly. The conclusion, therefore, is for investors to focus more on company fundamentals to guide their decisions.

What this boil down to is that the CAPM has not withstood the test of time. While investors would not advocate throwing out the theories that make modern finance, they would like to tinker with them. As Nichols (1993) observes, "despite tidy theories there may be no single answer in a global economy" p. 60.

2.4 THEORIES OF STOCK PRICE BEHAVIOURS

The traditional theories of stock price behaviours and security valuations can be classified into four major schools of thought. These are: (1) technical analysis school (2) fundamental analysis school (3) Random walk school, and (4) Efficient market school. This separation is for the purpose of this study. The four schools differ fundamentally in approach and methodology and arrive at different conclusions. A brief discussion of each is provided in the following subsections.

2.4.1 Technical Analysis School

Essentially the technical analysts believe that security prices follow predictable patterns. These patterns can be discovered by examining the security's historical price and volume data. Their approach involves the study of past prices and volume of transactions, employing charts and graphs. They thus seek to deduce the future trend of price movements. According to them, the price of a stock is influenced by supply and demand situations of the stock in the market. These factors, in turn, are subject to several rational and psychological factors. Impliedly, prices follow particular trends within the relevant range that demand and supply relationships are unchanged. Edward and Magee (1966) pointed out that these shifts in prices can be revealed readily in the actions of the market.

> The undrlying beliefs of the technicians have been clearly described by Levy (1966): The basic assumption of the technical theoriests is that history tends to repeat itself. In other words, past patterns of market behaviours will recur in the future and can thus be used for predictive purposes. In statistical terminology, the stock market technicians relies upon the dependence of successive price changes (Ibid, p. 83).

These theorists thus believe that they can discover trends in price or volume movements by studying the past behaviour patterns of individual or group of securities. For them, all the necessary data are market endogenous, and it is naive to evaluate a host of unnecessary information as other analysts do. They maintain that eventually the various judgement of analysts and investors will be reflected in the share's price and volume of transactions..

Unlike the fundamentalists, the technicians held the psychology of the market as an essential part of price and volume analysis. Malkiel (1975) explained this belief thus"... the market is only ten percent logical and 90 per cent psychological" p. 97. Contrary to the EMH, this claim implies that investors are irrational and are guided in their decisions by the spur of the moment. This does not adequately explain real life situation.

Technical analysts use various statistical tools such as charts and graphs to assess the impact of supply and demand on security prices (Jones et al, 1997). A major proponent of the school stressed that ".... for success in stock markets, timing is the important factor of all", and that one should" .... be guided more by the technical action of the market" (Mansukhani, 1968) p. 91 and 92. He recommends the use of 30 weeks to 20 days moving averages, but notes that investors with larger portfolios and traders requiring detailed analysis may apply Dow Theory, trendlines, and Chart Analysis in addition (Ibid, p. 107).

The Dow Theory, formed by Charles H. Dow, pioneered all technical analysis. Further development of the theory has been haphazard. The approaches of the technicians are criticized for being highly subjective by the efficient marketeers. As discussed later, the EMH do not believe in the fundamental assumptions of the chartists at all.

2.4.2 Fundamental Analysis School

Unlike the technical analysts, the fundamentalists argue that at any point in time an individual security has an intrinsic value. This value should be equal, theoretically, to the present value of the future stream of income of the security discounted at an appropriate risk related rate of interest. They thus maintain that the

actual price of a security is dependent on two principla factors: expected returns and capitalization rate. Changes in these factors result from new information and cause prices to fluctuate accordingly. As such, when there is poor "dissemination of information, the actual price of a security is generally away from its theoretical value" (Fisher and Jones, 1975) p. 72. By interpretation, the fundamental analysts believe that the market is not often right in valuing a firm.

The fundamentalist's approach is to calculate the real worth of a security from economic data, such as earnings, dividends, growth in earnings, capital structure, company size. From these parameters they hope to predict the future price of the company's share so as to decide the appropriate investment action to execute. The guiding rule is purchase when the intrinsic value is above market price; sell when market price is higher than intrinsic value. It is believed that this rule, if followed, will lead to above average performance. This is because it is implied in the rule that the market will eventually see "the error of its ways", (Dreman, 1977) p. 33.

The concept of security value was first suggested by Williams (1938). He also developed a model for estimating the real worth of shares. However, the concept become popular after the work of Graham and Dodd (1934). Their work pervaded security analysis for several years. Academicians have attempted further development of the theory with little success.

Compared to technical analysts, the fundamentalists do not concentrate solely on the market as the technicians do. They focus on key economic and financial facts which are ignored by the chartists. Thus, whereas market information is secondary to a pure fundamentalists, he believes the price will ultimately return to its real value by the interplay of competition among investors.

2.4.3 Random Walk School

The first formulation and test of the random walk model was credited to Louis Bachelier, (1900) In a doctoral dissertation, he developed a theory for the behaviour of commodity prices and discovered that those prices followed a random walk. However, formal development of the theory and use of the present terminology emerged much later in the work of Kendal (1953). Kendal (1953) found that instead of behaving in predictable ways, share prices followed a "random walk". Further development of the theory was encouraged by the published works of Roberts (1959) and of Osborne (1959). From that time, the theory has been the focus of several empirical studies.

Essentially, the theory of random walks seeks to determine whether future share prices can be predicted from historical data. Its primary trust is that future price changes cannot be predicted from earlier changes in any meaningful manner. This means that successive price changes or period returns in individual stocks are independent over time and the actual price is randomly distributed around its intrinsic value. Thus unlike the chartists, the random walkers assume that a security's price cannot be extrapolated from past data on the security. Fama (1965) stated the central idea of the random walk model thus:

> ".... The theory of random walks implies that a series of stock price changes has no memory. That is the past history of the series cannot be used to predict the future in any meaningful way. The future path of the price of a security is no more predictable than the path of a a series of accummulated random numbers (bid, p. 56).

Thus, the theory maintains that at any moment it is impossible to tell what prices would be a moment later.

Security prices are random and by definition unpredictable. Granger and Morgenstern (1970) confirmed this when they pointed out that at any p oint in time the size and direction of the next price change is independent of previous changes and the ".... best predictor of tomorrow's price is today's price" (Ibid, p. 71). An investor cannot, therefore, use past share price movements to earn above fair returns. "The past history of stock price movements and the history of stock trading volume, do not contain any information that will allow the investor to do consistently better than a buy and hold strategy in managing a portfolio" (Black, 1971) p. 18.

Formally, the random walk hypothesis are:

1 Successive price changes or changes in returns are independent; and

2 Price changes or returns changes are identically distributed according to some stationery distribution (Fama, 1976) p. 603.

This form of the model has been statistically defined by Fama (1970). According to him the conditional and marginal probability distribution of an independent random variable are identical. Although the theory postulates a probability distribution, its particular shape is not defined. However, Fama (1965) noted that ".... any distribution is consistent with the theory as long as it correctly characterises the process of generating the price change, (p. 41). Moreover, it was maintained that a low degree of dependence in successive price changes does not refute the practical utility of the theory. Such low correlation cannot be useful to make money in the stock market. The theory will be considered valid, therefore, insofar as the degree of dependence between

successive price changes is not high enough to enable investors predict future prices fairly right.

By itself, the RWH does not imply that variations in security prices are mere chance events. Neither does it say the market is senseless or irrational in fixing prices of stocks. On the contrary "the explanation of the ... randomness of stock prices lies in understanding the market making mechanisms" (Lorie and Hamilton, 1973) p. 79.

2.4.4 The Efficient Market School

Technically, the efficient market school is not different from the random walk school. Rather, it extends the work and conclusions of the RWH. The separation is made to allow a more detailed discussion of both theories within the context of the present study.

The efficient marketeers (EMH) attempt fundamentally to discover the "market making mechanisms" underlying security prices. The aim is to determine whether investors can "beat" the market if it is efficient in some sense. The central idea is that in a free and competitive market such as a stockmarket, security prices should be highly responsive to new information. That is, in financial markets prices reflect all available information about that security at any point in time. The theories define the security markets in which prices always fully reflect all information as efficient, Fama (1970); and Lorie and Hamilton (1973).

Thus, the EMH claim that it is not possible for investors to beat the market. An investor who has a price-sensitive fact may at the time being make some

profit by trading on the information. But eventually the news become incorporated in the price which will make it efficient. Therefore one investor should be able to earn higher returns than another only by taking big risks, or if he is lucky which rarely happens.

The theory of efficient markets has been refined and graded by academicians. Theoretically, all markets could be efficient, but in practice some markets are more efficient than others. Because of their special characteristics, financial markets are generally more efficient than most others. Efficiency of financial markets is defined in three forms, reflecting the degree of information that are expressed in prices (Fama, 1970). These are (1) weakform efficiency, (2) semistrong-form efficiency; and (3) strong efficiency.

The weak form of the EMH maintains that excess returns cannot be earned on the basis of historical price, volume or returns data. Current prices already reflect all facts implied by the past sequence of prices. The historical data will not provide a basis for superior forecasting of future prices. This form of the EMH is akin to the RWH. The predictions are directly opposed to the activities of technical analysts who argue that trading rules for achieving better returns can be developed by observing history. Many researchers have turned out empirical evidence supporting the weak efficiency (Alexandar (1961); Mandlebrot (1964); Fama (1970).

Semistrong efficiency says it is not possible to predict the future price of security on the basis of all publicly available "fundamental" information. Current prices of a stock closely equates its intrinsic value. Thus investors cannot earn abnormal profits from trading rules that use publicly available information. Annual reports of companies

investment advisory data, ticker paper information, articles and stories in newspapers and the financial press are some publicly available information. Since all facts available by these means are already reflected in current prices only unpredictable news can cause a change in prices. And because such news is unpredictable, price changes are undiscernible.

This form of the EMH contrasts with the work of fundamental security analysts. Recall, the fundamentalists' approach concern the analysis of public information. But semistrong efficiency argues that fundamentalists will have returns commensurate with the ability with which they process this information. This means except for the trained investors who can commit time and effort to the analysis like the professional, the average investor is not likely to do very well. Fama, et al (1969), Jensen (1968), Kaplan and Roll (1972), and Scholes (1972) agree that semistrong efficiency is obtainable in financial markets.

The third form of the EMH has not been supported with empirical findings as the weak and semistrong forms. The studies of Jaffe (1974), Ibbotson (1975), and Finerty (1976) suggest that specialists on major stock exchanges and officers and directors of companies may receive information they can use to earn excess profits. This contradicts the strong form of marketing efficiency which maintains that those who have privileged information cannot use it to achieve superior investment performance. Contrary to the evidence, this form of the EMH assummes that it is impossible to earn excess returns using any information - whether or not the information is published. The studies showed that corporate insiders could benefit from the information they receive ahead of the public. Since the information is not generally available, competition among those with the inside information did not immediately result in equilibriun prices that allow only fair returns.

Taken together, it appears that studies in the 1960's and early 19970s provide evidence supporting especially both weak and semistrong efficient markets. But studies in the 1980's have begun to cast doubts on the EMH in all three forms. This is discussed in the following section.

The efficient market theory has important implications for investors and fund managers. It implies for the investor that the essential decision is to choose a preferred risk class. This underlies the separation theory. It means that all investors, timid or aggressive can have the same risk of stock in their portfolio but vary only in the method of financing the investment. For fund managers, the theory warns that better than average returns is impossible to achieve. Prices reflect available information and returns are consistent with risk. Managers should therefore focus on improving the operating efficiency and performance of their companies and leave speculative forecasting. It seems this underlies the increasing popularity of index funds and other forms of passive management. The relationship of theEMH and CAPM has already been explained. Arbitrage pricing and the Black - Scholes option pricing models are theories that derive from the EMH.

2.5 BEATING THE MARKET AND FREE LUNCH THEOREM

Beating the market and the free lunch theorem are on both sides of the EMH. Whereas the first argues that there are ways to beat the market, the other maintains that excess profits are only rewards for risk-taking. The likelihood of better than 50-50 success rate in outguessing the market is difficult when transaction costs and risks are considered. Ridley (1993), Stevenson (1993), and Nichols (1993) have conducted separate surveys of empirical proofs of beating the market. Their findings form the basis of the present discussion.

The central issue involved in the debate is whether a financial market can be predicted. A group of financial experts and investors claim they have discovered new sources of profit in the forecasting of financial markets. According to Ridley (1993) four major developments underlie this claim.

> First, there is for the first time empirical proof that persistent predictability exists in financial markets. Second, there is growing evidence that a set of mathematical techniques.... can discover this predictability .... Third, computers have become powerful enough to make this a practical proposition. And fourth, there is a way to explain how the trick can keep working, even when everybody knows the rule (Ridley, 1993) p. 6.

This means that contrary to the predictions of the EMH, Quantitative techniques coupled with sophisticated computers have enabled investors to beat the market. Several of the ways investors have beaten the market can be found in the literature. Only a few of them can be discussed in this study.

Calendar effects. The calendar effects provide stricking evidence which contradicts the predictions of the semistrong form of the EMH. It states that at certain times of the year and on certain days of the week prices predictably rise (or fall) by more (or less) than on the average day. The related returns also vary accordingly. January, turn - of - the month, weekends, and holidays are such special periods which prices have been seen to behave so predictably.

Dividend effect. It is claimed that changes in corporate dividends affect the price of a firm's stocks. According to Shiller (1992), the market over-reacted to movements in the dividends paid out by companies to their shareholders.

Value investing. This is one simple trading rule some investors claim they have profited from. They claim it is cheap and profitable to buy shares with a below average ratio of market price to book value. Since this involves careful analysis of financial statements, only skilled investors can really benefit from the rule.

Moving averages. This aims at locating changes in the prices of an asset and imply that the market is not even weakly efficient. The rule suggest investors use a short and long moving averages. The strategy is: sell when the shorter average falls below the long term average, buy if otherwise.

Garch theory. This is a non-linear statistical technique developed to pick out significant patterns in market volatility. "GARCH" is an acronym for Generalised Auto-Regressive Conditional Hetroskadacity. It claims that "prices tend to be volatile when it has just been volatile, and not when they have not" (Ridley 1993) p. 8. It implies that money can be made by "straddling" a security, i.e. buying both a put and call option. This does not discount the random walk of stock prices, but claims that a pattern can emerge if the market is divided into high and low volatility.

Time delayed embedding. This theory asserts that returns reveal correlation over time if they are squared. Thus, it was discovered that a big profit or a big loss one day was more likely to be followed by a big profit or a big loss the next. The effect of negative values was examined by removing the minus signs. This reveal even higher correlation. It is concluded, therefore, that stock prices act as if they have memory of past events, implying some predictability in them.

Chaos and Fractals theory. The main basis of this theory is that "you can unlock the secrets of any situation if you can get the right perspective", (Nichols, 1993) p. 58. Chaos theorists believe that the markets are complex and not completely rational as

the EMH claim (Peters, 1991). Thus, stock prices move non-linearly and the distribution of actual prices are leptokurtotic.It produce trends that go in runs. This has three immediate implications:

1 It undermines the stronger market efficiencies since information is not immediately reflected in prices,
2 It contradicts the CAPM which uses standard deviation as a measure of risk.
3 It reveals that some factor is causing prices to be predictable. (Ridley, 1993) p. 12.

This shows that current stock prices depend on previous prices, and patterns which appear random can be predicted.

Lyapunov Time Horizon (LTH). This method relies on accomulating past patterns in several dimensions.It says that when the present resembles certain event of the past in detail, then the future will resemble what occured after that episode. The trick is to find when the LTH is high and positive where a prediction will be valied for slightly longer than usual. The theory claims that the next price can be predicted with a high degree of accuracy.

Neural networking. This is a computer program that recognises patterns. It is claimed that if carefully used, the programe can forecast stock prices accurately. The only snag is that the network tends to overfit the data and produce a pattern, however spurious and coincidental.

The difficulties inherent in the above techniques, and others like them, have attracted criticisms. Thus, critics of beating the market argue that isolated cases of above average performance do not discount the EMH. They claim that "Murphy's law" will make it impossible to consistently beat the market. This law states that *the rules of the game change as fast as they are learned*. This implies that a trick is continually becoming outdated.

This signals a warning for those considering using any of these tricks to beat the market. As Riddley (1993) noted, "for every genuine thinker groping about towards an understanding of non-linear forecasting, there are probably 20 charlatans on the loose" p. 15. Those who really know what they are talking about rarely obfuscate.

Of course some people might have become rich by trading on certain rules or computer guesses. But their tricks are not always right. It is easy to lose money when a market suddenly reverses trends than to gain from an upswing. It is precarious, therefore, to lean heavily on any one rule. Again those who claim to have found a trick for beating the market have been criticized for data-mining. They seem to investigate several rules till they found one that walked in the past and report this. But it may not work any more.

Summing up, there is a trade off between risk and return. By carefully selecting risky assets investors can earn above average returns. But this is not the same as beating the market. Some people might have used naive schemes to make money. However, for every successful fool there is always an unlucky fool who unfortunately does not talk. The investor who finds himself contemplating certain rules must remember: a fool and his money are quickly parted. There is no such thing as free lunch.

2.6 SUMMARY

This chapter comprised a detailed examination of literature concerning the valuation and pricing of securities. On a macro perspective, the history, structure, objectives, functions and operations of the Nigerian stock exchange were examined. The Exchange started as the lagos stock Exchange in 1961 with 19 securities, but has expanded to include six branches with a quotation of about 300 securities. The concept and implications of the capital asset pricing model are clearly examined in the chapter. The model asserts that rational investors will seek a premium for risky investments and used beta as a surrogate

measure of risk. It is criticized for being unrealistic. However, it remains a popular theory among financial managers.

Section 2.4 examined the four orthodox schools of thought concerning security markets. The technical analysis school believe that stock prices follow discernible trends which can be found by observing historical patterns. The fundamentalists argue that stocks have intrinsic values closely approximated by the capitalised value of the future income stream. They attempt to fix this value by analysing economic and financial data. The random walk school asserts that successive stock price changes are independent and the actual prices are distributed according to some stationery distribution. Future prices cannot, therefore, be predicted from past prices. The efficient market school maintains that prices are efficient, reflecting automatically all available information. Efficient markets are defined in three levels - weak, semistrong and strong-depending on the amount of news reflected in prices.

Critics of the EMH are called "revisionists". They claim that the market can be beaten and provided empirical evidence for this. However, there are more charlatans in the market than genuine thinkers and no technique has been shown to work consistently.

CHAPTER THREE
METHODOLOGY

3.1 INTRODUCTION

The research procedures for collecting and analysing the data and the methods for testing the hypothesis are described in this chapter. The chapter is divided into four sections. Section 3.2 describes the sample selection process and section 3.3 explains the statistical analysis to apply to the data. The last section provides a summary of the major facts presented in the chapter.

3.2 SAMPLE SELECTION

Sampling involves a process by which inference is made to the whole by examining only a part. Since it is not possible to obtain historical price data on all equity shares quoted on the Exchange, a sample of ten companies is taken. Stratified random sampling method is used. Each stratum is equivalent to an industrial group. The groups are coded according to the industrial classification presented in the NSE Daily official list.

Since all the industries cannot be represented in the study, the actual sampling is divided into two stages. The first stage involves selecting those industries to be represented. The second and final stage concerns selecting the particular companies whose shares are observed.

A random selection in the first stage yields eight industries. These are listed in Table 3.1. Column one of the table comprised the names of the industry groups, column two is the code assigned to each industry for the purpose of this study, and column three is the number of companies within each group as at 31 December, 1993.

TABLE 3.1

INDUSTRIAL GROUPS INCLUDED IN SAMPLE

NAME OF INDUSTRY GROUP (1)	CODE (2)	NUMBER OF COMPANIES (3)
Banking	BAN	19
Construction	CON	8
Food/Beverages and Tobacco	FBT	16
Industrial & Domestic Products	IDP	13
Insurance	INS	14
Petroleum Marketing	PET	7
Pharmaceuticals	PHA	8
Textiles	TEX	6

These represents 60% of all companies quoted on the NSE. The codes are for the purpose of this study only. The numbers in the Third column do not include companies listed in the secondtier market. This means that companies in the second-tier are not included in the study.

For the purpose of the final stage sampling, the companies within these industries are numbered 1,2,3, ..., n. n. represents the total number of companies in the group. Thus BAN1 should be interpreted as the first company in the list of companies in the group of banking PHA² is the third pharmaceutical company in the list. Using ths identification and the list as framework a minimum of one and a maximum of two companies from each industry group are selected so that the total number is equal to ten. This is analysed in Table 3.2.

TABLE 3.2

ANALYSIS OF SAMPLE BY INDUSTRIES

Industry Group	Companies selected	Percent of Total companies in group
(1)	(2)	(3)
BAN	2	10.5
CON	1	12.5
FBT	2	12.5
INDP	1	7.7
INS	1	7.2
PET	1	14.3
PHA	1	12.5
TEX	1	16.7
TOTAL	10	11.0

The weekly price data of the equity shares of each of these companies are then observed for the years 1991, 1992 and 1993. For the purpose of this study, price refers to the quoted prices of these securities. The study does not distinguish between a bid(+) or an offer (-) price. Equities refer to the common or ordinary shares of public liability companies quoted on the Exchange. Data on stocks and bonds are, therefore, not examined as part of the study.

3.3 ANALYTICAL TECHNIQUE

The random walk hypothesis examined by this study states that successive changes in stock prices are independent. This suggests that the major tests of its validity are statistical tests for randomness in successive price changes. Various statistical tests are available for achieving the same objective. But the serial correlation analysis is particularly suitable. This study will use this method to determine whether the independence assumption of the RWH is valid in the Nigerian context.

It is not possible for this study to examine the correlation in the prices of individual securities in the sample. The approach taken by the study is to summarize the observed price of the ten securities into a series of

single prices. This is done by means ofaverages. The average of the weekly prices of all the shares in the sample are computed for each week. For each week a single value is calculated. If the successive changes of the individual stock prices are independent, it would be expected that successive changes in the averages should equally be independent. Furthermore, compressing the volume of the data this way, makes it more amenable to analysis with the aid of a calculator.

A time period, for the purpose of this study, is equal to one week and is equivalent to a single price unit. These units can easily be fitted into the correlation mode (described below) to carry out the test. The aim is not to distort or disguise anomalies in the original data. Rather, it is hoped this approach can very much yield accurate results at a fairly little cost.

3.3.1 The Correlation Analysis

Correlation is a technique used to measure the strength of the relationship between two variables. It is concerned with describing the extent to which a dependence exists between two variables by measuring the degree of volatility of the data values. The less the variability the data points are, the stronger the correlation is said to be.

The strength of this correlation is defined by the correlation co-efficient. For the purpose of this study, this coefficient will be represented by the symbol, R. The numeric value of R lies between -1 and +1, inclusively. That is: $-1 < R < +1$. A value of $R = 0$ signifies there is no correlation present, while the further away from zero R is in either direction, the stronger the correlation. thus values near zero should imply acceptance of the null hypothesis that successive stock prices are independent.

The Model

The formal measure of correlation as described above is the product moment correlation coefficient. For the purpose of this study this is defined statistically as follows:

$$R = \frac{N\sum \bar{P}_t \bar{P}_{t+1} - \left(\sum \bar{P}_t\right)\left(\sum \bar{P}_{t+1}\right)}{\sqrt{N\sum \bar{P}_t^2 - \left(\sum \bar{P}_t\right)^2} \cdot \sqrt{N\sum \bar{P}_{t+1}^2 - \left(\sum \bar{P}_{t+1}\right)^2}}$$

For,

t = One period of time equal to one week. The value of t is one (i.e. t = 1) at the first week.

Pt = The average weekly price of the sample for t .

Pt+1= The average weekly price of the shares one period lagged.

$\bar{P}t$ = The change between Pt + 1 and Pt.

N = The number of weeks within the period under consideration. That is the number of the bivariate values Pt and Pt + 1.

The Significance of R.

It has been mentioned that the correlation coefficient R has a value in the range -1 to +1. It is positive for direct correlation and negative for inverse correlation. Values of R near to unity indicates a high degree of correlation, values near to zero indicate an absence of correlation. When the value of R is determined, the question therefore arises: "Does R differ significantly from zero?"

Table 3.3 gives the values of R at a significance level of P = 5%. If the calculated value of R is equal to or greater than

the corresponding value in the table, R differs significantly from zero. The hypothesis is not accepted at the 5% level of significance. This means that the probability that no dependence exists between successive stock price changes is 1/20 or less.

TABLE 3.3

VALUES OF THE CORRELATION COEFFICIENT R AT A SIGNIFICANCE LEVEL OF 5%.

NUMBER OF PERIODS	MINIMUM VALUE OF R REQUIRED	NUMBER OF PERIODS	MINIMUM VALUE OF R
5	0.88	14	0.54
6	0.82	15	0.52
7	0.76	16	0.50
8	0.71	18	0.47
9	0.67	20	0.45
10	0.64	40	0.31
11	0.61	80	0.22
12	0.58	100	0.20
13	0.56		

SOURCE: Loveday (1977): A second Course in Statistics, (London: Cambridge UniversityPress) P. 142

3.4 SUMMARY

The research procedures and the statistical test adopted for this study have been described. The weekly price data of ten equity shares quoted on the NSE will be observed for three years to 1993. These equities are selected using a stratified random sampling process and taking the industrial classification as in the Daily Official List of 31 December, 1993. Serial correlation test will be applied to the data. The model for this study is adopted from the formula for the product moment correlation coefficient.

CHAPTER FOUR
DATA PRESENTATION, ANALYSIS AND RESULTS

4.1 INTRODUCTION

The purpose of this chapter is to present, analysis and interpret the data generated for this study. The NSE Daily Official List is the main data source explored for this purpose. The average prices calculated for each week, as well as the successive changes between them are presented as charts. These differentials are then inputed into the serial correlation model described in chapter three. The aim is to determine the degree of association in successive changes of these weekly averages. This will provide evidence for accepting or rejecting the Random Walk Hypothesis as it applies to the Nigerian Stock Market.

4.2 DATA PRESENTATION AND ANALYSIS

The ten equities included in this study are listed in table 4.1 below. These equities are selected from a sample frame comprising eight industry groups, which covers a total of 91 companies in the first tier market. All the industries and corresponding companies, with appropriate codes, are presented in Appendix A.

TABLE 4.1

ORDINARY SHARE INCLUDED IN THIS STUDY

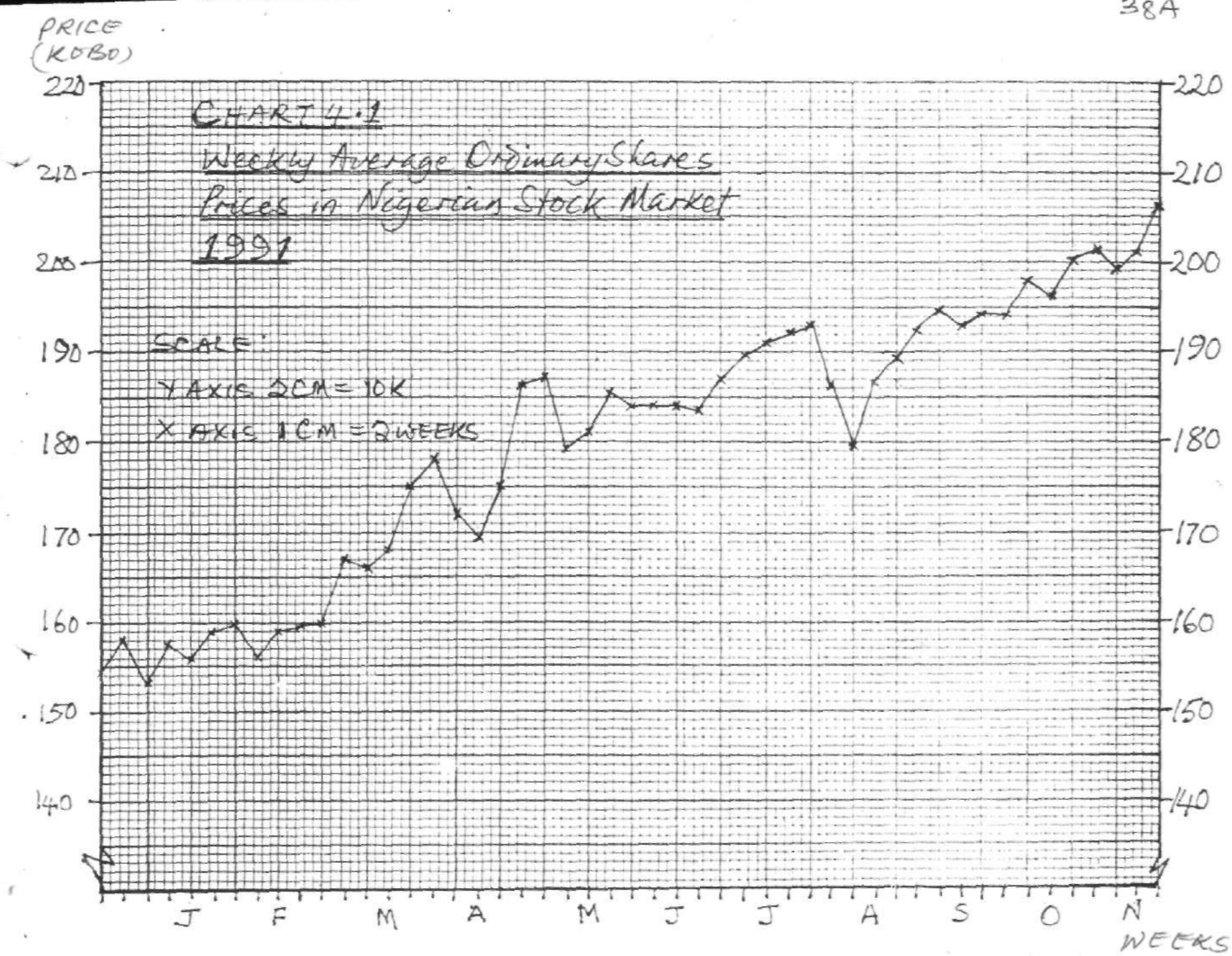
CODE	COMPANY
BAN 5	First Bank (Nigeria) Plc
BAN 11	NAL merchant Bank Plc
CON 7	Julius Berger Nigeria Plc
FBT 1	7-Up Bottling Company Plc
FBT 6	Nigeria Flour Mills Plc
IDP 12	Vitafoam Nigeria Plc
INS 12	The Niger Insurance Plc

PET 6	Total Nigeria Plc
PHA 3	Glaxo Nigeria Plc
TEX 5	United Nigeria Textiles Plc

These equities were randomly selected. The list shows that the major industries in the economy are represented. The finance industry, comprising one commercial bank (BAN 5) a Merchant Bank (BAN 11) and one insurance company (INS 12), forms the largest proportion of the sample. This may imply that fluctuations in the prices of these equities would have significant influence on the overall average values.

Ideally, the price movements of each of these equities should be analysed separately. Such analysis would throw up the possible effects any one of them may have on the whole. However, the cost involved in such approach makes it an impractical proposition for the present study. An alternative approach has been followed by this study. The study used weekly averages. This approach is feasible and effective for achieving the stated objectives. The values obtained for each of the three years are presented in charts 4.1, 4.2, and 4.3, respectively. The corresponding changes between the weekly average prices are shown in separate charts - charts 4.4, 4.5 and 4.6.

The patterns exhibited by the behaviours of these averages are not identical for the three years examined. Careful observation of chart 4.1 reveal three discernible patterns. The period between January and March, that is the first 11 weeks of the year, shows an even rise and fall in prices. The average prices within this period range from a low of 153 kobo to a high of 160 kobo. This means a variation of between +4.4k and -5.0k, representing an absolute average change of 3.6k (figure 4.4). There is greater volatility in prices between March and August, i.e. the next 24 weeks of the year. The lowest average price is 166k and the highest is 192k. Price


PRICE (KOBO)
220
210
200
190
180
170
160
150
140
CHART 4.1
Weekly Average Ordinary Shares Prices in Nigerian Stock Market 1991
SCALE:
Y AXIS 2CM = 10K
X AXIS 1CM = 2WEEKS
J F M A M J J A S O N
WEEKS

PRICE (KOBO)

CHART 4.2

Weekly Average Ordinary Shares Prices in Nigerian Stock Market 1992

SCALE

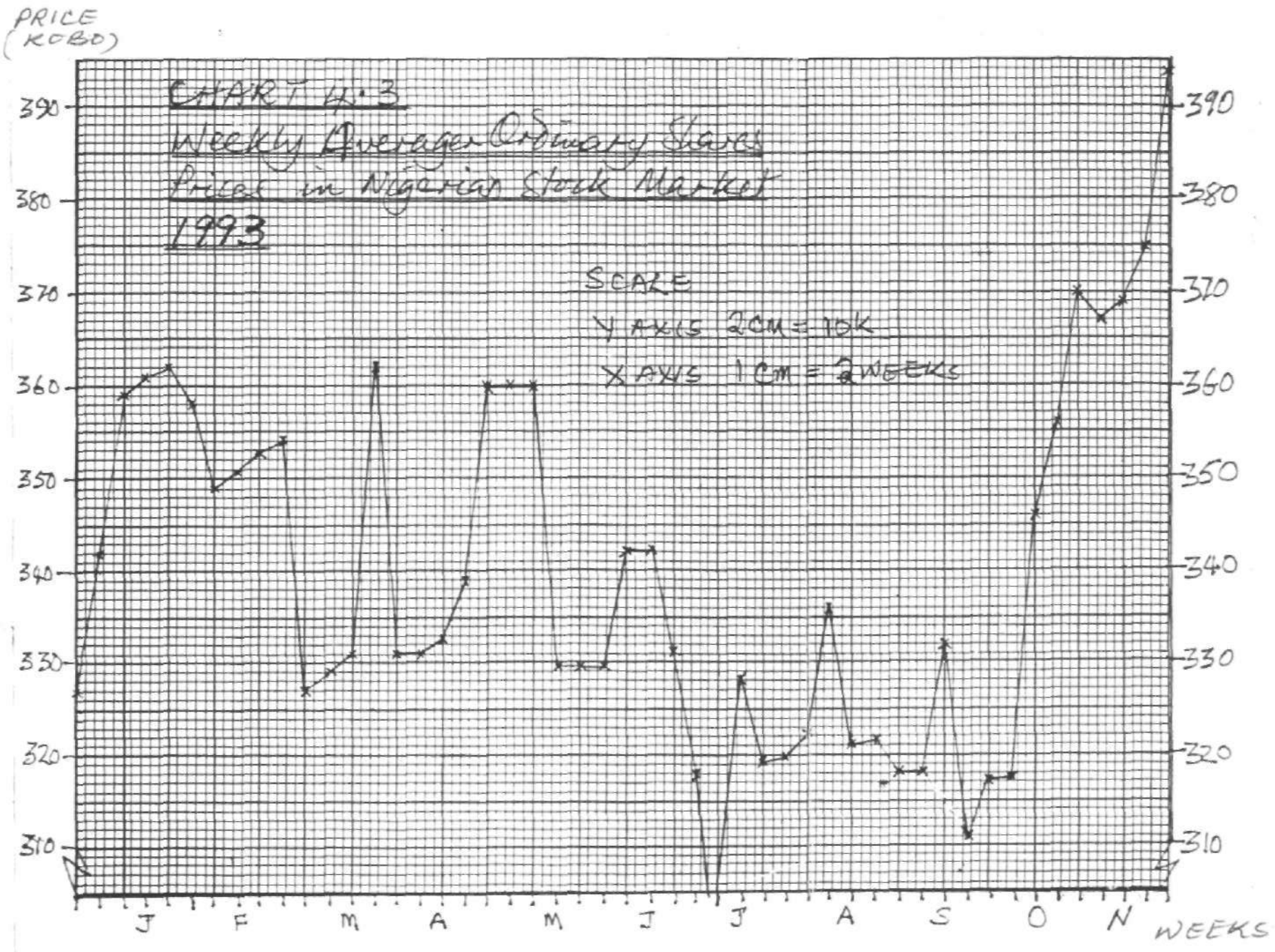
Y AXIS 2CM = 20K

X AXIS 1CM = 2WEEKS

340
320
300
280
260
240
220
200
180

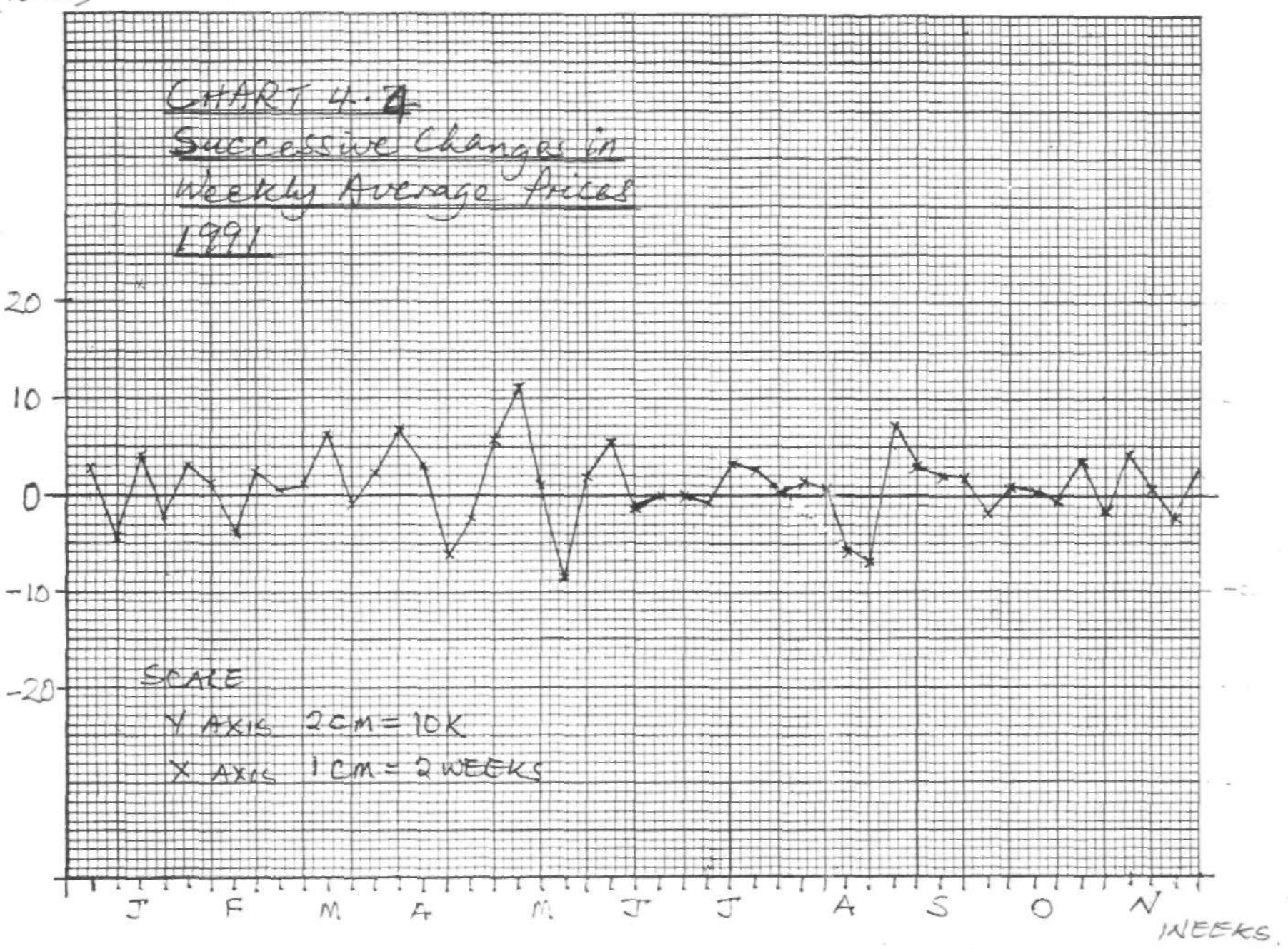
J F M A M J J A S O N

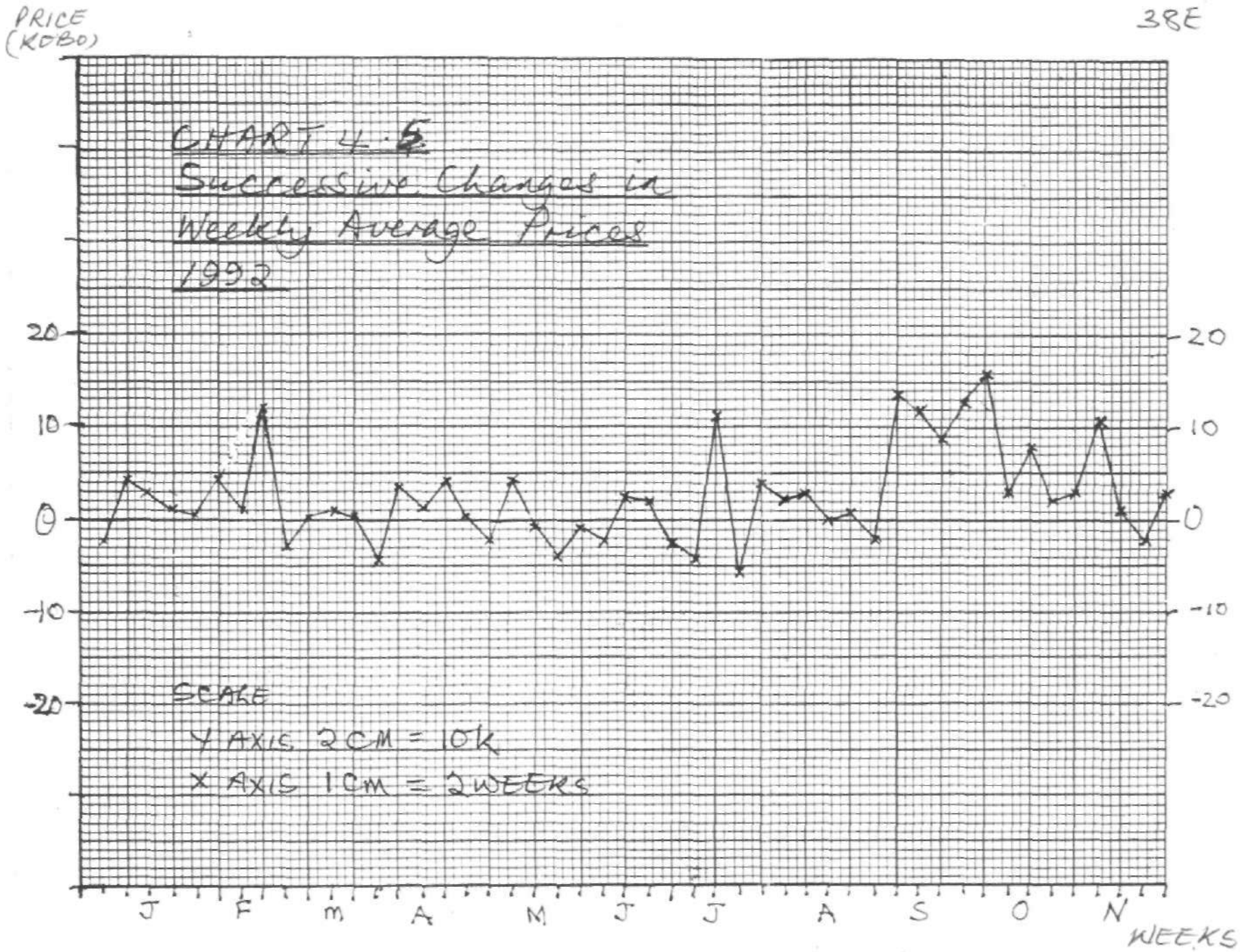
WEEKS


PRICE (KOBO)
CHART 4.3
Weekly Average Ordinary Shares Prices in Nigerian Stock Market 1993
SCALE
Y AXIS 2CM = 10K
X AXIS 1CM = 2WEEKS
390
380
370
360
350
340
330
320
310
J
F
M
A
M
J
J
A
S
O
N
WEEKS

PRICE (KOBO)

CHART 4.2
Successive Changes in Weekly Average Prices 1991




PRICE (KOBO)
CHART 4.5
Successive Changes in Weekly Average Prices 1992
20
10
0
-10
-20
SCALE
Y AXIS 2CM = 10K
X AXIS 1CM = 2WEEKS
J
F
m
A
M
J
J
A
S
O
N
WEEKS

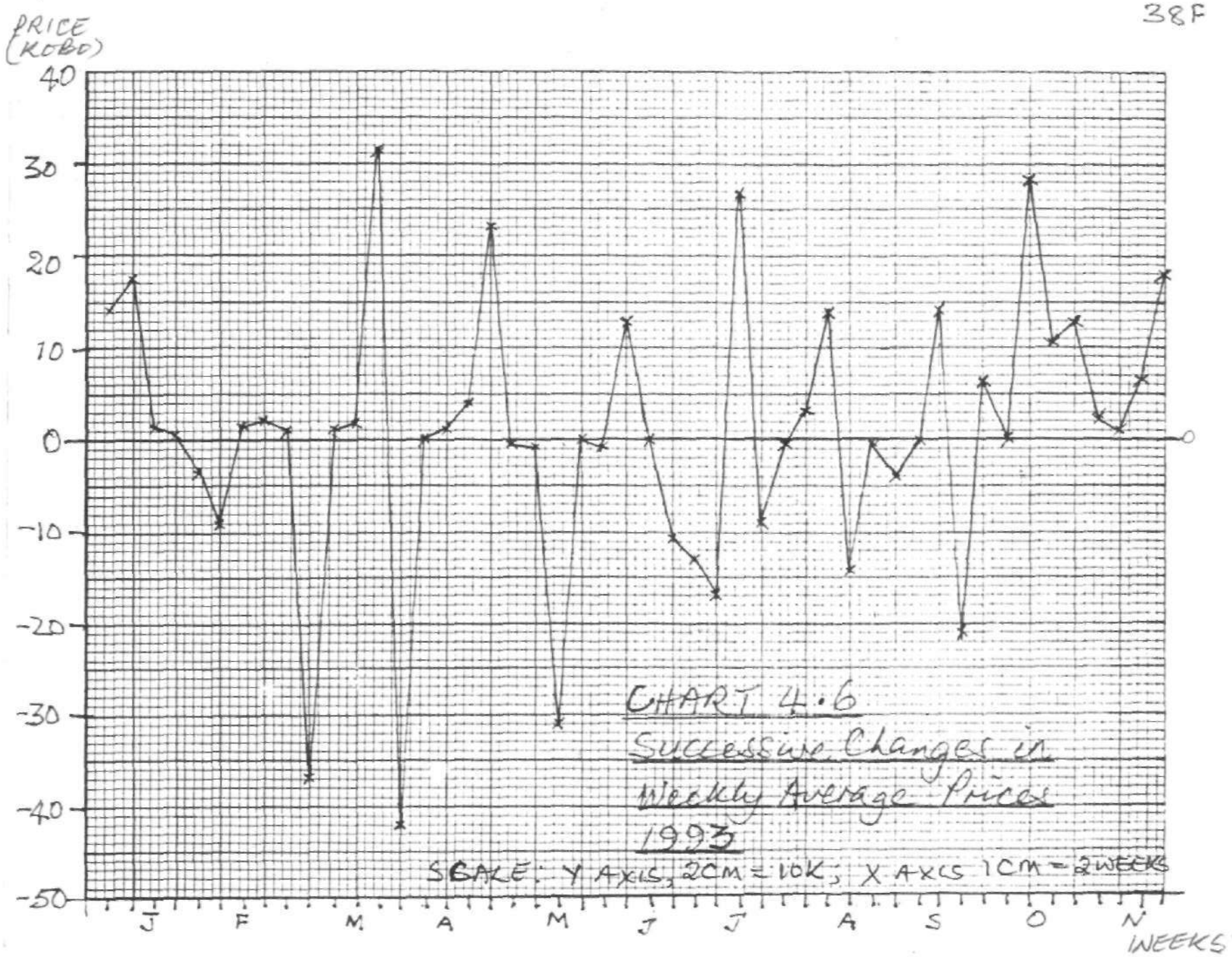


CHART 4.6
Successive Changes in Weekly Average Prices 1993

SCALE: Y AXIS, 2CM = 10K; X AXIS 1CM = 2WEEKS

movements within this period do not seem to follow any identifiable pattern. Changes in the weekly average for the period vary between +11.0k and -9.0k. This shows an average absolute variation of 4.0k. The last 17 weeks from end of August to December, show a gradual upward trend in price movements. From a low of 186.7k in week 36, the average price steadily increased to 206.8k in the 51st week. There are some decreases in four of these weeks. As shown in Chart 4.4, the successive changes vary just between +7.0k and -2.1k, an absolute variation of 2.4k. Taken together it seems that a prediction in the first and third periods will be more reliable than a forcast within the second period of the year.

The pattern of price fluctuations in 1992 is different. Chart 4.2 depicts the movements in the average prices and chart 4.5 shows the corresponding successive weekly changes. Two patterns can be observed in chart 4.2: a gradual increase within the first 36 weeks (January to early September), and a steep incline in the last 16 weeks (September to December). In the first period, the lowest average (187.3k) occured second week of January. This increased to 232.7k in the last week of August, showing a difference of 45.4k. If January and February figures are excluded, the difference reduced to only 15.3k.

In the other period, the average prices range from a low of 230.5k to a high of 344.4k. This shows a difference of 113.9k about three times the difference in the first period. This picture is emphasized in chart 4.5. The chart shows the distribution of successive changes in the weekly average prices for the year. The changes in the first period show variations between +12.4k and -6.3k, with an absolute mean of 3.1k. In the last period, the changes vary from

+16.2k to -2.1k and a mean of +7.2k. There is only one negative value in the second period, compared to 12 in the first. However, careful prediction in either period can be reliable.

The patterns of price behaviours in 1993 contrasts sharply with either patterns depicted in 1991 and 1992. A cursory look at Chart 4.3 may reveal no regular pattern in the movement of the average prices. But a careful study of the chart shows that prices generally decline in the middle of the month and are peaked at the end. Except for the last two months, this pattern is repeated throughout the year - though the rise and falls are not uniform.

Between January and early March, volatility in the prices is low. There is a sharp increase from 327.0k, in the first week, to 361.0k in the third week of January. This is followed by a low variation in prices for the next seven weeks, followed by a greater and higher volatility for the remaining part of the year. Between March and October, prices tend to vary in two phases (high and low) of an average of approximately two weeks. Prices would be low for about three weeks and suddenly rise and stay high for one or two weeks. From October to December, there is a steady climb, beginning with a low of 317.7k (Third week of October) to 417.2k high by end of December. Chart 4.6 clearly illustrates these fluctuations in the average prices. The chart shows that between January and October, the weekly price changes vary unpredictably between +31.2k and -42.8k. From end of October to December, the change range between +28.5k and +1.4k. This seems to imply that reliable timing decisions in the last part of the year, than at any other time, is possible.

These patterns of average prices and fluctuations in successive values, presented in the six charts for the three years, are interesting. They show that with care, accurate predictions of the future can be made on the basis of past trends. However, they do not provide sufficient proof of the validity of the RWH concerning price movements in the Nigerian Stock Market. Certain fundamental issues implied in the hypothesis have not been adequately answered. To prove the hypothesis, a serial correlation

WORKSHEET - 1

1991

$N = 50$ $\qquad \sum \bar{P}_t = 52$

$\sum_{t=2}^{51} \bar{P}_t \bar{P}_{t+1} = 31.56$ $\qquad \sum \bar{P}_{t+1} = 46.1$

$\sum \bar{P}_t^2 = 764.46$

$\sum \bar{P}_{t+1}^2 = 760.33$

$$R = \frac{50(31.56) - (52)(46.1)}{\sqrt{[50(764.46) - (52)^2] \cdot \sqrt{[50(760.46) - (46.1)^2}}$$

$$= \frac{-819.2}{35704.66}$$

$$= -0.0229$$

WORKSHEET – 2

1992

$N = 50$

$$\sum_{t=2}^{51} \bar{P}_t = 127.8$$

$$\sum_{t=2}^{51} \bar{P}_{t+1} = 139.0$$

$$\sum_{t=2}^{51} \bar{P}_t \bar{P}_{t+1} = 597.90$$

$$\sum_{t=2}^{51} \bar{P}_t^2 = 1727.22$$

$$\sum_{t=2}^{51} \bar{P}_{t+1}^2 = 1798.90$$

$$R = \frac{50(597.90) - (127.8)(139.0)}{\sqrt{[50(1727.22) - (127.8)^2]}\sqrt{[50(1798.9) - (139)^2]}}$$

$$= \frac{12130.8}{70325.45}$$

$$= 0.1725$$

WORKSHEET – 5

1993

$N = 50$

$$\sum_{t=2}^{51} \bar{P}_t = 53.6$$

$$\sum_{t=2}^{51} \bar{P}_{t+1} = 54.7$$

$$\sum_{t=2}^{51} \bar{P}_t \bar{P}_{t+1} = -1201.45$$

$$\sum_{t=2}^{51} \bar{P}_{t+1}^2 = 10548.59$$

$$\sum_{t=2}^{51} \bar{P}_{t+1}^2 = 10515.92$$

$$R = \frac{50(-1201.45) - (53.6)(54.7)}{\sqrt{[50(10515.92) - (53.6)^2][50(10548.6) - (54.7)^2}}$$

$$= \frac{-63004.42}{523676.28}$$

$$= -0.1203$$

In 1992, the average prices tend to follow an outstretched letter N (Chart 4.2). There is a gradual steady rise during January and February, followed by a stabilization from March to August, and then a sleep climb through September to December. The general implication is that fairly profitable forecasts can be made all through the year. On the other hand, the 1993 pattern implies a 50-50 chance of making large profits or sustaining huge losses from trading on previous trends. Except for the last three weeks when prices kept increasing rapidly, an increase one week may be followed by a decrease or an increase, of more or less magnitude, the next. There is thus no discernible trend in price movements during the year.

These patterns presented by the weekly averages belie the actual behaviour of prices observed during the years. Individual shares tend to have only one price over a long period of time. Changes occur very gradually for some but in jumps for others. For instance, the price of BAN5 remained 50k from April to Mid August in 1993, then jumped by 300 percent to 200k. It remained 200k for the next 30 days. Over about the same length of time, April 14, to September 6, 1993, the price of INS12 did not change from 331 kobo. Similarly the price of CON7 remained 192k from 1st January to 10th March, 1993. This behaviour is also characteristic of the other securities in the sample.

One fundamental conclusion can be drawn from this pattern of price movements: Security price movements in the Nigerian Stock Exchange are sticky either downwards or upwards. This may imply that most investors in the Stock Market:

1 are not highly responsive to fundamental information that may affect the performance of the companies

2 generally prefer to follow a buy-and-hold strategy,

3 buy shares for some naive reasons other than capital gain,

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4 are grossly ignorant and insensitive to the market making mechanisms, or

5 are generally risk averse.

It may also mean that the market is over regulated and that participants are highly conservative in reacting to relevant economic and political signals.

The serial correlation analysis performed as a major part of this study show R values of -0.0229, 0.1725, and -0.1203 for 1991, 1992, and 1993, respectively. The average correlation coefficient for the three years is 0.1053. To give credence to the random walk hypothesis, non of these coefficients should be significantly different from zero. The rule is: if the calculated R is greater than the value given in Table 3.3 for the appropriate N, R differs significantly from zero. The hypothesis is therefore, rejected at the 5 percent level of significance.

Table 3.3 gives the R values at N = 30 as 0.31 and at N = 80 as 0.22. By interpolation the expected R at N = 50 is 0.2875. this value is much higher than the calculated values of R for each of the three years involved in this study. means that the correlation coefficients of successive price changes for 1991, 1992 and 1993, do not differ substantially from zero at the 5% level of significance. This supports the RWH examined by this study: successive price changes are independent. None of the calculated R's is exactly zero, however. But this is not necessary to validate the practical utility of the theory of random walks (Fama, 1970). A small degree of dependence in successive price changes may not be useful to make money in the stock market.

This result is obtained when the actual signs of the changes are considered in the calculation. The revisionists argue that negative values affect the correlation of

successive changes in prices. Two approaches for examining this effect are suggested under the theory of time-delayed embedding. (1) The GARCH theorists maintain that if successive changes are squared, they do show correlation over time. (2) Ding and his associates show that correlation is even greater if the values are simply all made positive (Ridley, 1993). The second of these propositions is examined in this study.

When the negative signs attaching some of the changes are removed, the result show correlation coefficients of 0.1469, 0.2785, and -0.0333 respectively for the three years. As would be expected, the correlation in the first and second years increase in magnitude. But correlation in 1993 decreased in absolute terms. The average correlation, however, increased from 0.1053 to 0.1529, an increase of 0.0476. Still these values are lower than the expected significant levels, and do not therefore deviate substantially from zero. The initial conclusion based on the serial correlation test is thus not altered. The increased correlations do not show that prices run in trends. Rather, they imply that prices tend to be volatile, when they have been volatile and not when they have not. This means that volatility is clustered and prices have a relatively long memory of past events.

If this reasoning is accepted, then the results imply that information is not immediately reflected in prices and each move does not depend on what happened before. This would explain the patterns of price behaviours presented in the six charts. It also reveal that something is causing the market to be predictable, to have memory.

Thus, in a way, the results of this study indicate that data on weekly changes were valueless in predicting future price changes. Equity share prices on the Nigerian stock market appear to move randomly within the three years examined. The empirical evidence produced by the serial

correlation model show that the association in successive price changes is slight. In the other way, the study shows that, though the average weekly changes move randomly, some predictability exists in the market. Actual prices do not seem to move rapidly, the market tend to assimilate information gradually. It is not proved, however, that this predictability can enable investors to make excess profits consistently.

4.4 SUMMARY

The data obtained from a survey of the NSE Daily Official List, for the three years to 1993, as a major aspect of this study, have been presented and analysed in this chapter. The equities included in the sample cover a wide range of industries in the economy. Graphs and charts are used to show the patterns of share price behaviours during the period involved.

The graphs show that, closely observed, stock price movements do exhibit certain discernible patterns. These patterns vary from year to year, and the duration of a particular pattern within any year is not predictable. The serial corelation analysis indicate correlation coefficients that do not substantially differ from zero at 5% for the three years. This result is not altered significantly when all the changes are simply made positive. This means that there is only small dependence in successive price changes within the period examined. The random walk model is, therefore, probably a valid description of stock price behaviours in the Nigerian stock market.

CHAPTER VIE
SUMMARY, RECOMMENDATIONS AND CONCLUSION

5.1 INTRODUCTION

This is a concluding chapter of this study. It is divided into three sections, the first section summarized the data and information contained in the previous four chapters. In section 5.3, a number of recommendations on the basis of the research findings are provided. The last section of the chapter is the conclusion. It is maintained that, to a large extent, the random wlak model effectively describes the behaviour of ordinary share prices in the Nigerian stock market over the three years covered by this study.

5.2 SUMMARY

This study has been carried out to determine the patterns of stock price behaviours in the Nigerian stock market. The aim is to ascertain whether the random walk hypothesis concerning securities markets is valid in the Nigerian context. The simple random walk model involves two separate hypotheses. (1) successive price changes are independent, (2) Price changes conform to some probability distribution. Of the two hypothesis, independence is the most important and is the one examined in this study.

The theory of random walks, maintain that in highly competitive and organised markets, price changes will be indistinguishably close to random. The idea is that an efficient market, characterized by numerous well informed participants, should create prices which accurately reflect all current information. The security in question will be priced at a reliable estimate of its true worth. Price changes will reflect new information and, hence, will approximate a random variation.

Financial markets, unlike most other markets, assimilate information very rapidly, and a preponderance of empirical evidence has been presented to demonstrate that prices in this markets follow a random walk. If this theory holds, past prices do not provide any information useful in estaimting

future prices. The next move of a speculative price is independent of all past moves. this implies that technical analysts who study previous changes for indications of future changes in prices, and the fundamentalists who seek early knowledge of price changes by studying factors important in the future supply and demand for the security, are to be ignored. Both these schools of thought assume the existence of trends and believe that a financial market can be predicted.

Current developments and empirical studies led economists to criticise the theory of random walks. A group of these revisionists accept that the model is roughly true but maintain that no market is perfectly efficient in the handling of information. This implies that there are anomalies in financial markets which can be exploited. The other group argues that, apart from information advantages, there are other ways to beat the market. They, therefore, went on to demonstrate that prices contain hints of what they will do next and how computers can discover this predictability. The central idea is that some complicated noisy pattern which appear random can be predicted with some accuracy, if the underlying cause is descovered.

The models presented by these revisionists do not, however, work consistently. Moreover, academicians have tried to reconcile evidence of market inefficiency with the theory of random walks.They point out that if some people gain from a loophole in the markets others must lose from it. This means that smart traders consistently earn excess profits because noise traders consistently lose. It is obvious why the winners remain in the market, but not clear why the losers do so. It is, therefore, suggested that theorists should discover these noise traders and why they are willing to lose.

Taken together, these theories present inconclusive description of the behaviour of assets prices in financial markets. Early studies of, especially the U.s. Stock Markets confirm the random walk model. But later studies of both the U.S. and others present contrary evidence. Some authors describe the Nigerian Stock Market as inefficient and discount the applicability of the random walk model in the Nigerian context. Except to mention that the market is highly regulated, no rigorious empirical evidence is provided in support of this proposition. The present study is an attempt both to provide such evidence and test the validity of the random walk model concerning price behaviours in the Nigerian stock market.

The study assumes from the outset that the Nigerian Stock Market is efficient, and the independence assumption of the random walk hypothesis is applicable. It took data from the NSE Daily Official List and covered a period of three years - 1991, 1992 and 1993. The data obtained were subjected to statistical tests and analysis. Results of the analysis show that stock prices move according to some identifiable patterns. These patterns are not consistent through any particular year, nor are they identical for the three years involved in the study. The serial

Correlation tests applied show correlation coefficients of -0.0229, 0.1725 and -0.1203, with an average of 0.1053. These are not substantially different from zero at the 5% level of significance. This means that there is only slight dependence in successive price changes within the period covered by the study. On the basis of these results, it is naive to claim that the Nigerian Stock Market is not efficient and that the random walk model is inapplicable.

The information contained in this report is organised into chapters. Chapter one is mainly introductory. It includes a preview, the problem definition the objectives to be achieved,

as well as an indication of the scope and significance of the study. Chapter two is the literature review. The results obtained from a broad survey of relevant literature are presented in this chapter. Issues covered include the history, development, functions and operations of the Nigerian Stock Exchange. The concept and implications of the capital assets pricing model, which underly modern portfolio theory, are clearly discussed. This is followed by an extensive examination of the various schools of thought concerning investment valuation and security market behaviours. The views presented by these professional groups are conflicting, but provide profound interest and challenge for us to investigate the Nigerian capital market.

Chapter three detailed the procedures and methods followed by this study. It was explained that ten randomly selected equity shares will be observed for a period of three years. The basic data source would be the NSE Daily Official list. The statiscal analysis and test to apply were also described. Through serial correlation analysis, the study attempts to determine the extent to which successive price changes are dependent. The degree of association is defined by the correlation coefficient, R.

The essence of chapter four is to apply these methodologies and test the basic hypothesis. The results of both the analysis and tests reveal important features of stock price behaviours in the Nigerian Capital Market. These features present important implications for informed investors and academicians.

5.3 RECOMMENDATIONS

A developed economy depends on a highly developed capital market. Such capital market is founded upon a well organised system of stock exchange which should allocate capital resources efficiently and, so, determine the overall growth of the economy. It is important that the market allocate funds to

industries with growing demand and which are capable of increasing the economy's output. This suggests that the system itself is well organised, competitive, efficient. Prices should accurately and readily reflect all fundamental information and participants are well informed and responsive to price signals.

Knowledge of capital market efficiency is obtained from empirical study of the behaviour of stock prices in the market. This information is effectively provided by the Nigerian Stock Exchange Daily Official List. The present study found that the Nigerian Capital Market is efficient in some sense. Price movements in the market tend to follow a random pattern. However, there is room for the market to achieve greater efficiency in its handling of information. For such development to obtain, the following recommendations require careful consideration.

1 A minimum price control is essential in the Nigerian Stock Exchange. Price is a signal of profitability and an attraction for investors. A highly regulated price system distorts this information.

2 There is high need for an active involvement of the private sector. A predominance of government controlled equity shares is a critical way the government affects the efficiency of the stock market. The current privatisation exercise is, therefore, a welcome development. A high private ownership of stocks is important if prices are to effectively reflect all necessary information.

3 Investors in industrial securities traded on the Exchange should maintain flexible investment strategies.

An investor who follow a moderately short or a moderately long position strategy is more likely to be highly rewarded than one who stays in either extreme. The choice of particular strategies should be informed on the prevailing economic situation. This study revealed that, though seemingly random, the market contain "pockets of predictability" which can be discovered by careful analysis.

4 The study also provides evidence that financial managers can improve their performance through careful forecasting. The statistical analysis shows that fairly accurate predictions of the future can be made on the basis of past price movements. Although this may not necessarily result in excess returns, chances are, the fund manager who studiously examine historical patterns can gain from timing decisions.

5 The pausity of empirical investigation of price behaviours in the Nigerian speculative markets require a redirection of academic effort. Other aspectsof the market have gained profound interest and impact among our informed researchers. The attention given to studying market price behaviours and their implications by academicians in the industrialized economies, has not been paralleled in Nigeria. Given the history of the NSE and the need for improved economic development of the nation, it is time to direct more attention to studying price behaviours in the financial markets.

6 Since the present study is restricted in scope and rigour, it is further recommended that future studies be more comprehensive and sophisticated. Weekly price averages of a select group of ordinary shares have been used for this study. Other studies should examine the movement of individual security prices. This study applied only one statistical test. Future studies may apply a combination of different techniques that could provide more valid results.

The present study found that the movements of the weekly average prices are not identical for the three years observed. It was shown that there are wide fluctuation in prices in 1993 than the other two years. It is important that studies be undertaken to investigate the factors that underlie these behaviours.

5.4 CONCLUSION

This study found that the prices of ordinary shares traded in the Nigerian Stock Market do not move according to any consistent pattern. during any one of the three years examined, different patterns were identified. Over several months, the movements in the average prices are irregular, but movements within short periods are trendy. Within these short periods fairly accurate forecasts of future prices can be made on the basis of past prices.

There is a difference between the movements of the average prices and the actual prices of the individual shares observed. Individual share prices tend to be fixed over a relatively long period. Changes are either abrupt (especially during 1993) or gradual when they occur. This implies that individual share prices could be accurately predicted more often, but the effort may not result in above average performance.

The successive changes between the weekly average prices seem to follow a random pattern. For 1991 and 1992, the changes observed tend to cluster along the zero line, but there is great volatility in the changes during 1993. This means that moderate profits or losses could be made from trading on past trends during 1991 and 1992, while substantial gains or losses may be incurred in 1993.

The serial correlation test applied to the changes indicate that they are not dependent. The correlation coefficients for any one of the three years do not differ

considerably from zero at the five percent level of significance. This means that an increase one week is not usually followed by an increase the next week. An adjustment of the signs of the changes reveal higher correlations, which imply that prices tend to be volatile when they have just been volatile and not when they have not. It does not discount the fact that successive changes in the prices still follow a random walk.

The results show that current share prices in the Nigerian Stock Market do reflect available information. But, since the changes are not generally rapid, investors can fairly accurately predict the future, from past price movements. This proposition require planned empirical investigation and we recommend that academicians redirect ther efforts accordingly.

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APPENDIX A

SAMPLE FRAME: ORDINARY SHARES

CODE	INDUSTRY/COMPANIES
BAN	BANKING
1	AFRIBANK NIGERIA PLC
2	AFRICAN CONTINENTAL BANK PLC
3	ALLIED BANK OF NIGERIA PLC
4	ALPHA MERCHANT PLC
5	FIRST BANK (NIGERIA) PLC
6	FSB INTERNATIONAL BANK PLC
7	INLAND BANK (NIGERIA) PLC
8	INTER MERCHANT BANK PLC
9	LION BANK OF NIGERIA PLC
10	MERCHANT BANK PLC
11	NAL MERCHANT BANK PLC
12	ORIENT BANK OF NIGERIA PLC
13	OWENA BANK (NIGERIA) PLC
14	PROGRESS BANK PLC
15	SAVANNAH BANK PLC
16	TRADE BANK PLC
17	U B A PLC
18	UNION BANK OF NIGERIA PLC
19	WEMA BANK PLC
CON	CONSTRUCTION
1	ARBICO PLC
2	CAPPA & D' ALBERTO PLC
3	COSTAIN (W.A) PLC
4	DUMEZ NIGERIA PLC
5	G. CAPPA PLC
6	IMPRESIT BAKOLORI PLC
7	JULIUS BERGER NIGERIA PLC
8	ROADS NIGERIA PLC

INS		INSURANCE
	1	AIICO INSURANCE PLC
	2	ARUCABLE ASSURANCE PLC
	3	BRI-AMERICAN INS. CO. PLC
	4	CRUSADER INSURANCE PLC
	5	GUINEA INSURANCE PLC
	6	LASACO ASSURANCE PLC
	7	LAW UNION AND ROCK INS. CO. PLC
	8	N.E.M. INSURANCE CO. (NIG.) PLC
	9	PRESTIGE ASSURANCE CO. PLC
	10	ROYAL EXCHANGE ASSURANCE PLC
	11	SUN INSURANCE NIGERIA PLC
	12	THE NIGER INSURANCE PLC
	13	UNIC PLC
	14	WEST AFRICAN PROV. INS. COY. PLC
PET		PETROLEUM (MARKETING)
	1	AFRICAN PETROLEUM PLC
	2	AGIP (NIGERIA) PLC
	3	MOBIL OIL NIGERIA PLC
	4	NATIONAL OIL CO. PLC
	5	TEXACO (NIG) PLC
	6	TOTAL NIGERIA PLC
	7	UNIPETROL NIGERIA PLC
PHA		PHARMACEUTICALS
	1	CHRISTLIEB PLC
	2	BCN PLC
	3	GLAXO NIGERIA PLC
	4	MAUREEN LABORATORIES PLC
	5	PFIZER PRODUCTS PLC
	6	PHARMA-DEKO PLC
	7	SMITHKLINE BEECHAM NIG. PLC
	8	STERLING PRODUCTS PLC

FBT	FOOD/BEVERAGES & TOBACCO
1	7-UP BOTTLING COMPANY PLC
2	CADBURY NIGERIA PLC
3	CHRISLIEB PLC
4	FLOUR MILLS NIGERIA PLC
5	FOREMOST DAIRIES PLC
6	N. NIGERIA FLOUR MILLS PLC
7	NATIONAL SALT CO. NIG. PLC
8	NESTLE FOODS NIGERIA PLC
9	NIGERIA BOTTLING CO. PLC
10	NIGERIA TOBACCO CO. PLC
11	OKITIPUPA OIL PALM PLC
12	OKAMU OIL PALM PLC
13	ONVALTINE (WA) PLC
14	P.S. MANDRIDES AND COPANY PLC
15	TATE INDUSTRIES PLC
16	UNION DICON SALT PLC
IDP	INDUSTRIAL/DOMESTIC PRODUCTS
1	ALUMACO NIGERIA PLC
2	BEREC NIGERIA PLC
3	FIRST ALUMINIUM NIGERIA PLC
4	GROMMAC INDUSTRIES PLC
5	INDUSTRIAL GASES PLC
6	LEVENTIS TECHNICAL PLC
7	LIZ-OLOFIN AND COMPANY PLC
8	NIGERIA ENAMELWARE COMPANY PLC
9	NIGERIA YEAST AND ALCOHOL MAN. PLC
10	NIGERIAN LAMPS INDUSTRY PLC
11	OLUWA GLASS COMPANY PLC
12	VITAFOAM NIGERIA PLC
13	VONO PRODUCTS PLC

TEX	TEXTILES
1	ABA TEXTILE MILLS PLC
2	AFPRINT NIGERIA PLC
4	ENPEE IND. PLC
5	NIG. TEXTILES MILLS PLC
6	UNITED NIG. TEXTILES PLC
7	WESTER PLC

APPENDIX B

SERIAL CORRELATION ANALYSIS OF
PRICE CHANGES IN 1991

WEEK	Pt	Pt+1	Pt Pt1	P²t	Pt+1
2	3.3	-4.9	-16.17	1089	24.01
3	-4.9	4.4	-21.56	24.01	19.36
4	4.4	-2.1	-9.24	19.36	4.41
5	-2.1	3.0	-6.3	4.41	9.0
6	3.0	1.8	5.4	9.0	3.24
7	1.8	-4.1	-7 38	3.24	16.81
8	-4.1	2.5	-10.25	16.81	6.25
9	2.5	0.7	1.75	6.25	0.49
10	0.7	1.0	0.7	0.49	1.0
11	1.0	6.4	6.4	1.0	40.96
12	6.4	-1.1	-7.04	40.96	1.21
13	-1.1	2.6	-2.86	1.21	6.76
14	2.6	6.8	17.68	6.76	46.24
15	6.8	3.4	23.12	46.24	11.56
16	3.4	-6.2	-21.08	11.56	38.44
17	-6.2	-2.6	16.12	38.44	6.76
18	-2.6	5.6	-14.56	6.76	31.36
19	5.6	11.1	62.16	31.36	123.21
20	11.1	0.9	9.99	123.21	0.81
21	0.9	-8.6	7.74	0.81	73.96
22	-8.6	1.9	16.34	73.96	3.61
23	1.9	5.2	9.88	3.61	27.04
24	5.2	-1.4	-7.28	27.04	1.96
25	-1.4	0.0	0.0	1.96	0.0
26	0.0	0.0	0.0	0.0	0.0
27	0.0	-0.5	0.0	0.0	0.25
28	-0.5	3.1	-1.55	0.25	9.61
29	3.1	2.9	8.99	9.61	8.41
30	2.9	0.9	2.61	8.41	0.81
31	0.9	1.2	1.08	0.81	1.44
32	1.2	0.8	0.96	1.44	0.64

33	0.8	-6.0	-4.8	0.64	36.0
34	-6.0	-7.1	42.6	36.0	50.41
35	7.1	7.0	-49.7	50.41	49.0
36	7.0	3.1	21.7	49.0	9.61
37	3.1	2.8	8.68	9.61	7.84
38	2.8	2.2	6.16	7.84	4.84
39	2.2	-1.9	4.18	4.84	3.61
40	-1.9	1.0	-1.9	3.61	1.0
41	1.0	0.4	0.4	1.0	0.16
42	0.4	-0.5	-0.2	0.16	0.25
43	-0.5	3.8	-1.9	0.25	14.44
44	3.8	-1.5	-5.7	14.44	2.25
45	-1.5	4.3	-6.45	2.25	18.49
46	4.3	0.8	3.44	18.49	0.64
47	-0.8	-2.1	1.68	0.64	4.41
48	-2.1	2.2	-4.62	4.41	4.84
49	2.2	5.1	11.22	4.84	26.01
50	5.1	0.4	2.04	26.01	0.16
51	0.4	-2.6	-1.04	0.16	6.76
	52.0	46.1	31.56	764.46	760.33

Total number of Weeks, N = 50

APPENDIX C

SERIAL CORRELATION ANALYSISOF PRICE CHANGES IN 1992

WEEK t	Pt	Pt+1	Pt Pt+1	Pt	Pt+1
2	-2.4	4.3	-10.32	5.76	18.49
3	4.3	3.3	14.19	18.49	10.89
4	3.3	1.4	4.62	10.89	1.96
5	1.4	0.8	1.12	1.96	0.64
6	0.8	4.5	3.6	0.64	20.25
7	4,5	1.2	5.4	20.25	1.44
8	1.2	12.4	14.88	1.44	153.76
9	12.4	-2.9	-35.96	153.76	8.41
10	-2.9	0.4	-1.16	8.41	0.16
11	0.4	1.0	0.4	0.16	1.0
12	1.0	0.5	0.5	1.0	0.25
13	0.5	-4.4	-2.2	0.25	19.36
14	-4.4	3.8	-16.72	19.36	14.44
15	3.8	1.3	4.94	14.44	1.69
16	1.3	4.4	5.72	1.69	19.36
17	4.4	0.3	1.32	19.36	0.09
18	0.3	-2.2	0.66	0.09	4.84
19	-2.2	4.7	-10.34	4.84	22.09
20	4.7	-0.7	-3.29	22.09	0.49
21	-0.7	-4.0	2.8	0.49	16.0
22	-4.0	-0.9	3.6	16.0	0.81
23	-0.9	-2.1	-1.89	0.81	4.41
24	-2.1	2.8	-5.88	4.41	7.84
25	2.8	2.1	5.88	7.84	4.41
26	2.1	-2.7	-5.67	4.41	7.29
27	-2.7	-4.2	11.34	7.29	17.64
28	-4.2	11.5	-48.3	17.64	132.25
29	11.5	-6.3	-72.45	132.25	39.69
30	-6.3	4.1	-25.83	39.69	16.81
31	4.1	3.5	14.35	16.81	12.25

32	3.5	3.6	12.6	12.25	12.96
33	3.6	0.0	0.0	12.96	0.0
34	0.0	0.7	0.0	0.0	0.49
35	0.7	-2.2	-1.54	0.49	4.84
36	-2.2	13.9	-30.58	4.84	193.21
37	13.9	12.4	172.36	193.21	153.76
38	12.4	8.9	110.36	153.76	79.21
39	8.9	12.8	113.92	79.21	163.84
40	12.8	16.2	207.36	163.84	262.44
41	16.2	3.1	50.22	262.44	9.61
42	3.1	7.8	24.18	9.61	60.84
43	7.8	2.2	17.16	60.84	4.84
44	2.2	3.2	7.04	4.84	10.24
45	3.2	10.7	34.24	10.24	114.49
46	10.7	-1.1	-11.77	114.49	1.21
47	-1.1	-8.5	9.35	1.21	72.25
48	-8.5	-2.1	17.85	72.25	4.41
49	-2.1	3.4	7.14	4.41	11.56
50	3.4	1.5	5.10	11.56	2.25
51	1.5	8.8	13.20	2.25	77.44
TOTAL	127.8	139.0	597.90	1727.22	1798.90

Total number of weeks, N = 50

APPENDIX D

SERIAL CORRELATION ANALYSIS OF PRICE CHANGES IN 1993

WEEK	Pt	Pt+1	Pt Pt+1	Pt	P^2t+1
2	14.3	17.9	255.97	204.49	320.41
3	17.9	1.5	26.85	320.41	2.25
4	1.5	0.8	1.20	2.25	0.64
5	0.8	-3.6	-2.88	0.64	12.96
6	-3.6	-9.1	32.76	12.96	82.81
7	-9.1	1.7	-15.47	82.81	2.89
8	1.7	2.1	3.57	2.89	4.41
9	2.1	1.4	2.94	4.41	1.96
10	1.4	-36.9	-51.66	1.96	1316.61
11	-36.9	1.8	-66.42	1316.61	3.24
12	1.8	1.9	3.42	3.24	3.61
13	1.9	31.2	59.28	3.61	973.44
14	31.2	-42.8	-1335.36	973.44	1831.84
15	-42.8	0.0	0.0	1831.84	0.0
16	0.0	1.3	0.0	0.0	1.69
17	1.3	4.6	5.98	1.69	21.16
18	4.6	23.4	107.64	21.16	547.56
19	23.4	-0.1	-2.34	547.56	0.01
20	-0.1	-0.3	0.03	0.01	0.09
21	-0.3	-30.7	9.21	0.09	942.49
22	-30.7	0.0	0.0	942.49	0.0
23	0.0	-0.4	0.0	0.0	0.16
24	-0.4	13.1	-5.24	0.16	171.61
25	13.1	0.0	0.0	171.61	0.0
26	0.0	-10.5	0.0	0.0	110.25
27	-10.5	-13.0	136.5	110.25	169.0
28	-13.0	-17.1	222.3	169.0	292.41
29	-17.1	26.9	-459.99	292.41	723.61
30	26.9	-9.2	247.48	723.61	84.64
31	-9.2	0.1	-0.92	84.64	0.01

32	0.1	3.2	0.32	0.01	10.24
33	3.2	13.9	44.48	10.24	193.21
34	13.9	-14.7	-204.33	193.21	216.09
35	-14.7	0.1	-1.47	216.09	0.01
36	0.1	-4.0	0.4	0.01	16.0
37	-4.0	0.0	0.0	16.0	0.0
38	0.0	14.4	0.0	0.0	207.36
39	14.4	-21.0	-302.4	207.36	441.0
40	-21.0	6.3	-132.3	441.0	36.69
41	6.3	0.0	0.0	36.69	0.0
42	20.0	28.5	0.0	0.0	812.25
43	28.5	10.7	304.95	812.25	114.49
44	10.7	13.1	140.17	114.49	171.61
45	13.1	-2.4	-31.44	171.61	5.76
46	-2.4	1.4	-3.36	5.76	1.96
47	1.4	6.6	9.24	1.96	43.56
48	6.6	18.0	118.8	43.56	324.0
49	18.0	6.2	111.6	324.0	38.44
50	6.2	3.0	18.6	38.44	9.0
51	3.0	15.4	46.2	9.0	237.16
TOTAL	53.6	54.7	-1201.45	10575.92	10548.59

Total number of weeks, N = 50