Thesis

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Efficient Market Hypothesis and the Nigerian Capital Market Under Liberalization : an Empirical Analysis

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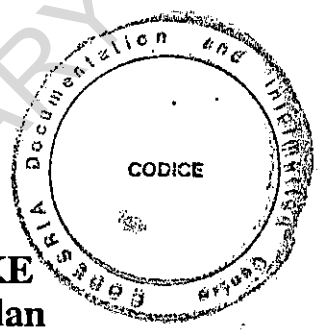
EFFICIENT MARKET HYPOTHESIS AND THE NIGERIAN CAPITAL MARKET UNDER LIBERALIZATION: AN EMPIRICAL ANALYSIS



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DEDICATION

To

Jehovah God

The Source of True Knowledge

Also To

'Bimpe,

'Wumi and 'Dayo

ABSTRACT

This thesis presents an empirical analysis of the behaviour of stock prices in Nigeria before and during liberalization within the framework of efficient market hypothesis. It compares the behaviour of stock prices as well as the performances of other basic stock market indicators before and during the period of financial liberalization, which include the exchange rate and interest rate deregulations regime. The study employs the properties of the efficient market hypothesis to test for efficiency and analyse the performance of the Nigerian Stock Market before and during liberalization. Various tests carried out include the frequency distribution tests, serial correlation tests, runs test, normal probability graphing and the overall performance evaluation of the volume and value of securities, new capital issues, market capitalization and the stock prices across sectors. The models generated the location parameter, index of skewness and measure of Kurtopsis conforming to the Mandelbrot and the Generalized Central Limit Theorem. The results represent a valuable input of great policy relevance on the impact of financial liberalization on the Nigerian Stock Market and the possible impact of full deregulation of the Nigerian Capital Market.

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CHAPTER ONE

INTRODUCTION

1. Introduction

This study sets out to provide an empirical analyses of the responsiveness of the Nigerian stock market to financial liberalization under the Structural Adjustment Programme, within the framework of efficient market hypothesis at the weak form level. The aim is to ascertain the pattern of influence, in order to access the possible impact of the deregulation of the capital market, using stock prices and some key indicators.

A capital market is defined as an organized market that provides facilities through which new capital could be raised. It exists to offer a mechanism whereby those supplying capital can quickly and easily restore their liquidity. Indeed, the importance of the capital market as a machinery for mobilizing and allocating long-term financial resources for industrial and social-economic development cannot be overemphasized.

Quite recently, Soyode (1989) observed that the institutions that make up the capital market function to ensure that there are adequate long-term funds to service the needs of the economy. He therefore contends that there is a positive correlation between the growth in capital market activities and overall economic growth.

Indeed, we can view the role of capital market in an economy in three perspectives:

i. Financing capital for the government and corporate sectors etc;

ii. Providing the investing public with a market place for investing their financial assets; and

iii. Contributing to an efficient management of the economy.

According to Fama (1970), the primary role of the capital market is the allocation of an economy's capital stock. Samuel and Yacout (1981) have defined an efficient market as one that functions effectively in the allocation process. In general terms, an efficient capital market is one in which prices provide accurate signals for resource allocation, under the assumption that security prices at any time reflect all the available information. Thus, a market in which firms fully reflect available information is efficient, at least in the weak form sense.

No doubt, in a well functioning capital market, the market becomes more active to the extent that it includes a whole range of investors and institutions, and approximates the efficient market. Indeed, the view still holds that sustainable industrialization and modernization in "free market" developing economies depend quite significantly on the timely evolution of

broad and deep capital markets (Adam, Cavendish and Mistry, 1990).

Furthermore, there is a view that capital markets are important for the efficiency and the solvency of the entire financial system. This is because they promote competition, lower intermediation costs, and provide borrowers and lenders with an alternative to debt financing from the banking sector. One important advantage of this role is that reliance on debt renders economies and enterprises vulnerable to external and internal shock thereby contributing to financial instability (Popiel, 1987).

Consequently, the level of development of capital markets has been seen as an important determinant of the flexibility and pace with which the financial system can adjust to internal and external changes and absorb shocks. The reason perhaps is that capital markets represent the longer term end of the financial system. Hence, the stronger the system, the greater its stability and resilience. Therefore, the current emphasis has been to raise the rate of private domestic voluntary saving and to allocate these savings more efficiently through the development and effective use of capital markets.

In turn, the ultimate objective of strengthening a country's financial system is to make possible an increase in,

and more efficient utilization of, financial resources in the development process as a means of speeding real economic growth. According to Popiel (1987), the specific objectives of financial development include the following:

(i) to increase domestic savings;

(ii) to improve the efficiency of the allocation of savings to investment in the public and private sectors;

(iii) to broaden the base of ownership of real and financial assets;

(iv) to make investment capital available to more people; and

(v) to ensure the availability of long-term financial resources while minimizing the risk of financial assets acceptable to savers and establishing a proper framework for long term transformation by financial institutions.

The strategies for achieving the objectives of financial system development comprises among other components:

(i) analysis of the present strengths and weaknesses of the existing financial system;

(ii) development of a medium and long-term strategy of financial system reform in the light of broad national economic, social, and political objectives; and

(iii) development of an appropriate range of public and private financial instruments, services, institutions, and markets.

It is in the context of the above that the Nigerian government, in 1986, adopted a Structural Adjustment Programme (SAP). The main policy instruments of SAP are exchange rate adjustment, interest rate deregulation policy designed to promote domestic savings and appropriate allocation of resources, control of money supply and credit among many others. Indeed, the SAP remains the most comprehensive radical government response to the problems posed by the numerous imbalances in the Nigerian economy (Phillips, 1987). It has also been described as one of the most rigorously implemented sets of public policies in recent times (Ajakaiye, 1987).

Following the regime of financial repression characterizing the Nigerian economy in the early 1980s, which manifested through interest rate controls, and low investment, the Nigerian government, in an attempt to promote financial development as an enabling structural change, adopted a two-year SAP in 1986. The

bedrock of the policy has been the financial liberalization. Consequently, series of measures were adopted.

For instance, on September 26th, 1986, Nigeria embraced the most far-reaching reform in its exchange rate management policy, the second-tier foreign exchange market was introduced. Furthermore, in 1987, the Federal Government deregulated the interest rates as part of the policy package. The interest rate deregulatory measures took place in January and August 1987. The major aim of the policy was to stimulate savings that would be transformed into investment and thereby achieve economic growth. This policy presupposes a direct relationship between changes in interest rates, deposits, savings, investment and growth of the economy.

As part of the programme to restructure the Nigerian economy for the achievement of a higher degree of efficiency, the Federal Government in July 1988 promulgated the Privatization and Commercialization Decree, No. 25 (FGN, 1988). With this, the government set out to privatize certain public enterprises. The main objectives of privatization include the following:

(i) to restructure and rationalize the public sector in order to lessen the dominance of unproductive investments in the sector;

(ii) to re-orientate the public enterprises towards a new horizon of performance improvement, viability and overall efficiency; and

(iii) to assure positive returns on public sector investments in commercialized enterprises.

A basic relationship exists between privatization and capital market in that the transfer of ownership of the affected companies are carried out through the stock market.

Generally, the thinking is that those policies will bring about sustained economic growth partly by increasing investment due to increased domestic savings and attraction to foreign capital. Consequently, the capital market activities are expected to boom taking advantage of financial liberalization and free market-oriented policies.

However, given the number of years since the Nigerian Capital Market was established, and the substantial financial resource endowment available in the country, coupled with the existing institutions, one can claim that the entire spectrum of

the capital market has not been sufficiently active, especially, when compared with the capital market of similar or lesser age in other developing countries (e.g. Malaysia, Singapore and Korea) (Wai and Patrick, 1973).

The predominance of the money market mirrored by the growth in the number of financial institutions seems to portray the relatively underdeveloped nature of the capital market. Indeed, the Nigerian capital market is largely characterized by a low level of patronage, limited range of corporate securities available to investors, a low volume of secondary market transactions, and insufficient activities and sophistication of the financial intermediaries involved.

There seems to be a poor response of companies going public, even when economic rationality demands they do. This is partly blamed on the mechanism adopted in determining prices of shares of companies affected, which is alleged to be motivationally biased (Ariyo, 1991). As a result of the disenchantment with the mechanism for share pricing, companies rely more on alternative sources of capital such as retained earnings and debt, in carrying out necessary expansions (Oyejide and Soyode, 1976).

Furthermore, Inanga (1977) has contended that the information content of company annual accounts, being used for share valuation appears inadequate for investment decisions such as buying and selling of shares in a company. The information in the account is basically historical and often intended for purposes other than assisting shareholders in the investment decisions. Consequently, the ability of share prices in Nigeria to provide accurate signals for efficient resource allocation prior to the liberalization appeared questionable. This was also reinforced by the low patronage of the market.

Noticeably, one of the main goals of SAP was the restructuring of the financial sector and improving the financial intermediation. Theoretically therefore, the financial reforms are expected to enhance the operation of the capital market which is expected to accurately mirror the macro-economy. Equally, the reforms are supposed to accelerate the growth rate of major activities in the stock market.

In this regard, an assessment of the impact of liberalization on the capital market appears warranted especially as the government contemplates full deregulation of the Nigerian capital market.

1.2 Need and Policy Relevance of Study

Admittedly, there is a considerable number of empirical studies on the Nigerian Capital Market. However, researches on capital markets in Nigeria to date concentrate on key issues such as dividend policies, retained earnings and a few others (See Soyode 1975, 1978[b], 1992; Inanga 1975, 1977, 1988; Ike 1984 etc). Consequently, Soyode (1989) noted that "if there is an area in economics which has attracted very little attention in Nigeria, it is the interface with business studies", and that many important aspects of capital market studies are yet to be examined.

This view is further reinforced by the fact that the Federal Government also deemed it necessary to set up an inter-ministerial committee, and also commission a study on the possibility of the capital market reforms. The recommendations therein are to provide some guides to the government about liberalizing the capital market.

According to the Central Bank of Nigeria (CBN), the government opined that there was the need to overhaul the capital market in order to raise its operational standard and enable it move at the pace of the money market (CBN, 1990).

It becomes necessary therefore to carry out an empirical analysis of the behaviour of the Nigerian stock market prices

before and under liberalization with the intention of analyzing the effect of financial reforms on the stock market. It is believed that such an empirically-based study stands a chance of providing an insight to the general performance and potentials of the Nigerian capital market.

Equally, the study is considered important and relevant in view of the possible introduction of stock markets in other African countries that are also undertaking one form of SAP, or another.

1.3 Objectives of the Study

The central focus of this study is to empirically analyse the possible impact of the financial liberalization on the performance of the Nigerian stock market in general and on the efficiency of the Nigerian stock market in particular. The thesis therefore attempts to analyse the degree of the responsiveness of the Nigerian stock market to financial liberalization, with a view to tracing the consequences of financial reforms on the stock market.

The central question in this study is:

"How does the Nigerian Stock Market especially the stock price changes, respond to financial market liberalization?"

The specific objectives shall therefore be:

(i) to empirically analyze the degree of efficiency of the Nigerian stock market before and after liberalization;

(ii) to examine the effect of financial liberalization on the operational performance of the Nigerian stock market;

(iii) to highlight the major problems confronting the Nigerian stock market; and

(iv) to offer useful suggestions and make policy recommendations on ways to improve the current performance of the Nigerian stock market and enhance its efficiency.

1.4 Scope of Study

The study covers a sample of 25 active listed companies on the Nigerian stock exchange. They were selected by stratification for representativeness among the 145 companies listed on the Nigerian stock exchange. The daily, weekly, bi-monthly and monthly stock prices of the selected listed firms on the Stock Exchange between 1984 and 1991 were used. The choice of companies reflected the main classifications of the listed companies, cutting across various sectors.

The justification for the 25 companies selected is not far-fetched. Apart from the fact that the standard practice by the Nigerian Stock Exchange itself has been to highlight mainly, the top 10 listed companies by volume of shares traded and the top 10 listed companies by market capitalization for the analysis (see NSE 1993: 39, 40), it will be noted that as at 1984 (the starting point of our analysis), there were only 92 quoted companies on the Stock Exchange. More importantly, about 50 per cent of these got listed during the preceeding five years and as a result, their historical records were fairly short.

Furhtermore, about 50 per cent of the listed companies were found to be inactive on the stock market on daily basis in terms of trading in their share. Therefore, rather than bring in all the inactive stocks, which will tend to bias the results, we resolved to include the most active stocks across sectors for representativeness, reliability and for more meaningful analysis. Consequently, the daily, weekly and monthly share price changes of the selected companies were employed for our analysis.

Furthermore, some critical indicators of the stock market were used. These include the volume and value of industrial, government, and all other securities, market capitalization, share price index, new capital issues and the number of listed companies.

We attempted to look at the performance of each of these indicators before and after liberalization.

1.5 Organization of the Study

The rest of this report is organized as follows. In chapter 2 we highlight the Nigerian stock market profile, tracing the evolution and growth to date. Next in chapter 3, we examine the link between financial reforms and the capital market. The review of the literature and their relevance to the Nigerian case is presented in chapter 4. Next in chapter 5, we provide a searchlight into the theoretical framework. The methodology is presented in chapter 6. The empirical analysis is presented in chapter 7. An overall performance analysis is done in chapter 8. We conclude with some recommendations in chapter 9.

CHAPTER TWO

THE NIGERIAN STOCK MARKET PROFILE

In this section, we highlight the profile of Nigerian stock market as a prelude to understanding its growth and performance between 1960 and 1992.

2.1 Evolution and Growth of the Nigerian Stock Market

The evolution of the stock market in Nigeria can be traced back to 1946, when the Ten Year Plan Local Ordinance was promulgated. The ordinance provided for the floatation of 300,000 local loan stock bearing interest at 3¼%, annual interest with a maturity of 10 to 15 years. The issue was reported to have been oversubscribed by 500,000. However, the bulk of response was from the United Kingdom (Arowolo, 1971).

In 1951, another attempt at capital accumulation was made through the creation of a loan fund for financing some public utilities. These were the significant attempts at providing investment opportunities to Nigerians. As a result, they can be seen as the genesis of capital market development in Nigeria.

In May 1959, in pursuance of its role and commitment to capital market development, the Central Bank of Nigeria (CBN) floated the Federation of Nigerian Development Loan of N4 million on behalf of the government. The absence of a formal stock market made the task of ensuring the marketability of the

stock floated difficult. The Barback Committee had been set up in May 1958 by the then Federal Minister of Commerce and Industry to consider ways and means of fostering a share market in Nigeria.

Following the report of the Barback Committee, the Lagos Stock Exchange was registered in March, 1960. It was later incorporated under section 2, Cap. 37 of the Lagos Stock Exchange Act, of 15th September, 1960.

One basic objective of the Lagos Stock Exchange as specified in its Memorandum and Articles of Association is to provide facilities to the Nigeria public for the purchase and sale of funds, stocks and shares of any kind and for the investment of money. Similarly, a legal framework was provided through the Lagos Stock Exchange Act of 1960. For instance, Section 3 of the Act states that "The business of stockbroking in Nigeria in relation to stocks, shares and other securities for the time being granted a quotation by the Exchange shall be undertaken only by members of the Exchange".

Section 4 spells out the penalty for a violation of the provision in section 3. It comprised a fine not exceeding ₦1,000 for an individual or an imprisonment of 2 years or both. For an incorporated organisation, the penalty was a maximum of N5,000 (see Alile and Anao, 1988; Areago, 1984).

The stock market trading began formally with 10 securities in June 1961. The securities comprised 6 government bonds, 1 industrial stock and 3 equities. However, the number of listed securities latter increased from 10 in 1961 to 217 in 1990. Similarly, the composition of the listed securities changed drastically with 43 Government Loan Stock, 43 Industrial Loan Stock and 131 equity stock, including those on the second-tier securities market (see Table 1 in the Appendix).

There are basically two types of membership of the Exchange namely Ordinary and Dealing members[1]. Dealing members increased from 3 in 1972 to 80 in 1990. On the other hand, Ordinary members increased from 17 in 1972 to 211 in 1990. A fairly recent development is the introduction of the second-tier securities market (SSM) in April 1985[2]. As at 1992 the number of securities quoted on the SSM was 20. They comprised mainly equity stocks from small scale and medium size entrepreneurs in Nigeria.

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[1]An ordinary member is one who, in accordance with the articles of the exchange, has taken up five shares of the issued share capital of the exchange, and has been admitted into the register of members. A dealing member of the exchange is a person or an institution who, in addition to being an ordinary member, is licenced by the council to trade in stocks, shares and bonds on the stock market.

[2]The Second-tier Securities Market is a market introduced to assist small and medium sized companies that are unable to meet the requirements of the First-tier Market in raising long term capital.

The basic feature of the SSM is the reduction in capital requirement for listing on the market and the relaxation of the disclosure requirement.

2.2 Performance of the Nigerian Stock Market

One basic role of a stock market is to serve as a vehicle for capital mobilization. Capital mobilization in this sense means channelling of savings into new uses through the issue of securities which will result in a net increase in the aggregate investment in equity or loan stock and thus, net capital formation. The table that follows presents the net contribution of the stock market into the Gross Fixed Capital formation.

From Table 2.1, it can be seen that the position of the Nigerian stock market in terms of its contribution to the overall capital formation, was quite low. The percentage contributions range from 0.5 per cent to a maximum of 12 per cent between 1980 and 1989 except 1990 when it moved to 32.5 per cent. In fact, if we exclude government stocks, the story will be more worrisome. This leaves much to be desired as it suggests that the stock market lacks the appeal to most entrepreneur. A similar observation was made by Samuel and Wilkes (1980), concerning the stock exchange in Great Britain in 1980. It was noted specifically that the number of companies listed on the London Stock Exchange reduced by about one-sixth

between 1974 and 1977 (see also Alile, 1986). The Nigerian experience therefore may not be an isolated case.

On the other hand, in terms of the growth of the stock market, the number of quoted securities had grown from 10 in 1961 to 239 in 1991. This represent an increase of about 2170 per cent. A particularly noticeable case is that of equity stock which grew from 3 in 1961 to 131 in 1990 representing over 4,300 per cent increase. Industrial loan stock has increased from 1 to 43 between 1961 and 1992.

To enhance accessibility of the stock market facilities to investors and other users of funds, the stock market has been decentralized. As will be shown later, there are currently six trading floors. These are located in Kaduna, Port Harcourt, Kano, Onitsha, Ibadan and Lagos. The aim is to ensure that an increasing number of investors from different parts of the country patronize the stock market. There are 211 members (dealing and ordinary) operating in the cities where the trading floors are located as of 1992. There has not yet been any statistical analysis of geographical distribution of stock market users in Nigeria. However, it is contended that share allotment has been widely dispersed (Alile and Anao, 1986).

TABLE 2.1: **CONTRIBUTION OF THE STOCK MARKET TO THE GROSS FIXED CAPITAL FORMATION** (₦ million)

Years	Gross Fixed Capital	New Capital Issues	% Contribution of the stock market
1980	10,841.2	372.3	3.4
1981	12,215.0	336.2	2.7
1982	10,922.0	454.3	4.1
1983	8,135.0	479.4	5.8
1984	5,417.0	25.0	0.5
1985	5,573.0	675.4	12.1
1986	7,323.0	646.0	8.8
1987	10,661.1	285.8	2.6
1988	12,383.7	280.9	2.2
1989	18,414.1	1,627.6	8.8
1990	30,626.8	9,964.4	32.5
1991	35,423.9	1,024.0	2.9
1992	58,890.0	1,660.0	2.8
1993	104,750.0	2,734.4	2.6

Sources: 1. The Nigerian Stock Exchange **Annual Reports** (Various Issues)

2. CBN, **Statistical Bulletin**, Vol. 4 No. 2, 1993.

Notably, a comparison of the market capitalization of the Nigerian stock market with other emerging stock markets shows that the performance of the Nigerian stock market is still very poor as revealed in Table 2.2.

TABLE 2.2 **STOCK MARKET SIZE RELATIVE TO GROSS NATIONAL PRODUCT,**

COUNTRIES	Market Capitalization. (U.S $m)		Size of Market to GNP. (%)	
	1989	1991	1989	1991
NIGERIA	1,005	1,882	5.9	5.6
KOREA	140,946	92,373	45.7	33.6
BRAZIL	44,368	42,759	43.5	9.6
MALAYSIA	39,842	58,627	68.6	128.0

Source: IFC, Emerging Stock Markets, (1991).

Another major focus is the allocative efficiency of the stock market. In an efficient market, securities prices should reflect the market's collective judgement of the relative worth of each security (Fama, 1970). Factors influencing allocative efficiency of a stock market include, quality of information, degree of investor's rationality, growth of the market and degree of freedom from restrictions. Consequently, any form of restrictions on the marketing process, including the determination of share prices by an external body, such as the Security and Exchange Commission, may distort the working of the market process.

Currently, there is the need for evidences to conclude that security prices are efficient. The market appeared too thin, until recently, in terms of available number and value of

securities. Trading in some high grade securities such as gilt-edged ones are virtually absent, until recently (NSE, 1992:36). Consequently, the market is dominated by fairly dormant securities. The tentative conclusion appears to be that the stock market in Nigeria has performed below expectation in terms of allocative efficiency.

Finally, a remarkable point is that of security price movements. The rate of change in security prices represents an indicator of the relative performance of one stock as against others in the same competitive market (Alile, 1986). A change in a security's market can result from a relative change in its risk-return profile. The stock price index in Nigeria shows an appreciation of 75.1 per cent for all sectors between 1984 and 1990. The implication of this for the overall market efficiency will be examined later.

2.3 **Problems confronting the Nigerian Stock Market**

Some observers have identified certain weaknesses in the Nigerian stock market which seemingly had constrained its expansion in depth and breadth of operation.

According to Ike (1984), these include the following:

(i) low interest rate structure;

(ii) paucity of the market operators;

(iii) presence of unregulated informal financial market;

(iv) constraining securities laws;

(v) alledged underpricing of securities;

(vi) high positive transaction costs; and

(vii) rigorous listing requirements.

2.3.1 Low Interest Rate Structure

Prior to the deregulation of interest rate in 1987, it was believed that the Nigeria's interest rate structure did not reflect the real cost of capital. Yields on government instruments were too low. Consequently, it was the Central Bank rather than the public that was absorbing the securities. It was contended that if the rates were to be higher to reflect the true opportunity cost of capital, the public would have desired owning more securities. Given the average inflation rate which was about 12 per cent prior to deregulation, the real rate of interest to most institutions would have been negative (CBN, 1991).

TABLE 2.3: **STRUCTURE OF INTEREST RATE IN NIGERIA (PERCENT)**

	Central Bank			Deposit Rates				
		Treasury Certificate		Time				
Years	Treasury Bills	One Year Maturity	Two Year Maturity	3 months	3 - 6 months	6 - 12 months	over 12 months	Sa
1980	5.00	5.50	6.00	5.75	6.00	6.25	6.50	6.
1981	5.00	5.50	6.00	5.50	6.00	6.25	6.50	6.
1982	7.00	7.50	8.00	7.25	7.50	7.75	8.00	7.
1983	7.00	7.50	8.00	7.25	7.25	7.75	8.00	7.
1984	8.50	9.00	9.50	9.75	7.25	9.75	10.00	9.
1985	8.50	9.00	9.50	9.25	9.50	9.75	10.00	9.
1986	8.59	9.00	9.50	9.25	9.50	9.75	10.00	9.
1987	11.75	12.25	12.75	14.90	15.30	15.10	15.80	14
1988	11.75	12.25	12.75	13.40	12.10	13.70	14.30	14
1989	17.50	16.38	17.75	18.90	21.60	21.40	21.20	16
1990	17.50	18.20	18.80	19.60	20.50	22.10	23.00	18
1991	15.00	15.00	15.50	15.71	17.09	20.10	20.10	14
1992	21.00	22.00	23.00	20.23	21.04	21.12	20.50	16
1993	26.90	27.40	27.80	23.60	23.26	23.99	28.02	16

Source: Central Bank of Nigeria (1993) Statistical Bulletin Vol. 4, Nos 2 December, P.26

TABLE 2.4 INFLATION RATE IN NIGERIA (1980-1990)

Year	Inflation Rate
1980	9.9
1981	20.9
1982	7.7
1983	23.3
1984	39.6
1985	5.5
1986	5.4
1987	10.2
1988	38.3
1989	40.9
1990	7.5
1991	13.0
1992	44.5
1993	57.2

Source: CBN, (1993) Statistical Bulletin, Vol. 4 No 2, p. 129.

A comparison of two Tables 2.3 and 2.4 shows that the real rates of interest which is given as the nominal rate minus the inflation rates were negative. Equally, securities holding appeared unattractive to private investors who are not bound by applicable laws with regard to the composition of their investment portfolio. The preference was for the equity yielding higher investments as against those with fixed interest. Regretably, government stock with relatively low yield featured more prominently. It was also contended that

the inactivity in the bond market was a reflection of the relative unattractiveness of the yields rather than the low volume of transactions (Ike, 1984).

TABLE 2.5: **LENDING RATES IN NIGERIA (1980 - 1992)**

Year	First Class Advance	Produce Advance	Other Advances
1980	7.50	8.50	9.50
1981	7.75	9.75	10.00
1982	10.25	7.75	11.75
1983	10.00	9.75	11.50
1984	12.50	7.00	13.00
1985	9.25	8.50	11.75
1986	10.50	10.50	12.00
1987	17.50	19.00	19.20
1988	16.50	17.30	17.60
1989	26.80	25.90	24.60
1990	25.50	26.00	27.70
1991	20.01	20.51	20.80
1992	29.80	30.80	31.20
1993	36.09	39.06	18.32

Source: CBN (1993) Statistical Bulletin, Vol. 4 No 2 P.26

2.3.2 Paucity of Market Functionaries

Market imperfection can be epitomized by the paucity of functionaries. Consequently, the fewer the functionaries, the less active the stock market will be. This could result in a tendency for the few functionaries, for example, to manipulate

prices in a way that works against the interest of the investing public. As at 1991, the dealing members on the Nigeria stock market stood at 110. As the number increases the market is expected to be more dynamic and competitive. The possibility of collusion by dealing members for price manipulations would tend to be minimal. It is noteworthy that the ordinary members (146) outnumbered the dealing members (110) who are supposed to be the major participants in the stock market. This is reflected in the low level of activities on the stock market. Furthermore, between 1972 and 1985, the number of ordinary members continued to be in multiples of the dealing members however between 1990 and 1991, the wide margin narrowed down considerably. In general, the growth rates fluctuate between 11 per cent and about 180 per cent for ordinary members while dealing members increase by about 30 per cent to 250 per cent in some cases between 1972 and 1991.

TABLE 2.6 **MEMBERSHIP OF THE NIGERIAN STOCK MARKET**

Year	No. of Ordinary Members	No. of Dealing Members	Total
1972	14	3	17
1977	37	4	41
1980	63	10	73
1985	75	23	98
1990	131	80	211
1991	146	110	256

Source: Nigerian Stock Exchange; Annual Reports

2.3.3 Presence of Large Unregulated Informal Markets

As can be noted during the period of implementing the indigenization policy, informal markets featured prominently thereby resulting in low patronage of the official stock market. For example, it was reported that over 1000 companies out of 1,120 which complied with the indigenization measures sold their shares through unofficial arrangement (Ike, 1984; Gill, 1982).

The absence of a second-tier securities market (SSM) until 1985 left a lot of securities from small and medium scale firms with no avenue for trading. The establishment of the SSM in April 1985 thus served as a relief in the sense that firms with relatively small capital outlay could be listed on the SSM. With the less stringent conditions, SSM could serve as a training ground for companies preceding full listing. The rigours of the listing requirements are discussed further in section 2.3.7.

2.3.4 Constraining Securities Laws

Several Acts relating to the operation of the stock market are in operation. However, most securities laws in the country have been regarded as instruments for raising only government shares. For instance, there are the Income Tax Management Act (1961), the Insurance (Miscellaneous Provisions) Act 1964, and the Insurance Act (1976).

Mostly, these enactments appeared to direct institutional saving to government stocks since they happened to be the major

ones quoted on the stock exchange until recently. A look at table 2.7 below shows that government securities dominated the stock market, up till 1991, partly due to the contraining legislations.

As can be observed from Table 2.7, government securities accounted for well over 90 per cent of the total value of securities in most of the listed years. Specifically, government stock was 98.7 per cent and 98.5 per cent of total value of stocks in 1970 and 1975 respectively. It also stood at 97.9 per cent in 1980 valued at about ₦380.8 million out of the N388.7 million for the total value of all securities. The proportion was 92.6 per cent in 1985. However, the proportion declined to about 65 per cent in 1990, and to about 16 per cent in 1992. This could be traced partly to privatization exercise which transferred ownership of some government securities in certain parastatals to private individuals.

In more advanced countries, industrial bond listings usually dominate the stock market. The converse appears to be the case in Nigeria prior to the privatization of some public enterprises which is currently going on. The stock market in Nigeria had functioned more as an outfit for government to raise loan finance rather than an instrument for mobilizing industrial finance. The securities laws are assumed to have contributed to this development in no small measure.

Table 2.7: **Value of Transactions in the Nigerian Stock Market (1970 - 1993)**
(₦'million)

Year	Government Securities	Industrial Securities	Total	%Contribution of Government Sec. to Total.
1970	16.4	0.2	16.6	98.7
1971	32.7	3.5	36.2	90.3
1972	26.2	1.0	27.2	96.3
1973	91.9	0.5	92.4	99.4
1974	49.4	1.3	50.7	97.4
1975	62.8	0.9	63.7	98.5
1976	111.3	0.6	111.9	99.4
1977	178.8	1.2	180.0	98.8
1978	187.2	2.5	189.7	98.9
1979	249.7	4.7	254.4	98.1
1980	380.8	7.9	388.7	97.9
1981	298.7	6.1	304.8	98.0
1982	207.0	8.0	215.0	96.2
1983	384.8	13.1	397.9	96.7
1984	240.9	15.6	256.5	93.9
1985	295.3	213.3	518.6	56.9
1986	477.3	20.3	497.9	95.9
1987	340.0	42.4	382.4	89.0
1988	99.4	33.0	132.0	75.0
1989	507.0	63.0	570.0	88.9
1990	155.0	83.0	238.0	65.1
1991	92.6	141.8	234.6	60.1
1992	85.0	406.6	491.6	16.1
1993	84.2	719.7	803.9	10.1

Source: Nigerian Stock Exchange; Annual Reports.

2.3.5 Underpricing of Share Issues

Industrialists have contended that the quoted price for their stocks fall short of the actual worth of such issues (Ike, 1984). There is the view that free market force is supposed to determine rational prices for both new and existing securities. In 1972, the Capital Issues Commission was established. Later in 1978, the Securities and Exchange

Commission (SEC) was established and charged with the duty of determining the offer prices. There was the view that the methods used by the commission led to low pricing (Gill, 1982). Thus, the regulatory agency that operates in the direction of reducing the volume and value of securities superceeds the efficient allocative power of the price mechanism.

The phenomenon of underpricing has been examined by some scholars. Lately, Ariyo (1991), in a recent study, has shown empirically that there is no significant difference in the share prices approved by NSEC and those suggested by the dividend model except those suggested by the earnings valuation model (see also Kadiri, 1983 and Akamiokhor, 1983; 1986). However, a recent survey of some unquoted companies revealed that a good number of industries shy away from the stock market for fear that their shares might be underpriced. This, if it happens represents a capital gain to the buyer of an underpriced (i.e. when a share is priced below its true market value) issue but a loss to the firm issuing out the shares (Ogwumike, and Omole 1992).

It can also be noted that, in an attempt to protect the investor, the mechanism for pricing in the secondary market has led to low level of activities on the stock market. This is due to the fact that the stock exchange also monitors the offer price between the buyer and the seller before transactions and transfer of stock certificates could take place.

2.3.6 The High Transaction Costs

The financial cost of going public, and for quotation on the Stock Exchange, appears to be too high for many industries. Equally, the process of listing is relatively tedious and complicated. Transactions cost, no doubt, include a lot of direct and indirect costs emanating from the minimum requirement for listing.

For instance, there is the requirement of detailed record of the company, as well as, its prospects. In addition to preparation and publication of annual reports and accounts, holding of annual general meetings is necessary and compulsory for listed companies. There are also fees to be paid to financial intermediaries and personnel including issuing houses, auditors, trustees, solicitors. Commitment fee, transfer fee, professional fee, underwriters fee, and stamp duties are other costs. It was once estimated by a reputable firm that it could cost the company an estimate of N6.5 per account year, on the average for each shareholder (Business Times, Jan. 11, 1992, p.8). To be added to this is the minimum commission to dealers. With the current economic recession, most firms may find the financial obligation too difficult to meet. Hence, their low patronage of the stock market for purposes of listing.

2.3.7 Rigorous Listing Requirements

The introduction of the SSM was necessitated by the claim that the listing requirements were too rigorous for many

indigenous businesses to meet. For instance, there was the requirement that the company be incorporated under the Companies Decree and the Memorandum and Articles of Association be acceptable to the Council of the Stock Exchange.

Also, it was stated that not less than 25 per cent of the issued share capital, and having a minimum value of N250,000, must be made available to the public. Furthermore, preliminary application with a view to ascertaining the suitability of a security for listing must be submitted with the required items of financial information. Such items include the preceding five years turnover, profit before and after taxation, dividends, capitalization issues, trade debtors and creditors, external indebtedness, retained profits, reserves and net tangible assets, estimated profits and appropriations and two copies of the audited accounts for each of the preceding five years. In general, the listing requirements are intended to safe guide intended investors by providing adequate information regarding the true worth of the firms.

Apart from the fact that very few indigenous Nigerian companies could satisfy the requirements of N1 million paid-up capital, it is widely believed that private businessmen usually cherish their confidentiality as they prefer secrecy for their business operation, probably for purposes of wide scale tax evasion.

Other pertinent problems relate to the unwillingness of the Nigerian businessmen to divulge the ownership of their

jealously guided business empire. Soyode (1988), asserted that Nigerians should be enlightened to realise that 20 per cent of N1 million is better than 100 per cent of nothing.

2.4 Possible Consequences of the Problems

A capital market sets out to foster the mobilization of financial resources with which newly issued securities of government or enterprises can be purchased. Furthermore, the market attempts to improve the efficiency of capital allocation through competitive pricing. Equally, there are opportunities for individuals to invest in a wide range of securities offering a wide range of risks and returns.

Admittedly, all these laudable objectives and intent of capital market development have been adversely affected by the earlier mentioned problems.

For example, the stock market in Nigeria has been seen to be shallow and lacking resilience. It is thin in size relative to the economy. More so, the development has led to the predominance of money market as an alternative source of fund (See Soyode, 1988; Ike, 1984 and Gill, 1989).

More importantly, the efficiency of the capital market in terms of mobilization and allocation of the fund has been constraint by the various administrative bottle-necks and lack of awareness of investors of opportunities that abound in trading their shares. Consequently, poor performance of the Nigerian stock market has been brought to a sharper focus, more so as the grants and funds coming from the advanced countries,

to developing nations, including Nigeria, are growing less and less. It therefore becomes necessary to examine the Nigerian stock market with a view to assessing its growth and the impact of financial reforms on its operation. This will provide a window to look into its future.

In the next chapter, we shall consider the features of the financial reforms and deregulation especially as it influences the stock market. The theoretical expectations will also be explored.

CHAPTER THREE

FINANCIAL REFORMS AND ECONOMIC LIBERALIZATION IN NIGERIA.

3.1 Background to Reforms

A number of countries, both developed and developing, have taken steps to liberalize their financial systems during the past decade. For instance, interest rates have been liberalized in Argentina, Australia, Ghana and Nigeria, to mention a few. Several countries, such as Chile and Korea, have privatized their commercial banks. Others such as Korea and the Philippines have reduced their directed credit programmes and interest rate subsidies (The World Bank, 1990).

These shifts in policy were prompted by several factors. First, the economic shocks of the 1970s and early 1980s underscored the limitations of regulations on interest rates and credit. Second, the need for rapid economic development in most third world countries was becoming clear and urgent with the dwindling tax revenue coupled with inadequate external aids (Oyejide 1972). Thus, many developing countries began to place greater emphasis on the private sector and on market - determined pricing. Also, rapid advances in the developed countries, in telecommunications and information processing have spurred the development of new financial instruments and have promoted greater financial integration both domestically and internationally. This has made it more difficult for governments to control financial markets. Therefore, the shift now in financial policies is towards liberalization.

Consequently, a large proportion of recent writings about financial policies have also been on the theme of liberalization (Olashore 1991; Soyode 1991, 1992).

Liberalization represents a possible policy response, encompassing a package of measures intended to remove any undesirable state-imposed constraints on the free working of financial markets. It embodies the removal of interest rate ceilings, the loosening of deposit and credit controls, privatization of public enterprises, and various other measures (Killick and Martin, 1990).

Two important features of structural adjustment programmes (SAP) in the developing countries, particularly in the way it is promulgated by the Bretton Wood institutions, involve the liberalization of financial markets, which implies progressive capital market development and a reduced role for the public sector through privatization policy (Adam, Cavendish and Mistry, 1990). Perhaps the thinking is that a strategy of financial liberalization will help to simulate the role of finance which in turn would cause a resurgence of economic growth.

The Nigerian economy was largely depressed in the early 1980s with the resultant effect of persistent pressure on the financial sector. There were inadequate funds and a general lull in the economy coupled with sluggish movements in the monetary and credit aggregates. The need to encourage increased mobilization of resources and also promote a more

efficient allocation of available resources became paramount.

The economic depression became pronounced to the extent of warranting the declaration of a state of National Economic Emergency for a period of 15 months with effect from the 1st of October, 1985 by the then Armed Forces Ruling Council. Against the background of serious economic problems facing the Nigerian economy at the close of 1985 and the urge to revamping it, various economic policies were put in place in 1986 under the SAP. A good number of the policy initiatives relate to the restructuring of the financial sector in an attempt to boost the national economy. Indeed, the framework of structural adjustment contains a singular attachment to a strategy of "financial liberalization" from repression which it is argued, would of itself lead to economic growth, stimulate reform of the financial system and deepen the financial structure (Nissanke, 1991).

Consequently, Nigeria liberalized the foreign exchange market with the establishment of the second-tier foreign exchange market (SFEM) which constitutes the bedrock of the SAP in September, 1986. One of the key objectives of this policy was to attract foreign inflow of investible capital. This objective is far from been achieved yet.

Also, with effect from 1st August, 1987, all controls on interest rates were removed in line with the emphasis on the deregulation of the economy. This policy has the intent of enhancing private savings mobilization and more efficient

resource allocation. Additionally, the Federal Government embarked on privatization and commercialization of public enterprises in 1989, as an integral element of SAP. Additional complementary measures, such as sectoral credit guidelines, relating to credit expansion and channelling of investible resources to productive sectors were adopted.

The anticipated benefits of deregulation on resource mobilization is not far-fetched. For instance, deregulation would attract to the stock exchange, firms, which had earlier stayed away. They could now raise long-term funds at a relatively lower cost. Equally, the performance by companies enhanced by competition can culminate in increased share prices which in turn will enhance the market capitalization growth. Similarly, enabling economic environment propels positive market expectations which enhances share price appreciation. Notably, share price appreciation represents increased returns on investment in the stock market.

No doubt, gains from domestic financial liberalization may arise from improved incentives to save and more efficient allocation of resources. Hence, investment are expected to be enhanced through financial liberalization and increased intermediation. The process of capital accumulation is expected to be enhanced under financial liberalization.

3.2 Issues in Financial Reforms and the Link with Stock Market

The debate on the role of financial intermediation and the financial system in economic development was revived by

McKinnon (1973) and Shaw (1973). In the debate, the functions of finance in the saving-investment process were underlined as an effective mechanism for the mobilization and allocation of capital by equilibrating the supply of loanable funds with the demand for investment funds, and the distribution of risks and maturities (Nissanke, 1991).

In other words, financial intermediaries and financial market operations are expected not only to mobilize investible resources but also to ensure the most efficient transformation of mobilized funds into real productive capital. The general claim by the McKinnon and Shaw was that financial liberalization, besides stimulating savings and more efficient investment, raises the average efficiency of a greater volume of investment. On the other hand, the consequences of financial repression include low level of savings, reduction in the efficiency of capital allocation and the quality of investment, various distortions and negative implications for income distribution. Indeed, a balanced and competitive economic system contributes to macro economic stability by making the system more robust in the face of external and internal shocks.

There is also a link between financial policy reforms and stock market operations. In the Keynesian theory, impact of monetary policy can be transmitted to the rest of the economy through the monetary system. For instance, there is the assumption that in the presence of an efficient money market,

liberalization permits the allocation of funds among competing uses in an efficient way. It is believed therefore, that liberalization of interest rates, incorporating price competitiveness of the banking system would stimulate the rate of saving and hence the supply of domestic capital (Ndekwu, 1987: 82).

Shaw, (1973) expects real yields on all forms of wealth, including money, to have a positive effect on the savings rate. In Shaw's paradigm, where interest rates are at equilibrium levels through liberalization, the financial intermediaries can use their expertise to allocate efficiently, the larger volume of investible funds. Furthermore, Shaw contends that expanded financial intermediation between savers and investors, under ideal conditions, increased incentives to save and invest and also raises the average efficiency of investment. Additionally, it increases real returns to savers, while also reducing real costs to investors by accommodating liquidity preferences. It could also lead to reduction in risk through diversification, reaping economies of scale in lending, increasing operational efficiency and lowering information costs to both savers and lenders through specialization and division of labour (Nissanke, 1991).

No doubt, economic and social development can be accelerated by an efficient, competitive financial sector. This, in turn, requires a large and diversified savers and financial intermediaries and a wide range of financial

instruments and issuers to provide a "critical mass" of activity to warrant the necessary financial market infrastructure (Adam, Cavendish and Mistry 1990). On the other hand, a correlation appears to exist between relatively high degree of state control, small and inefficient financial markets, and less than optimal economic performance. For example, pegging interest rates below their market levels inevitably limits any capital market development. In fact, studies have suggested that rigid ceilings on interest rate have hindered the growth of financial savings, and reduced the efficiency of investment (Collier and Mayer, 1989).

In other words, interest rate rigidities can lead to capital outflows and disintermediation crises. Conversely, positive real interest rate attracts long term funds for investment. Therefore, artificial controls of interest rates often lead to demonetization and liquidity shortage which, in turn, hampers the velocity of activities on the stock market (Adam, Cavendish and Mistry, 1990).

Based on a background paper by Gelb (1989), the World Bank suggests that liberalizing interest rates can have powerfully beneficial effects. The paper documents a strong correlation across countries between real interest rates and the GDP growth rates and argues that the relationship reflects a positive association of financial deepening with interest rates which in effect promotes productive employment of capital (Collier and Mayer, 1989; World Bank, 1989). Hence, there is an observation

of a positive relationship between interest rates and the productivity of investments as measured by GDP growth rate to investment ratios.

Noticeably, the debate revived by McKinnon (1973) and Shaw (1973) on the effect of financial liberalization has attracted attention of some researchers in recent times. For example Callier (1990) contends that the role of the financial sector in the process of development goes well beyond the traditional concerns about resource to finance investment. Rather, the financial system now has an overwhelming influence on the allocation of the resources it mobilizes as well as the productivity of such investment. It was noted that the existence of widespread financial distress in the financial system clearly suggests that developing countries have much to gain from reforms aimed at improving the way the financial system operates to generate a higher rate of returns, than from measures designed mainly to increase the quantity of resources channeled through the financial institutions (World Bank, 1989).

Some prerequisites for a successful financial reform have been highlighted by Hamad El-Nil (1991). Essentially, the pre-condition include political commitment to reform, prevalence of a stable economic environment, a reasonable supply of logistics and the human and capacity building among others. Sundararajan and Leite (1991) examined the issues of interest rate management and liberalization. They contended that the

government has an important role in promoting competition through idealized interest rate regime. Equally, rates of return that exceed the cost of investment should be considered in determining appropriateness of relevant policies.

Lopes (1988), surveyed financial adjustment in a number of countries of Europe, Middle East, and North Africa, drawing from the experiences of Egypt, Hungary, Morocco, Tunisia and Turkey. He noticed that the fragmentation of the financial markets resulting from the regulations resulted in losses of economies of scale and in little incentive to improve efficiency. He opined that countries should carefully consider liberalization following the trend towards more competition.

Horch (1989), outlined the policies that could guide and foster the development of money and capital markets. He considered the benefits of an actively planned approach to money and capital market development, as opposed to a more passive evolutionary approach. He contended that an active approach is needed if the financial markets in the developing countries are to emerge strongly within a reasonable time frame.

The problems that financial institutions face when the financial system is being reformed were examined by Vogel (1987). He concluded that financial institutions have more opportunities not only to increase efficiency and profitability, but also faces a risk of encountering difficulties that can lead to insolvency, after the

implementation of an adjustment programme.

Popiel (1990), reviewed the role of financial markets in the development process. He identified the development of a stock exchange as both desirable and necessary not only to channel savings into long-term investments, but also to encourage the development of productive enterprises. Earlier, Popiel (1989), examines the phenomenon of financial depression that has taken on worldwide dimensions in the late 1970s and in the 1980s. He outlined various options and steps leading to a restructuring of distressed financial institutions and examined the macro economic and sectoral pre-requisites to financial restructuring. He also examined recent developments in international financial market that sharply intensified the process of financial innovation. He traced the forces that stimulated the financial innovation and surveyed briefly, the causes and effects of the structural changes that took place in international financial intermediation and reviewed the main new financial instruments. He identified some of the benefits of innovation as including the substitution of direct transactions in securities for bank credit and reduction in intermediation cost through competition.

Also, Callier (1991), reviewed the issues related to financial systems and policies in the context of economies relying, on market mechanisms to allocate resources. He also presented an inventory of the most common problems hindering the effective performance of the financial system as a

development tool, and some policy guidelines based on the analysis.

Hinds (1990), noted that the world has become more competitive, in the last two decades. He therefore, examined the implications of outward versus inward development strategy for the financial sector. He contended that government-owned financial institutions should try to maximize their profits, which means they should either be private or mimic private behaviour. Also, they should mobilize resources from the market, in free competition with other financial institutions. In such an environment, interest rates would tend to equalize throughout the financial market, thus becoming an effective instrument for screening potential uses for credit in accordance with their profitability. Roe and Popiel (1990), synthesized a succession on the restructuring of the financial system in Latin America. The discussion focussed mainly on the problems entailed by, or related to, financial stabilization and adjustment in Latin America. Policies to deal with the insolvency and illiquidity of financial intermediaries and options for further development of financial systems were examined.

Long (1989), examined the phenomenon of financial depression that has, in the late 1970s, and in the 1980s, taken a worldwide dimension. He concluded that financial depression has a severe impact on mobilization and allocation of financial resources and thereby on economic and financial development.

Roe and Popiel, (1988) also synthesized another discussion on the role played by financial policies and institutions in the process of adjusting an economy to external shocks and structural changes in its operating environment. Issues covered include the interdependence between general macroeconomic adjustment policies and specific financial adjustment policies.

Nissanke (1991), reviewed the financial liberalization experience in Asia and latin America. She also examined the structural impediments to savings mobilization and financial intermediation as including imperfect information and risk. She later opined that as policies are introduced to encourage capital markets in developing countries, the improvement in banking institutions' operation should be given due attention so that the economies could eventually benefit from the advantages of both bank-based, and non-bank based finance.

Adam, Cavendish and Mistry (1992) contended that successful privatization and capital market development are mutually reinforcing. They argued that whilst privatization can make a major contribution to the deepening of equity markets, a positive outcome from concurrent implementation of the privatization programme and capital development is by no means automatically assured.

Indeed, the debate and wide-ranging discussions about the need and consequences for financial liberalization is an on-going exercise. A recent effort by Soyode (1992), attempted

to assess the impact of economic restructuring on the Nigerian stock market in general. He identified exchange rate as the most significant factor influencing the market performance in the 1980s. However, the study did not include a test of the efficiency under restructuring, a gap which this study attempts to fill.

Another major concern relates to the link between privatization of public enterprises and the stock market. No doubt, the latter is a corner-stone in any privatization programme. Equally, privatization holds a special place in stock market operation for three reasons. First, privatization provides the additional listing on the stock market. Second, the floatation through privatization helps to inject new "life" into the market. Third, it gives diversity and a measure of maturity to the stock market. Indeed, stock market efficiency can also be measured in terms of "shareholder's democracy" brought about by privatization. In other words, privatization enhances the extent to which small savers have the same opportunities as the more privileged minority to maximize their risk-related returns (Adam, Cavendish and Mistry, 1991).

Furthermore, privatization can revitalize equity market to the point wherein it will be more efficient. Policies strengthening the domestic equity market and steps towards internationalizing the equity market, and privatization of public companies have led to a significant increase in the size of many stock markets. For instance, privatization policy in

Korea resulted in an expansion of the equity market from about 10 per cent of GDP in 1985 to about 30 per cent of GDP in 1990 (Adam, Cavendish and Mistry, 1992).

Generally, the increased volume of transactions brought about by privatization exercise represents a driving force toward the technological upgrading of financial market infrastructure, starting with the stock market itself. Privatization programme, no doubt, has remarkable impact on the structure of the financial markets. The stock market in turn serves as a barometer of the financial market.

3.3 Theoretical Link Between Liberalization and Stock market Efficiency

From the on-going discussion, one expects a positive functional relationship between the financial reforms and the stock market. At first, it could be expected that there would be an upsurge in the activities of the stock market as an interface of investment which also has a positive functional relationship with the growth of savings.

Earlier studies have established that institutionalized savings increased substantially with the interest rate liberalization. The evidence suggested growth in saving following the deregulation regime (See for instance, Ndekwu; 1991; 68).

Also, by widening the ownership base of the capital market through the issuance of public enterprises shares to the public, privatization provides a boost to the stock market operations. Invariably, the demand and supply mechanisms

provided impetus to share price movements which is enhanced by the liberalization of the financial markets.

There is a strong assertion therefore, that financial liberalization promotes efficiency through competition, and improved incentives to save. Consequently, share prices would be influenced. The reason is that share prices represent the worth of a company both now and in the future. If the economic environment is buoyant and the market expectation is positive, the share price will continue to appreciate. Notably, a company's present profitability and probability of continued future profitability are strong determinants of positive movement in share prices. Thus, share price appreciation potrays profitability and efficiency of investment. They serve as attractions or incentives to resource mobilization. By implication, such indeterminable movements in share prices constitute some elements of market efficiencies.

CHAPTER FOUR

LITERATURE REVIEW

4.1 Introduction

We present in this section various contributions in the literature relating to the efficient market hypothesis in general.

First, we proceed with a general review of past studies including recent contributions to the body of knowledge known as the Efficient Capital Market Theory and some empirical evidences. Next, we discuss issues relating to the determinants and measures of the performance of stock prices in general. This is followed by an overview of literature on the stock market operation in Nigeria. Furthermore, we review the current challenges to the stock market efficiency theory, based on recent findings. We conclude the section with some comments on the relevance of studies to Nigeria.

4.2 Review of Past Studies

4.2.1 Review of Study on Efficient Capital Market Theories

Many scholars have contributed to the growing body of knowledge on the Efficient Market Hypothesis which started as random-walk hypothesis (Fama, 1965). The original empirical work on the random-walk theory was done by Bachelier (1900, 1914). The result reported by Bachelier was confirmed later by Working (1934) and Cowles and Jone (1937). Other studies in support of the random-walk theory include Black and

Scholes, (1972), Horne and Parker, (1967), James, (1968), Fama and Blume, (1966), Mandelbrot, (1966), Roberts, (1959), Osborne, (1959), Moore, (1962), Morgenstein and Granger, (1963), Fama, (1965), Samuelson, (1965), Samuel and Yacout, (1981), and Ayadi, (1984).

Models of Capital Markets were developed by Sharpe (1964). Lintner (1965[a]) and Diamond (1967) in which they acknowledged the imperfection of the market system by assuming the existence of an incomplete set of markets. Tests of allocational efficiency of the capital market have been carried out by Fama, (1970), Chong and Meets (1971), Friend and Cani (1966) and Friend and Hasbroud (1982). Mandelbrot (1963) and Samuelson (1965) first recognized the importance of "fair game" models (the sub-martingale and random-walk) in the theory of efficient markets.

Indeed, most of the empirical research on the theory of efficient markets have been concerned with whether prices "fully reflect" particular subsets of available information. Most of the initial results of the weak-form tests came from the random-walk literature (Samuelson, (1965), Mandelbrot, (1966), Kendal, (1953), Working, (1934) and Roberts (1959).

The semi-strong form tests in which the concern was with the speed of price adjustment to publicly available information (e.g., announcements of stock splits, annual report and new security issues) was carried out by Fama, Fisher, Jensen and Roll (FFJR) (1969). Finally, there are

strong form tests in which the concern is whether any investor or groups (e.g., Managements of Mutual Funds) have monopolistic access to any information relevant for the formation of prices, such as in Niederhoffer and Osborne (1966), Scholes (1969), Sharpe (1965, 1966), Treynor (1965), and Jensen (1968, 1969).

However, Vasicek and McQuown (1972), asserted that all existing features of capital market theory do not correspond to reality always. But they contended that there is sufficient correspondence between reality and the extent of capital market theory which should therefore warrant the attention of the financial analysts.

They concluded that if the efficient market model is to be applicable to real capital markets, and not idealized ones, it must be able to explain actual observed price changes.

Fama, Fisher, Jensen and Roll (1969) examined the adjustment of stock prices to new information. Their evidence suggests that past stock splits for instance, have often been associated with substantial dividend increases. In realization of this, the market uses the announcement of a split, the market reacts only at its dividend implications such that the split causes price adjustments only to the level of future dividends. The study was based on data from the New York Stock Exchange between 1927 and 1959.

Officer (1975), studied the role of seasonality in the Australian capital markets. He examined the behaviour of share returns in relation to specific seasons. The test included forecasts of the seasonal variations. The results indicate some evidence of a seasonal variation. This however, did not indicate market inefficiency but reflects the structure of the economy characterized by changing opportunity cost of money through the year.

Basu (1977) contends that in a strong-form efficient capital market, security prices fully reflect available information in a rapid unbiased fashion, and that, security prices provided unbiased estimates of the underlying economic values. He tested the efficient market hypothesis by examining the investment performance of common stocks in relation to their price-earning ratios. He believed that price earning ratios are indicators of the future performance of a security. He claimed that prices of securities are biased and that the price-earning ratio is an indicator of the bias. He concluded that contrary to the view that publicly available information is instantaneously impounded in security prices, there seems to be lags and frictions in the adjustment process. As a result, publicly available P/E ratios seem to possess "information content" and may warrant an investor's attention at the time of portfolio formation or revision.

4.2.2 Review of Empirical Results from Past Studies on Efficient Market Hypothesis

We are presenting here, a brief summary of valuable empirical results from efficient market hypothesis studies in an attempt to highlight the diverse nature of such studies. Girmes and Benjamin (1975) carried out two tests to investigate the random walk hypothesis using 543 stocks and shares registered on the London Stock Exchange. They based the numerical analysis on observations of daily closing prices of the stocks and shares for a period of about 600 days from October 1968 to April 1971. They concluded that there were fairly strong evidence that the larger companies have more random share price movements. Of the 543 stocks and shares covered in the study, about 30 per cent were noticed to behave like a genuine random walk while 20 per cent deviated significantly.

In a similar development, Kemp and Reid (1971) examined the behaviour of equity prices in Britain in the context of the random-walk hypothesis. They employed time series of the price of 52 shares, of considerable length covering October 28 1968 to January 10, 1969. Noticeably, they used judgement sampling in an attempt to get a sample which was in some sense representative of the population. Their results showed that the random-walk hypothesis has been over-generalized with about 80 per cent of the sample found to be significantly non-random. Working with only daily prices,

they concluded that share price movements were conspicuously non-random over the period considered.

Shiller (1981) also attempted to uncover the determinants of movements in real stock prices and to see if such movements can be explained by new information about subsequent real dividends. He developed a simple Efficient Capital Market model relating real price of a share at the beginning of the time period to real dividend paid at the end of time. He noted that price movements cannot reflect new information about dividends if dividends never change. He concluded that stock price volatility over time appear to be far too high (about five to thirteen times) to be attributed to new information about future real dividends. He however contended that movements in stock prices can be attributed to changes in expected real interest rates.

French (1980), examined two alternative models of the process generating stock returns, namely the calendar time and trading time hypotheses. Under the calendar time hypothesis, the process generating stock returns operates continuously and the expected returns for Monday was to be three times the expected returns for other days of the week. On the other hand, under the trading time hypothesis, returns were to be generated only during active trading and the expected return was to be the same for each day of the week. His results, using the daily returns to Standard and Poor's Composite Portfolio between 1953 and 1977 were inconsistent

with both models. Rather, the average return for the four days of the week was consistent, while the average for Monday was significantly negative, during each of the five -year sub-periods.

He concluded that the persistently negative returns for Monday appear to be evidence of market inefficiency since investors could have increased their expected returns by altering the timing of trades, such as executing sales scheduled for Monday on the preceding Friday.

Gibbons and Hess (1981), also examine day of the week effect on asset returns. They conducted tests with the S & P 500 and the value-and-equal-weighted portfolios constructed by the Center for Research in Security Prices. They documented the existence of day of the week effect in asset returns, and strong daily seasonal and persistent negative mean returns on Monday for stocks. Even after adjusting for the market, stock returns still exhibit day of the week effects. They concluded that future tests of market efficiency, should allow for the day of the week effects in both raw returns and market adjusted returns.

Fama and Blume (1966) presented a review of theory and practice of filter rules and stock market trading. In their analysis of the filter rule and trading profit, they contended that if transaction costs are ignored, the filter technique appears to be inferior to buy-and-hold strategy except for two securities out of the thirty covered by their

study. Overall, they contented that the random-walk model was an adequate description of price behaviour. Additionally, their study confirm a strong correspondence between the filter results and serial correlation tests.

Rosenberg and Rudd (1982) examines the relationship between serial correlation and market inefficiency using stock returns. Using a linear multiple - factor - plus specific-return model for security returns, they decomposed total excess return into factor-related return and specific return. Their results show positive serial dependence in the factor-related component and negative serial dependence in the specific component which nearly offset one another, thereby resulting in zero correlation in total excess returns. Owing to the fact that the previous month's specific returns predict the current month's specific returns, with a t-statistic of -11, their results reject the weak-form of the efficient market hypothesis. It was noted that the predictive variables were essentially predetermined thereby warranting a rejection of market efficiency.

In a similar development, Rozeff and Kinney (1976) presented evidence of the existence of seasonality in monthly rates of return on the New York Stock Exchange from 1904 - 1974. Their dispersion measures revealed no consistent seasonal patterns and the characteristic exponent seemed invariant among months. However, they found that seasonality on the New York Stock Exchange, which appears undetectable in

the auto-correlation function of returns, becomes clearly evident once rates of return are tested by month. They noticed an outstanding feature of the seasonality as higher mean of returns of the January distribution of returns compared with most other months. They concluded that possible explanation for seasonality in the risk premium may be due to seasonality in market returns. They also affirm that the fact that expected returns vary by month is not necessarily inconsistent with market efficiency, since the market may still be efficient with respect to information patterns which do not allow the investors to earn abnormal rates of return which are incommensurate with the degree of risk that is accepted, the market can be regarded as efficient.

From the brief review above, one tentative conclusion, that can be made is that there is no universal agreement regarding the validity of the random walk hypothesis as applied to share prices. As Reid and Kemp (1971) asserted random-walk is "in the ascendant". Consequently, further verification of the applicability of the postulations of the theory to particular countries continued to be an empirical issue. Next, we shall examine the basic determinants of share prices as analyzed in the literature.

4.3 Determinants of Share Prices

The issue of the probable determinants of share prices have equally been dealt with extensively in the literature. Kumar and Mohan (1975), identified dividends and retained earnings as the major determinants of share prices in India. They asserted that dividends are relatively better explanatory variable for share prices and that retained earnings play relatively a minor role. Also, Fisher (1961) examined share prices of five cross-sectional samples of equities quoted on the London Stock Exchange between 1949 and 1987. The paper examined the effects of four variables on the share prices prevailing in the market for different companies. The variables include: the last declared dividends per share, the last declared undistributed profits per share, the past average annual growth in dividends per share and the size of companies to which the share correspond. All the variables exercised significant influence on share prices although at varying degrees.

Ibbotson (1975), examine the price performance of common stock. The paper studies the initial and after market performance measured by risk-adjusted returns, on newly issued common stocks which were offered to the public during the 1960s. The results confirm that average initial performance is positive, while the distribution of returns is skewed so that the subscriber of a single random new issue offering has about an equal chance for gain or loss. The

results are generally consistent with market efficiency. The study also indicated that new issue offerings are underpriced. Other investigators who have studied common stock public offerings include Reilly and Hatfield (1969), Stickney (1970), McDonald and Fisher (1972) and Logue (1973). Others include Stigler (1964) and Shaw (1971).

Lintner (1965) examined security prices, risks and maximal gains from diversification. He concluded that prudent selection and broad diversification can substantiably reduce the risks associated with given expected returns and improve the relation of expected returns to risks.

In a study of stock price behaviour, King (1966) argued for the hypothesis that market and industry factors explain co-movement in stock prices. The implication of this is that stock prices of similar market or industry will tend to move at a somewhat related direction. Long (1974) employed a form of capital market equilibrium to examine the consumer's reaction to uncertainty about shifts in commodity prices and how this reaction is reflected in portfolio choices and equilibrium stock prices.

Murphy (1989) analyzed the dynamics of the real exchange rate and the price of equity for a small open economy. He used an optimizing model in which the process of capital accumulation entails adjustment costs. The analysis demonstrated how changes in fiscal policies or interest rates can generate sustained movements in equity prices simply

because investment requires scarce resources. The results indicated that a stable and consistent set of fiscal policies can help reduce unnecessary volatility in real exchange rates and equity prices.

Also, Harkavy, (1953) examined the relation between distributed earnings and common stock prices for large listed corporations. He concluded that there is a tendency for stock prices to vary directly with the proportion of earnings distributed, as of a given time. Over a period of years, the stock of corporations retaining the greater proportion of earnings tend to exhibit the greater share appreciation.

Overall, one important conclusion one can draw from these studies is that the macro economic environment has significant influence on stock prices. By implication, policies that affect the economic environment will tend to have impact on the behaviour of stock prices. The direction will depend largely on both the nature of the environment and the pattern of influence. This underscores the need for enabling macro economic policies.

4.4 Contributions to Stock Market Operation in Nigeria

On the Nigerian scene, there have been a number of contributions on different aspects of the Nigerian Stock Market. Among these are, Ojo and Adewunmi, (1982), Akinnifesi, (1988), Ike, (1984), Nemedia, (1982), and Phillips, (1978, 1985). Problems of company dividend policy have engaged the attention of Uzoaga and Alozieuwa, (1974),

Adedeji, (1985), Inanga, (1975), Soyode, (1975), Oyejide, (1976), Odife, (1977) and others. The two methods adopted by the Security Exchange commission (SEC) in security valuation, namely (i) the Net Asset Value Method; and (ii) The Earnings or Maintainable Profit Basis were discussed by Akamiokhor (1983) and Akingbohungbe (1985). More pertinent issue about corporate behaviour having bearing on stock price changes as well as the extensive use of debt and retained earnings in financing industrial growth and the pattern of shareholding in Nigeria have been examined by Soyode (1976, 1978).

In an earlier work, Soyode (1975[b]) contended that the cost of equity capital was higher than the cost of borrowing in the 70s. He also showed that while the least return on investment shares was approaching 50 per cent per annum, the cost of borrowing (debt) remained at 20 per cent or less prior to 1973. This partially explains the reason for the "pervasive use" of retained earnings and borrowing (debt) by firms rather than going into the capital market for additional funding.

Kadiri (1983), contended that the absence of intervention by government in the valuation of securities during the indigenisation periods resulted in heavy financial loss by many Nigerians. He therefore stressed the need for government intervention in security valuation. The basic sources of funds for corporate organisation in Nigeria, namely, equity capital, retained earnings and debt and the

need for long-term capital for investment activities have been discussed by Oyejide and Soyode (1976) and Oyejide (1987). The focus of the Capital Assets Pricing Model (CAPM) namely, the description of the equilibrium state of the efficient capital markets and an explanation of the implications for wealth allocation decisions by investors among securities and portfolios in the capital market under conditions of risk and uncertainty was discussed by Inanga (1977) and Vasicek and MsQuown (1972).

Ariyo and Soyode (1985), also attempted to provide a framework aimed at measuring information adequacy, and for the determination of items being considered for disclosure to enhance the adequacy of the information. They concluded that the concern with the quality and quantity of information contained in Annual Financial Reports (AFRs) should also not overlook any possible information overload (i.e. too many information) and other limitation of human beings at processing information. They therefore suggested that the evolution of an efficient accounting information disclosure process requires an evaluation of the likely impact of existing information items on the one being considered for disclosure. This effort extends the assertion by Inanga (1977), that the information content of annual accounts published within the provision of Companies Decree of 1968, and partly being used by the Securities and Exchange Commission for share pricing, appears inadequate for

investment decision, such as buying or selling of shares in a company. He contended that such statement presented are basically historical and often intended for purposes other than assisting shareholders in their investment decisions (Inanga, 1976). Ajayi (1978), therefore contended that in the absence of a variety of financial assets which are substitutes for money, the alternative form of holding money as a form of wealth would then be real assets holding.

Other current efforts include Soyode (1991; 1992) which attempt to examine the impact, of economic restructuring on the Nigerian Stock Market. He concluded that the economic restructuring have had some remarkable impacts on the stock prices. Ariyo (1990) also reviewed the share valuation method under the on-going privatization of public enterprises programme in Nigeria. He concluded that the share pricing mechanism adopted by the SEC were in line with the model-based prices. Similarly, the rationale for privatization in Nigeria as well as lessons from the international experience were examined by Adegbite (1990). She opined that privatization may just be an economic fad, hence, caution must be exercised as the state retreats.

Ogwumike and Omole (1992), highlighted the role of capital markets in mobilizing domestic financial resources for economic development in Nigeria. The study reveals that the Nigerian stock market has a lot of potentials if complementary financial policies are put in place.

Similarly, Omole and Falokun (1992) highlighted lessons from the recent privatization policy in Nigeria for possibilities of increasing equity holdings and enhancing growth in the Nigerian economy. Based on the results from the privatization exercise so far, the study concludes that privatization can bring about more equity holdings and growth if it is well implemented.

4.5 A Review of Current Challenges to Efficient Market Theory

However, there have recently been challenges to stock market efficiency. The current evidence is from the Mean Reversion studies. Engel and Moris (1991) noted that many analysts have begun to question the reliability of the efficiency of the stock market. The major basis for the challenge is a fall in Dow-Jones Industrial Average by 23 per cent in October 19, 1987. The question is, what information could have possibly caused the profits of the companies to fall by such substantial amount. Thus, many analysts contend that the stock market is inefficient because many traders pay attention to information unrelated to future profits. The article surveys the mean reversion evidence which is defined as "the tendency for prices to overshoot but eventually revert to true values". It was found that stock prices might be mean reverting, although the evidence claimed was not strong enough to rule out market efficiency.

Fair (1970), provided an analysis of a large-scale macro-econometric model with rational expectations in bond

and stock markets. Indeed, the assumption of rational expectations in bond and stock markets has received increased attention in works with theoretical and empirical models. (Lucas, 1973); Sargent, (1973); Sargent and Wallace (1975). A criticism of this class of models was provided by Fair (1978).

In a review of the capital market efficiency issues, Levy (1990) portends that the statistical evidence accumulated in the 20 years following Fama's (1970) survey raised questions about his conclusion that capital markets are efficient. He claimed that stock price volatility has been shown to exceed the volatility consistent with capital market efficiency. Furthermore, other available evidence include the small-firm effect, the January effect, and related anomalies of stock prices which he claimed points in the same direction. The stock market sell off of October 19, 1987 was therefore seen as an evidence that capital markets may not be efficient after all. Rather, the evidence seems to suggest that most fluctuations in stock prices cannot be traced to changes in rational forecasts of future dividends, contrary to what the efficient markets model predicts.

Similarly, Roll (1980) reported the results of tests of whether the efficient markets model provides accurate ex-post explanations for stock prices. His conclusion was that some irrelevant information appears to be of dominant importance in explaining stock prices variations.

Also, Cecchetti, Lam and Mark (1990), demonstrated that the presence of negative serial correlation in long horizon stock returns is consistent with an equilibrium model of assets pricing. In a study on the presence of mean reversion in equilibrium assets prices, they concluded that stock prices are mean reverting. Earlier, Poterba and Summers (1988) found that their variance ratio test rejects the hypothesis that stock prices follow a random-walk. However, Lucas (1978), and Michener (1982), contended that the serial correlation of returns does not in itself imply a violation of market efficiency.

Engel et al (1989), tested the conditional mean-variance efficiency of the U.S stock market. They found that stock-market shares by themselves have statistically significant explanatory power in predicting monthly excess stock returns. However, there was mixed support for the assumption that forecasts could be rational.

No doubt, the abrupt daily stock price changes of recent years have rekindled interest in ways to curtail stock market volatility (Hardouvelis and Peristiani (1990). The issue of the link between stock market dispersion and business cycles was examined by Loungani, Rush and Tave (1991). They contended that stock market dispersion is a potentially important factor for predicting business cycles. Change in such dispersion, they claimed, account for the stock price variation. In a summary of the symposium organised by the

Federal Reserve Bank of Kansas City on "Financial Market Volatility", Weiner (1989) noted that the stock market crash of 1987 sent shock waves through the world's financial markets. The crash was responded to by sharp swings in the credit markets, commodity markets, and foreign exchange markets. To this extent, it is believed that financial market volatility has important consequences for investors and policy makers.

For instance, Becketti and Sellon (1990) asserted that investors equate higher volatility with greater risk and thus alter their investment decisions in the light of increased volatility. Equally, policy makers may feel that increased financial volatility threatens the viability of financial institutions and the smooth functioning of financial markets. Alternatively, policy makers may see financial volatility as spilling over into the real economy thereby harming economic performance. Indeed, persistent volatility of stock prices, interest rates and exchange rates are seen to be detrimental, as such volatility may impair the smooth functioning of the financial system and adversely affect economic performance. Hence, the increased attention and much concern over financial market volatility in recent times. Of much concern has been the stock market shock which centered on the 508 - point drop in the Dow-Jones average on October 19, 1987, which was the largest one-day percentage drop in history. The effects can be in various channels including fall in

consumer wealth, weakening consumer confidence in the stock market and a reduction in business investment spending, to mention a few.

4.6 Relevance of Studies to the Nigeria Case

Given the age of the Nigerian stock market and the rapid expansion it has witnessed in the past thirty years, in terms of institutional mechanism and the number of participants in the market, it can be seen that the studies reviewed are quite relevant to an appraisal of the Nigerian Stock market.

Also, to the extent that efforts are being made to ensure that the Nigerian stock market operates like the other stock markets in the advanced countries, the applicable principles in the literature would therefore be relevant. For instance, trading floors have been increased to six while dealing members have from one in 1960, also risen to six in 1992. Insider trading are also being guided against through some regulatory framework. Hence, we are convinced that we can highlight the performance of the Nigerian stock market in view of the body of knowledge already contained in the literature.

However, it is important to note that in addition to the paucity of shares traded in, stock prices in Nigeria have moved rather sluggishly (Soyode,1992). This, perhaps, has some implications for expectations of the random-walk hypothesis. One of such implications is that, the randomness of stock price changes, as expected in the random-walk

hypothesis, is minimized. Notwithstanding, the limitation of share price movements may not be considered strong enough to ignore testing for its efficiency. We shall therefore, endeavour to carry out some performance analysis for the stock market, as a way of corroborating our findings on the efficiency tests.

CHAPTER FIVE

THEORETICAL FRAMEWORK

5.1 Introduction

In this section, we provide an overview of efficient markets theory. Efforts are made to highlight various versions of the theory as well as conditions consistent with market efficiency. Furthermore, we discussed the various tests of the efficient capital market, including the most recent volatility test of the stock market. We also provide the link between liberalization and market efficiency as a prelude to our analysis.

5.2 The Theory of Efficient Markets

Over time, a large volume of research has been undertaken with regard to testing the validity of the Efficient Market Hypothesis (EMH) as an explanatory model of price behaviour in various speculative markets including commodity, foreign exchange and stock markets. Most of the research on capital market efficiency has been confined to the advanced capital markets of developed countries. Conversely, little research has been conducted on the developing countries capital markets. Pehaps the development could be explained by the observation of Wai and Patrick (1973:268) who in their report of the findings of a cross-country survey of capital markets commented:

> *"With a few exceptions (for example, in Brazil, India, Malaysia, and Singapore), markets are thin with little or no trading with relatively few and insignificant*

amounts of new public issue by private corporations.... Information is poor and manipulation is substantial, especially for private issues. It is our strong view that the most profitable line of research would lie in detailed case studies of capital markets in specific countries".

This study therefore, represents one of the prescribed "detailed study", indeed with an extension of testing for the impact of financial liberalization on the market efficiency in Nigeria.

The primary role of a stock market is to allocate the economy's capital stock. In an efficient market, stock prices are to provide accurate signals for resource allocation, such that firms are able to make correct production-investment decisions, while investors are able to choose the most preferred stocks for investment. If this occurs, it can be asserted that such security prices "fully reflect" all available information and is therefore regarded as "efficient".

There are several versions of efficient market models. However, most distinctions relate only to the mode of specification of the models. Indeed, each specification is more or less an extension of the other. A full discussion is provided by Fama, (1965, 1970, 1976[a], 1976[b]). We shall highlight some of these briefly.

5.2.1 Expected Return or "Fair Game" Models

In an attempt to provide testable model for defining how prices "fully reflect" available information in an efficient market, the Expected Return Model posits that equilibrium prices or expected returns on securities are generated as in the two parameter world, (Sharpe 1964; Lintner 1965[a], 1965[b]).

The basic assumption is that the conditions of market equilibrium can be stated in terms of expected returns. Hence, if stock prices fully reflect available information, and these prices react instantaneously, and in an unbiased fashion to new information, then this rules out the existence of any trading system which would consistently out-perform the general level of market return (Fama 1970, Keane 1983, Sheffrin 1983, Strong and Walker 1987). In this case therefore, "returns" will be a "fair game" with respect to the information set.

In notational terms, the expected return theories are of the following form:

$$E(\tilde{P}_j,\ t+1/\varnothing_t) = [1+E(\tilde{r}_j,\ t+1/\varnothing_t]\,P_j,t \qquad \ldots\ 5.1$$

where

E: the expected value operator

P_j,t: the price of security j at time t

$P_j,\ t+1$: the price of security at t+1

$r_j,\ t+1$: the one-period percentage return

øt: a set of information to be "fully reflected" in the price at t.

There is an empirical implication in the assumption that conditions of market equilibrium can be stated in terms of the expected returns and that equilibrium expected returns are formed on the basis of the information set $\varnothing_t$. The implication is that they rule out the possibility of trading systems that have expected profits or returns in excess of equilibrium (market) expected returns based only on information in $\varnothing_t$. Therefore, let

$$X_{j\ t+1} = P_{j,t+1} - E(P_{j,t+1}/\varnothing_t) \qquad \ldots 5.2$$

Then

$$E(\tilde{x_{j,}}t+1/\varnothing_t) = 0 \qquad \ldots 5.3$$

Note that x_j, t+1; = the excess market return of security j at time t+1.

In other words, equation (5.3) says the sequence X_{jt}) is a "fair game" with respect to the information sequence ($\varnothing_t$). Equivalently,

let $$Z_{j,\ t+1} = r_{j,\ t+1} - \tilde{E(r)} \qquad \ldots 5.4$$

Then

$$E(Z_{j,\ t+1}/\varnothing_t) = 0 \qquad \ldots 5.5$$

So that the sequence (Z_{jt}) is also a "fair game" with respect to the information sequence ($\varnothing_t$).

Thus the term, $X_{j,\ t+1}$ is the excess market value of security j at time t+1. It is the difference between the observed price and the expected value of the price that was projected at time t on the basis of information $\varnothing_t$.

Similarly, Z_j, t+1 is the return at t+1 in excess of the equilibrium expected returns projected at time t.

Let

$$\alpha(\varnothing_t) = (\alpha_1(\varnothing_t), \alpha_2(\varnothing_t), \alpha_n(\varnothing_t) \quad \ldots 5.6$$

based on $\varnothing_t$ which tells the investor the amount $j(\varnothing_t)$ of funds available at t that are to be invested in each of the n available securities, the total excess market value at t+1 that will be generated by such system will be

$$V_{t+1} = \sum_{i=1}^{n} \alpha_j(\varnothing_t) \; [r_j, t+1 - E(\tilde{r}_j, t+1/\varnothing_t] \quad \ldots 5.7$$

This, according to the "Fair Game" property of equation (5.5), has expectation,

$$E(\tilde{V}_{t+1}/\varnothing_t) = \sum_{i=1}^{n} \alpha_j(\varnothing_t) \; E(\tilde{Z}_{j,t+1}/\phi_j) = 0 \quad \ldots 5.8$$

More generally, therefore, if we let V_{t+1} $(\varnothing_t)$ be the excess market value (i.e., the difference between actual market value and the conditional expected market value) of any collection of the securities generated by any trading system based on $\varnothing_t$, then $E(V_{t+1}/\varnothing_t) = 0$ can be derived as a "testable implication" of the efficient market model.

Notably, the "Expected Return" or "Fair Game" models discussed above can be divided into two special cases. They include:

i The Submartingale model, and

ii. The Random-walk model

We shall discuss the basic features of each of these briefly using our earlier specifications.

5.2.2 The Submartingale Model

There is a statement by Fama (1970) that the price sequence $(P_{j,t})$ for security j can follow a submartingale distribution with respect to the information sequence $(\varnothing_t)$. It is given thus

$$E(\tilde{p}_{j,t+1}/\varnothing_t) > p_{jt} \quad \ldots 5.9$$

or equivalently

$$E(\tilde{r}_{j,t+1}/\varnothing_t), \geq 0. \quad \ldots 5.10$$

This is also saying that the expected value of next period's prices projected on the information $\varnothing_t$, is equal to or greater than the current price. If equations (5.9) and (5.10) hold as equality in both cases, so that expected returns and price changes are zero, then it is said that the price sequence follows a martingale. In other words, the submartingale conditions do not hold strictly (see Fama, 1970:386).

There is an important empirical implication in a submartingale in security prices. The assumption that expected returns conditional on $\varnothing_t$ are non-negative directly implies that such trading rules based on the information in øt cannot have greater expected profits that a policy of buy-and-hold during the future period in question (Fama, 1965, 1970).

5.2.3. The Random Walk Model

This is another special case of the expected return model. It is based on two hypotheses. First, there is the

statement that the current price of a security "fully reflects" available information. This is assumed to imply that the successive price changes are independent. The second assumption is that successive changes (or returns) conform to some probability distribution (Fama, 1965, 1970). Notationally, the model says that

$$E(r_{j,t+1}/\varnothing_t) = E(r_{j,t+1}) \qquad \ldots 5.11$$

This usual statement is saying that the conditional probability distributions of an independent random variable are identical. In addition, the density function, f, must be the same for all t.

If we restrict equation (5.1) by assuming that the expected return on security j is constant over time, then we will have

$$E(\tilde{r}_{j,t+1}/\varnothing_t) = E(\tilde{r}_{j,t+1}) \qquad \ldots 5.12$$

Equation (5.12) says that the mean of the distribution of $r_{j,t+1}$ is independent of the information available at t,$\varnothing$, whereas, equation (5.11), in addition, says that the entire distribution is independent of $\varnothing_t$.

Random-walk model can be regarded as an extension of the general Expected Return or Fair Game Model. This is because, the Random-walk model, in addition to stating the conditions of market equilibrium in terms of expected returns, went further to relate the stochastic process generating returns. It asserts that the evolution of investor's tastes and the process of generating new information combined to produce

equilibria in which return distribution, repeat themselves through time (Fama 1970).

Fama (1970), also considered sufficient conditions to determine capital market efficiency. They are as follows:

(a) There are no transactions costs in trading securities.

(b) All available information is costlessly available to all market participants.

(c) All agree on the implications of current distributions for the current price and distributions of future prices of each security. In such a market, prices "fully reflect all available information.

Fortunately, these conditions are sufficient but not necessary for market efficiency. However, though the absence of the three conditions above are not necessarily sources of market inefficiency, they are potential sources. Admittedly, all the three do not exist to some extent in real world markets. Measuring their effects on the process of price formation, no doubt, is an important goal of empirical work in the area. Notably, scholars have continued to investigate the issue of randomness of stock prices (Leroy, 1990). Although, the vast bulk of the empirical evidence has been in support of the efficient markets and random walk hypothesis, many technical analysts continue to flourish. Some of these analysts have argued that the tests are uni-dimensional, too

restrictive, or too simplistic to offer conclusive proof that market movements cannot be forcasted in advance (Leroy, 1976; Murphy, 1977; Grossman ans Stiglitz, 1980; Ferguson, 1983). However, other researchers have pointed out that their experiments are yet to indicate the existence of any market inefficiencies (Bishop and Rollins, 1977; Beaver, 1981; Treynor and Ferguson, 1985). Interestingly, no analysts or critics have been able to present conclusive evidence against the efficient market hypothesis (Hatzoulis and Stark, 1981; Joy and Jones 1986).

In spite of all the above criticisms by the scholars, the Efficient Market Hypothesis as presented by Fama (1965), (1970) and (1976[a]) is the most widely adopted by researchers in the field. Leroy (1976) criticised Fama's model as being tautological and, therefore, empirically vacuous.

However, Fama (1976[a]) replied by denying tautology. Consequently, he presented the model in a different way which appears to be free of whatever is misleading or difficult to follow in his earlier approach. Thus:

$$E(P_t / \varnothing_{t-1}) = E_m (P_t / \varnothing^m_{t-1}) \quad \ldots 5.13$$

$P_t = (P1_t, P2_t \ldots\ldots Pn_t)$ is the vector of prices of securities at time t,

$\varnothing_{t-1}$ the set of information available at t - 1

$\varnothing^m_t - 1$ the set of information used by the market,

$Em(P_t/\varnothing^m_{t-1})$ the market assessed density function for Pt, and

$E(P_t/\varnothing^m_{t-1})$ the true density function implied by $\varnothing_{t-1}$.

The explanation of the randomness of stock prices lies in understanding the market making mechanisms such as the demand and supply forces. In an efficient market where information is freely available, the price of a security can be expected to approximate its "intrinsic" value because of competition among investors. Intrinsic values which may be defined as "marginal evaluation based on consumer's taste" can change as a result of new information. If, however, there is only a gradual awareness of new information, and all that it implies, is that successive price changes will exhibit dependence. If the adjustment to information is virtually instantaneous, successive price changes will be random. The first specification of efficient markets and their relationship to the randomness of prices of things traded in that market is attributable to Samuelson (1965) and Mandelbrot (1966).

If a market has zero transaction costs, and if all participants and potential participants in the market have the same time horizons and homogenous expectations with regard to prices, the market will be considered efficient and prices in such a market will fluctuate randomly (Lorie and Hamilton 1973).

Murphy (1977) argues that efficiency is not an accurate description of the capital market and may not even be a very good description of the capital markets and that there are serious problems with the risk/reward relationship, and

perhaps even the statistical methods. Grossman and Stiglitz (1980), claimed that arbitrage profits cannot be perfectly eliminated when arbitrage is costly. However, it should be noted that the existence of investors who choose to pay, in order to acquire and process information may not be due to the fact that they can consistently obtain a return on this outlay. Rather, it can be due to the point made by Lorie and Hamilton (1973); Firth (1977); and Hevas (1984) that the necessary conditions for efficiency are far less stringent and are merely that information be readily available to a "sufficient" number of investors, that transactions costs be "reasonable", and that, in the absence of agreement about the implications of current information and expectations regarding price movements, there can be no evidence of consistent superiority or inferiority by significant participants in the market. We shall now explore further the various tests of efficient market as highlighted in the literature.

5.2.4 Tests of Market Efficiency

The **random walk hypothesis** assumes that the security trading mechanism represents an "efficient" market place which is characterized by the presence of a large number of rational, profit-seeking, risk-averting investors who compete freely with one another in their efforts to predict the future value of individual securities (Koh 1989[a]). Thus, any information that is sufficiently significant to affect any

security's future value, is available to all investors immediately. As a result, chart reading by technical analysis or recommendation by fundamental analysis, is assumed to contain no useful information that will enable an investor to out perform a strategy of buy- and- hold in managing portfolio. Hence, the **random walk hypothesis** is regarded as the true challenge for the **chartist theories.**

The test of **random walk hypothesis** is usually conducted by looking for association between stock price changes on subsequent days. The tests include:

- Frequency distribution tests.
- Regression analysis,
- Runs test,
- Spectral analysis test, and
- Filter rules tests.

(1) **Frequency distribution tests:**

This investigates the degree of randomness in price changes from transaction to transaction. Thus, if transactions are fairly uniformly spread across time, and if the number of transactions per day, week or month is very large, then the central limit theorem leads us to expect that these price changes will have Normal or Gaussian distributions. The distribution of changes in log price can be analysed in a simple way by constructing the frequency distributions for the individual stocks. Mathematically, the model can be expressed as:

$$P_t = P_{t-1} + E_t, \qquad \ldots 5.14$$

where

P_t is the price of stock at time t;

p_{t-1} is the price of the stock in the immediately preceding period and;

E_t is a random error.

According to Granger and Morgenstern (1970) and Cooper (1980), three conditions hold.

(i) If E_t and E_{t-k} are uncorrelated where k is any lag and k>0, then P_k is a second-order Martingale, i.e., the absence of serial correlation does not in itself imply independence.

(ii) If E_t and E_{t-k} are independent where k=0, then P_t is a strictly random walk.

(iii) If E_t and E_{t-k} are independent and E_t are all identically normally distributed, then p_t is a Wiener process i.e. a strictly random walk.

The sum to which P naira will amount after k periods at a continuous rate of return U_t is

$$A = P^{exp}\ (U_t k). \qquad \ldots 5.15$$

After one time period where k = 1.

$$A = P^{exp}\ (U_t). \qquad \ldots 5.16$$

If we apply log, we know that

$$p_{t+1}/p_t = \exp.(\text{Log}\ (P_{t+1}/p_t))$$

$$P_{t+1} = P_t \exp.(\text{Log}\ (P_{t+1}/\log P_t))$$

Therefore, $U_t = \text{Log}(p_{t+1}/p_t) = \text{Log}p_{t+1} - \text{Log}p_t$

where P_{t+1}: the stock price at the end of day t+1

P_t: the stock price at the end of day t

Thus, for each stock, the empirical price changes, with a derived standard deviations of the mean, can be computed and compared with what should be expected if the distributions were exactly normal.

(ii) **Regression Analysis:**

Regression analysis, on the other hand, examines whether price changes were linearly or non-linearly related over time. They examine the association between current price and future price changes. For instance, if P_t represents today's price change, then it can be presented as

$$P_t = \alpha + \beta P_{t-1} \quad \ldots 5.17$$

The term "α" which is also the intercept, measures the expected change in price, unrelated to the previous price change. On the other hand, the term "ß" measures the relationship between the previous price changes and the next price changes. It is possible to take the log of all the prices. Here, the serial correlation coefficient to be denoted (r_k) provides a measure of the relationship between the value of a random variable in time t and its value k periods earlier. The population serial correlation coefficient (R_k) is estimated using the sample serial correlation coefficient (rk).

For a given variable U_t + (Log p_{t+1} - Log p_t), the serial correlation coefficient for log k is the correlation between

pairs of terms k units apart, viz:

$$r_k = \frac{Cov(U_t,\ U_{t-k})}{\sigma(U_t)\ .\ \sigma(U_{t-k})} \qquad \ldots\ 5.18$$

If approximated, it becomes

$$r_k \approx \frac{Cov(U_t,\ U_{t-k})}{(Var)\ (U_t)} \qquad \ldots\ 5.19$$

where

U_t is a log price relative

$t = 1, 2, \ldots\ldots\ldots, n.$

$k = 1, 2, \ldots\ldots\ldots\ n - 1$

In more analytical terms, rk can be expressed thus:

$$r_k = \frac{\frac{1}{n-k}\sum_1^{n-1}\left[U_t - \frac{1}{n-k}\sum U_t\right]\left[U_{t+k} - \frac{1}{n-k}\sum_1 U_{t+k}\right]}{\left[\frac{1}{n-k}\sum_1^{n-k}(U_t - \frac{1}{n-k}\sum U_t)^2\ \frac{1}{n-k}\sum_1^{n-k}(U_{t+k} - \frac{1}{n-k}\sum U_{t+k})^2\right]^{1/2}} \qquad \ldots 5.20$$

For theoretical convenience, and simplicity, these definitions can be modified to some extent. For instance, instead of measuring the first (n-k)U's about their mean, we can measure the mean of the whole set of observations; and similarly for the values. Therefore, following Kendall and Stuart,

(1976), writing $\bar{U}$

for $\sum_1^n U_t$

$\overline{n}$, we will have

$$r_k = \frac{\frac{n}{n-k}\sum_1^{n-k}(U_t - \bar{U})\ (U_{t+k} - \bar{U})}{\sum_1^n (U_t - \bar{U})^2} \qquad \ldots\ 5.21$$

Here in this case, we measure the mean of the whole set of observation given as $\bar{U}$

(iii) **The Runs test**

Sometimes the correlation coefficient may be heavily influenced by one pair of extreme observations called "outliers". In order to correct for possible bias, the non-parametric runs test can be used. A run is defined as a sequence of price changes of the same sign. The runs test takes into account only the signs of P_t and not the magnitude.

If we designate a price increase $(P_{t+1}-P_t)>0$ by "+" and a constant $(P_{t+1}-P_t) = 0$, and if price changes were positively related, then it would be more likely that a "+" was followed by a "+" and "-" by a "-", than to have changing signs. In this case, an investigator analysing a sequence of correlated price changes would expect to find longer sequences of +'s and -'s than could be attributed to chances.

Consecutive occurrences of the same sign are thus called a run. For instance, in a given sequence of + + 0 - - - - +, if runs tend to persist, (i.e. if there are trends) the total number of runs will be fewer, since there will be less price changes. Consequently, the average length of runs will be longer than if the series were random (Stigler 1964; Fama 1965; Granger and Morgenstern 1970).

Basically, there are three different types of price change namely:

(i) positive (+)

(ii) negative (-) and

(iii) zero (0)

The number of runs over a given period is the number of sign changes plus one. The larger the coefficient of serial dependence in price changes, the smaller will be the expected number of runs. Given that "m" represents the expected number of runs in a distribution, and "R" represents the actual number of runs, and "K" the coefficient of statistical significance, the expected number of runs represented by "m" will be compared with the actual number of runs "R". The standardized normalized variable ,"K", tests the statistical significance of (R - M).

K takes the form:

$$K = \frac{(R + \frac{1}{2}) - m}{\sigma_m} \qquad \ldots 5.22$$

Where:

$$m = \frac{N\,(N + 1) - \sum_{i=1}^{3} n_i^2}{N} \qquad \ldots 5.23$$

σ_m: standard error of "m"

m: the expected number of runs in the series

N: the total number of price changes or differences (U_t)

n_i: the number of price changes for each type (i = 1 for positive changes, i = 2 for negative changes, i = 3 for no change).

The standard error of m is

$$\sigma_m = \frac{\left[\sum_{i=1}^{3} n_i \{ \sum_{i=1}^{3} n_i^2 + N(N+1) \} - 2N \sum_{i=1}^{3} n_i^3 - N^3 \right]^{1/2}}{N^2(N-1)} \quad \ldots 5.24$$

"m" is computed based on two assumptions:

- that the sample proportion of positive, negative and zero price changes are good estimates of the population proportions; and
- that successive price changes are independent. Where N is large, the sampling distribution of m is approximately normal. Because the distribution of K is N(0,1), then the critical value of K at the 5% level of significance is ± 1.98

Wherever $K \geq |1.98|$, then the sign movements series are not randomly distributed and a tendency exists for a movement in the same direction. If this occurs, the random walk hypothesis is rejected, otherwise, it is accepted (Wong and Kwong, 1984).

(iv) **Spectral Analysis Tests**

Spectral analysis is an examination of the variance of a time series with respect to frequency components (Rausser and Cargill 1970; Leuthold 1972). It decomposes a time series into a number of components, each associated with a frequency or period. The "frequency" of variation is the reciprocal of the period. Frequency in this sense, indicates the number of cycles per unit of time, and the period

describes the length of time required for one complete cycle.

There are two special types of spectra. If the spectrum is flat, indicating that every frequency component is present to an equal amount, the series is merely a sequence of uncorrelated readings, also referred to as "purely random series". In other words, if the random walk model is true, then:

$$X_t = \text{Log}P_{t+1} - \text{Log}P_t \qquad \ldots 5.25$$

where

P_t is the closing price series in time t,

P_{t+1} is the closing price series at time t + 1

X_t is the random walk series.

The model suggests that X_t has mean zero and is uncorrelated with X_{t+k}, where k is any lead and all $K \neq 0$). If the spectrum has a peak at some frequency, this results in a "cycle" appearing in the series.

The main references on applied spectral analysis include Harvey (1975), and Kendall (1976). Following Praetz (1979) and Harvey (1975) the model can be specified in notational forms as follows:

$$F_x(w) = \frac{1}{2\Pi} \sum_{k=-\infty}^{\infty} r_x(k) \exp(-iwk), \quad -\Pi \leq w \leq \Pi \qquad \ldots 5.26$$

where

$F_x(w)$: a continuous function of w called the theoretical power spectrum

w: the frequency measured in radians per unit of time,

i: the square root of 1

$r_x(k)$: covariance between x_t and x_{t+k}

exp: exponetial function

Equation (5.26) derives from the Fourier transformation which expresses $F_x(w)$ in terms of the $r_x(k)$ and w.

Since we are dealing with a real process, the auto-covariance function will be symmetric about k = 0, and likewise the power spectrum will be symmetric about w = 0. Expression (5.26) can therefore be expressed as

$$F_x(w) = \frac{1}{2\Pi}\left[\sigma x^2 + 2\sum_{k=1}^{\infty} r_x(k)\,\mathrm{Cos}\,wk\right] \quad 0 \le w \le \Pi \ldots 5.27$$

Estimation of the spectrum corresponding to a theoretical F(w) often uses a finite set of values, denoted by (wj), j = 0, 1...m, as it is possible to estimate overall values of w, 0, W Π. Indeed, a very commonly used set of values is an equispaced set defined by $w_j = j\Pi/m$ (Praetz 1979).

For the size of m, it is suggested by Praetz (1979) that m ranges from n/5 to n/6 where n data points are available.

Consequently, the spectral estimates are of the form

$$F_x(wj) = \frac{1}{2\Pi}\left[\mu.C(0) + 2\sum_{k=1}^{m}\mu_k C(k)\,\mathrm{Cos}\,wjk\right] \ldots 5.28$$

where

$$C(k) = \sum_{t=1}^{n-k}(x_t - \bar{x})\,(x_{t+k} - \bar{x})/(n-k) \qquad \ldots 5.29$$

In other words,

c(k) is the autocovariance coefficient of order k

μ_k: a set of weighting coefficients

m: an arbitrary integer to be chosen by the user representing the maximum lag.

w_j: a set of real numbers with $|w_j| \leq \pi$ (j = 0, 1, 2, ...m).

Note that weights μ_k are used for consistent estimates of f(w). If an appropriate set of weight is not used, the estimates $f(w_j)$ are not consistent with f(w).

Several weight functions can be used. However, the commonly used set of windows are:

(i) the 2nd Turkey - Hanning weight, specified as

$\mu_k = \frac{1}{2}(1+\text{Cos } \pi_k/m) = 0$, and

(ii) the 2nd Parzen weight, specified as

$\mu_k = 2(1 - |k|/m) = 0$, (see Jenkins 1961 for details).

After obtaining the spectral estimates, the next step is to examine whether or not they represent a significant deviation from a white noise time series. Studies have shown that for a sequence of uncorrelated normal variates, the periodogram is proportional to a chi-squared variate with two degrees of freedom (Praetz 1979). Spectral estimates will be asymptostically chi-squared with equivalent degrees of freedom (EDF) a function of the weights (μ_k) used.

Specifically, for the 2nd Turkey - Hanning and for the 2nd Parzen weights, they are as follows:

EDF = $2^2/_3 n/m$ for the 2nd Turkey - Hanning weight while EDF = 3.7 n/m for the 2nd Parzen weights. The significance of the spectral ordinates can therefore be estimated by getting

confidence interval at a level of a significance. The confidence intervals used are of the form:

$$1 - \alpha = P\left[f(wj)V_1 \leq f(wj) \leq V_2 \right] \qquad \ldots 5.30$$

where

$V_1 = X^2_{EDF,\ 1 - \alpha/2}$ (Lower Limit)

$V_2 = X^2_{EDF,\ \alpha/2}$ (Upper Limit)

α = spectral confidence interval

As the flat spectrum can be simplified to $f(w) = \sigma^2/2\prod$ for all w, the actual spectral estimates are then compared to see whether they deviate from the flat spectrum. In this case, σ^2 can be replaced by the sample variances (Praetz 1979). Therefore, the actual test will be to consider the number of estimates that lie outside the confidence interval and then compare them with the expected number of observations to lie out of the confidence intervals. It has been shown that for 95% spectral confidence limits ($\alpha = 0.05$), the expected value of 8, the number of estimated spectral ordinates, is given by

$$S - E(s) = 0.05\ (m + 1) \qquad \ldots 5.31$$

Perhaps the only problem with this approach is how to judge whether the difference, S - E(s), represents a serious deviation from a white noise or not. This, according to Hevas (1984) may depend on the researcher's personal judgement.

(v) **Filter Rules**

The Filter rule says: if the price of a security moves up at least x%, buy the security and hold until its price

moves down, at least, by x% from a subsequent high, at which time simultaneously sell the stock and go short. The short position is maintained until the closing price rises atleast x% above a subsequent low, at which one should simultaneously cover and buy the stock. If the stock price changes by less than x% up or down, simply do not make any transaction. Such trading rules are referred to as x% filters. In this case, the magnitude of x depends on the individual's choice. So it is possible to have 1%, 2%, 5% etc., filter rules, where each filter indicates a different set of transactions even though all deal with the same stock and are based on the same set of price changes.

(vi) **Volatility Tests**

The more recent tests of the expected returns model include the measure of volatility of the stock prices. Analysts contend that market efficiency implied a bound on the volatility of stock prices. If this bound is violated, then stock prices are more variable than is consistent with market efficiency.

Market efficiency has been shown to imply that stock prices equal the discounted sum of expected future dividends (Leroy, 1990) as expressed in the following equations:

$$P_t = \frac{E_t(d_{t+1}) + E_t(d_{t+2}) + E_t(d_{t+n})}{1 + r \quad (1+ r)^2 \quad (1 + r)^n} \quad \ldots 5.32$$

where:

P_t = Stock prices

E_t = Mathematical expectation of (d)

d_t = Dividend yield at time t.

r = expected rate of return, r > 0

Given that stock prices will behave like a weighted average of dividend over time, an average is always expected to be less volatile than its component. The key hypothesis therefore is that the stock price volatility should be lower than the volatility of dividends (Leroy 1990).

Also, Leroy (1989) showed that the less information investors have, the higher will be the variance of the rate of return. Consequently, assuming markets are, at least, weak-form efficient, so that investor's information includes at least past returns, which puts a lower bound on the amount of information investors have, implying an upper bound on the variance of the rate of return.

To derive the upper bound on the variance of the rate of return, it is necessary to evaluate this variance when investors predict future dividends using no information other than past return. Consequently, when markets are at least weak-form efficient, the upper bound on the variance of the rate of return on stock is the variance that would occur if investors based their dividend forecasts wholly on past dividend behaviour.

Leroy (1990) concluded by asserting that the decreasing relation between investors information and return volatility implies that if capital markets, are at least weak-form

efficient (and if dividends follow a random walk) the variance of the rate of return on stock cannot be greater than the variance of the dividend growth rate. Indeed, it should be approximately equal. However, stock price volatility, being an average of the component should be lower than the dividend volatility.

In general, volatility is measured by the standard deviation of prices, returns, dividends, etc., for a given period. Such measure of dispassion is given as

$$\sigma_t = \left[\frac{\sum_{i=1}^{n} (x_{it} - \bar{x})^2}{N-1} \right]^{\frac{1}{2}} \quad \ldots 5.33$$

where

σ: Standard deviation,

X_i: variable of concern such as stock prices, returns, dividends etc.,

N : Population of the distribution.

All the tests we have discussed so far relates to the test of market efficiency at the weak-from level.

In the studies of semi-strong form, the focus of the test is to analyze the share price movements in order to see exactly how long it takes for the share price to digest and respond to new information. In this regard, the publicly available information to be tested usually included information on:

(a) bonus issues;

(b) stock splits;

(c) right issues;

(d) earnings announcements;

(e) published investment recommendations; and

(f) weekend or Year end effects (seasonality).

In the next section, we shall take a look at the various forms of empirical tests of market efficiency as documented in various literatures. Finally, while considering strong-form empirical studies, the tests, include an examination of the performance of analysts, recommendations or professionally managed portfolios such as mutual funds and unit trusts. In this regard, a portfolio performance test can be conducted in which the performance of a mutual fund can be compared with the performance of an unmanaged portfolio with similar asset composition.

Another test is to observe the behaviour of share price of a fund around the time a recommendation was published by portfolio performance analysts in order to identify possible abnormal returns following their recommendations. Finally, the stock performance can be investigated in order to estimate the profitability of insider trades through for instance, calculating the rate of return on a portfolio constructed from insider buying list and the rates of return on a random portfolio (see Jaffe, 1974; Kerr 1980).

5.2.5 Forms of Empirical Tests

Most of the empirical tests have been concerned with whether prices "fully reflect" particular sets of available information. They can be classified into three categories:

(a) **Weak-Form Tests**

The weak-form test is one in which the information subset of interest is just past price or return. Weak form efficiency therefore implies that the market is efficient in the weak sense as share prices "fully reflect" the information implied by all prior price movements. In effect, price movements are totally independent of previous movements, implying the absence of any price patterns with prophetic pattern. As a result, investors are unable to profit from studying charts of past prices. This also rules out the validity of trading rules. Prices would respond only to new information such as new economic events.

Various studies have been conducted in this area, mostly adopting the serial correlation analysis. A summary of some of these and their results are provided below.

TABLE 5.1: SELCETED EMPIRICAL STUDIES OF SERIAL CORRELATION ANALYSIS

No	Author	Data	Variables	Interval	ACC*
1.	Kendall (1953)	22 commodities (UK)	Price	1 week	0.088
2.	Moore (1964)	30 companies (US)	Log price	1 week	-0.056
3.	Cootner	45 companies (US)	Log price	1 week	0.131
4.	Fama (1965)	30 companies (US)	Log price	1 day 4 days 9 days 16 days	0.026 -0.039 -0.053 -0.057
5.	King (1966)	16 indices	Log price	1 month	0.018
6.	Praetz (1979)	16 indices 20 companies (Australia)	Log price Log price	1 week 1 week	0.000 -0.118
7.	Jennergren (1975)	15 companies (Norway)	Log price	1 day 2 days 5 days	0.068 -.0070 -0.004
8.	Jennergren & Korsvold (1979)	30 companies (Sweden)	Log price	1 day	0.102 -0.021 -0.016
9.	Errunza (1979)	64 companies (Brazil)	Log price	1 month	-0.163
10.	Laurence (1986)	16 companies (Malaysia) 24 companies (singapore)	Log price Log price	1 day 1 day	0.041 0.078
11.	Brown and Easton	Daily prices (UK)	Log price	1 day	0.049

Source: Koh, 1989. * Average correlation coefficient.

(b) **Semi-Strong Form tests**

In the semi-strong form tests, the concern is the speed of adjustment to new publicly available information such as announcements of stock splits, annual reports, new security and issues. Hence, the concern is whether prices efficiently adjust to these other information that is obviously publicly available.

Thus, the market is efficient in the semi-strong sense if share prices respond instantaneously and without bias to newly

published information. The argument is whether or not the users of such information might distinguish between the significance or otherwise of new data or piece of information by themselves. In this case, the implication is that the prices that are actually arrived at in such a market would invariably represent the best interpretation of the information.

The focus of empirical studies of this form has been to analyse share price movements to see exactly how long it takes for the share price to digest and respond to new information. No doubt, publicly available information is so large and heterogeneous that it is quite impossible to test for market efficiency relative to all the sources of information. However, one can test for several types of information which tend to have major effects on stock prices. Information on the stock splits, bonus issues, rights issues, published investment recommendations, earnings announcements, and weekend or year end effects, are examples of the semi-strong form empirical tests. We provide a list of some of these tests in the table below:

TABLE 5.2: SELECTED SEMI-STRONG FORM EMPIRICAL STUDIES

No.	Name (year)	Subjects	Country
1.	Fama, Fishers, Jensen and Roll FFJR (1969)	Stock splits	US
2.	Firth (1977)	Capitalization issues	UK
3.	Franks et.al. (1977)	mergers	UK
4.	Firth (1979)	Recommendations	UK
5.	French (1980)	Weekend effect	US
6.	Roll (1983)	Year-end effect	US
7.	Theobald & Price (1984)	Week-end effect	UK
8.	Kato and Schallhelm (1985)	Seasonality	Japan
9.	Brennan & Copeland (1988)	Stock splits	US

Source: Koh, 1989.

(c) **Strong-Form Tests**

Finally, strong-form tests are the ones in which the concern is whether any investor or groups (e.g. management for mutual funds) have monopolistic access to any information relevant for the formation of prices. Similarly, the market is efficient in the strong sense if share prices fully reflect not only published information but all relevant information including data not yet publicly available.

If the market is therefore, strongly efficient, even an insider would not be able to profit from his privileged position. Strong-form empirical tests consist of an examination of the performance analysts' recommendations from

professionally managed portfolios i.e., mutual funds, and insider trading. We also provide a summary of such studies in the table below.

TABLE 5.3: SELECTED STRONG-FORM EMPIRICAL STUDIES

No.	Name (year)	Data	Country	Focus
1.	Sharpe (1966)	34 Mutual Funds	US	Performance
2.	Lorie & Nieder hoffer (1968)	Mutual Funds	US	Insiders
3.	Jensen (1969)	115 Mutual Funds	US	Performance
4.	Faffe (1974)	200 Large firms	US	Insiders
5.	Fitzgerald (1975)	635 analysts recom.	UK	Recommendation
6.	Kerr (1980)	120 Stocks	US	Insiders
7.	Bjerring et.al. (1983)	221 additions	Canada	Insiders
8.	Dimson & Marsh (1984)	4187 forecasts	UK	Recommendation
9.	Givoly & Palmon (1985)	Mutual Funds	US	Insiders
10.	Seyhun (1986)	6000 transaction	US	Recommendation
11.	Levy & Lerman (1987)	424 Stocks	US	performance
12.	Ippolito (1989)	143 Mutual Funds	US	Signalling
13.	McNichols (1989)	733 Forecasts	US	

Source: Koh, 1989.

Hint: Insiders represents insider information.

Notably, unlike the major industrial countries of the world, a limited number of empirical work is available for the stock markets of the less developed countries, sometimes, referred to as emerging markets. Consequently, a considerable testing still needs to be undertaken for the underdeveloped capital markets of the world. Happily, interest in these markets has increased significantly in recent years, but dearth of empirical results remain. We also provide below a brief summary of studies on the emerging markets.

TABLE 5.4: SUMMARY OF SELECTED EMH STUDIES ON THE EMERGING MARKETS

No.	Author (Year)	Country (Sample)	Testing Method	Efficiency
1.	Jennergen (1975)	Sweden (30)	Filter test	Reject
2.	Jennergen & Korsvold (1975)	Norway 915)	Serial Runs of Distribution tests	
		Sweden (30)	Seasonality	Reject
3.	Officer (1975)	Australia (651)	Runs. Serial	Accept
4.	Juffner & Mettugh (1976)	Australia (188)	Serial Runs	Reject
5.	Roux & gilbertson (1978)	Johannesbourg (24)	Serial	Reject
6.	Ang & Pohlman (1978)	Far East	Serial Runs	Accept
7.	Hai Hong (1978)	Far East (4)	Serial Runs	Accept/
8.	Gandhi et.al. (1980)	Kuwait (Index)	Serial Runs	Reject
9.	Law (1983)	Hong Kong (56)	ARR	Reject
10.	Dawson (1984)	Hong Kong (267)	Serial runs	Accept
11.	Wong & Kwong (1984)	Hong Kong (28)		Reject
12.	Sareewiwatthana & Malone 1985)		Thail-Leenders	
13.	Barnes (1986)	Kuwait	Serial runsete	Reject
14.	Lawrence (1986)	Thailand (72)	Serial runs	Accept
		Malaysia (16) &		Reject
15.	Dawson (1987)	Singapore (24)	New Issues	
		Hong Kong (21)		Accept/
		singapore (39)		Reject
		Malaysia (21)		

Hint: 1 ARR: Abnormal average return
2 Serial: Serial Correlation Analysis
3 Runs: Runs test
4 Spectral: Spectral Analysis.

Indeed, the validity of the random-walk or efficient market hypothesis draws its significance, from its practical implications for market participants. The concept of EMH cannot be adequately defined except in terms of its practical consequences for investors, an efficient market, being one whose prices are such that investors cannot "beat the market" other than by chance (Keane 1983).

5.3: Relevance to the Nigerian Case

The application of efficient markets model is quite relevant to Nigeria. It should be recalled that the Nigerian Stock Market has been ranked among the rapidly growing stock markets in the world. A study conducted by the Data Stream International based in the United States of America places

Nigeria at the 15th position in terms of performance and returns to investors (NSE, 1992:45). The high rating of the Nigerian Stock Market was attributed to the tremendous growth and the development that has taken place in the market in recent times.

For instance, market capitalization in Nigeria shot up to over ₦23 billion as at February 1992, while the number of quoted companies has grown from 44 in 1972 to 146 in 1992 with 18 listed in the second-tier market. Furthermore, efforts have been made to ensure wide participation of buyers and sellers on the stock market. Such efforts include opening of new trading floors in various parts of the country. As at present, there are six of such trading floors. These are Lagos, Kaduna, Port-Harcourt, Kano, Onitsha and Ibadan. The main aim, has been to ensure that market efficiency is enhanced. To this end, it would seem that studies intending to test for the efficiency would not only be relevant but also of utmost importance.

CHAPTER SIX

METHODOLOGY

6.1 Introduction

Testing for the efficiency of financial markets has generated enormous attention in the literature. For example, Bollerslev and Hodrick (1992) provided a selective survey of the econometric tests and estimation procedures that have been employed in the literature to test for market efficiency.

Fama (1970, 1991) indicated that any test for market efficiency necessarily involves a joint hypothesis regarding the equilibrium expected rate of return and market efficiency were primarily concerned with short-horizon returns (i.e. holding periods within one year). In general, these tests typically assumed that the expected rate of return was constant through time if markets are efficient (Bollerslev and Hodrick, 1992).

The more general efficient market model, acknowledged that the markets may have some imperfections, such as transactions costs, information costs, and delays in getting pertinent information to all market participants. However, it states that these potential sources of market inefficiency do not exist to such a degree that it is possible to evolve trading systems whose expected profits or returns will be in excess of expected normal, equilibrium

returns or profits. Genrerally, equilibrium profits can be defined as those that can be earned by following a simple buy-and-hold strategy rather than a more complex, mechanical system (Fama, 1965, 1970). In a sense, the random-walk model represents a special, restrictive case of the efficient market model.

As noted earlier, an efficient capital market is one that is efficient in processing information. The prices of securities observed at any time are based on 'correct' evaluation of all information available at that point in time, consequently, it is said that, in an efficient market, "prices fully reflect" available information (Fama, 1976).

There are at least, two aspects to the efficiency of a market's response to new information:

- the speed with which it processes the information;
- its ability to correctly assess the implications of the information.

According to Jensen (1978), a market is efficient with respect to (an) information set, if it is impossible to make economic profits by trading on the basis of (this) information. The economic profits in this regard refers to abnormal returns adjusted for any costs which the investors may incur (e.g. transactions costs).

Samuelson (1965) and Mandelbrot (1966) therefore contended that in a model of a competitive security market,

price changes will follow a random walk. The random-walk models are based on some assumptions noted earlier (see p. 79). Other additional assumptions are:

- there are a large number of buyers and sellers who are price takers;
- all securities in the same risk class may be considered to be perfect substitutes (i.e. they all offer the same risk-return) (see Samuelson, 1965 and Mandelbrot, 1966).

As a result, a direct and comprehensive test of the efficient market theory necessarily requires the following steps:

(i) the identification of all relevant information currently available;

(ii) the determination of the set of share prices consistent with this set of information; and

(iii) a comparison of this set of share prices with those determined by the stock market.

In an attempt to specify a model of returns implied by market efficiency, Fama (1965) suggested the use of the "fair game" model which specifies that given the information available at the beginning of a period, only a fair return can be anticipated, a return commensurate with the risks accepted, consequently, the expected abnormal return is equal to zero. In other words, no investor can use any information which is currently available to develop a trading strategy which will

systematically beat the market.

It can be stated thus:

Expected (Abnormal return) (Information available)
(in period t+1) given (at the beginning) = 0

(of the period)

Notationally, it is written thus:

$$E(AR_{j,t+1}/I_t) = 0 \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (6.1)$$

where

'E' represents the expectations operator,

$AR_{j,t+1}$: the abnormal return on security j in period t+1;

the bar '/': implies 'given'; and

I_t: the information available at period t.

The abnormal return is given by:

$$AR_{j,t+1} = R_{j,t+1} - E(R_{j,t+1}/I_t) \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad 6.2$$

In other words, it is the difference between the actual return and the return expected on the basis of the information available at the beginning of the period.

Such abnormal returns are purely fortuitous, and on average, over a period of time, will be equal to zero. Therefore, if share prices fully reflect available information, investing will simply be a fair game. However, if investors are expected to earn a fair return, then share prices may be expected to rise over time. As a result, the proposition in equation 6.1 will not be strictly true.

In that case, we will have

$$E(R_{j,t+1}) \geq 0 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad 6.3$$

then

$$E(P_{j,t+1}) \geq P_{j,t} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad 6.4$$

Note that:

$R_{j,t+1}$ implies return on security j, at period t+1. Similarly, $P_{j,t+1}$ implies price of security j, at period t+1. In this regard, before the efficient market theory can be tested, in view of the earlier discussion, it is necessary to specify the content of the information set in a more precise manner. Interestingly, Fama (1970), had already identified three of such information sets, each corresponding to a different level of market efficiency, as noted earlier, for purposes of empirical testing. They include:

(i) Weak Form Efficiency

In this case, market prices will reflect any information reflected in the historical pattern of price levels and movements;

(ii) Semi-Strong Form Efficiency

Here, market prices will reflect all publicly available information such as the contents of accounting reports and merger announcements;

(iii) Strong Form Efficiency

In this case, market prices will reflect all relevant information.

Testable hypothesis has been developed for each level of efficiency. However, since our study is mainly concerned with the weak form efficiency of the Nigerian stock market, we shall concentrate much more on the various tests applicable to this form of efficient market, in the next section.

6.2 Weak Form of the Efficient Market Hypothesis

The weak form efficiency says the current prices of stocks already fully reflect all the information that is contained in the historical sequence of prices. Therefore, there is no benefit - as far as forecasting the future is concerned - in examining the historical sequence of prices.

This hypothesis is also known as the random-walk theory. In a sense, it suggests that share prices will exhibit no patterns and will consequently change in a random fashion. In this regard, tests of this hypothesis, generally attempt either to identify patterns in share prices or to demonstrate that price changes occur in a random fashion (see Bachelier, 1900; Kendall, 1953 and Fama et al, 1969).

6.3 Tests of the Weak Form of the Efficient Market Hypothesis

An impressive literature has been developed, over the years, regarding the empirical tests of random-walk. (Cootner, 1967). Most of these researchers aimed at testing whether successive or lagged price changes are independent. The statistical techniques that have been employed over time

can be classified into two categories, thus:

(i) those that test for trend in stock prices; and

(ii) those that test the mechanical systems directly.

The following tests are applicable to the weak form hypothesis. They are:

(i) Serial-correlation tests;

(ii) Simulation tests;

(iii) Runs tests;

(iv) Filter tests; and

(v) Normal distribution tests.

We shall highlight these briefly as a prelude to our subsequent exercise.

6.3.1 Serial-Correlation Tests:

This autocorrelation tests assess the interdependence of price changes over time. It requires that one day's change in share price (ΔP_t) is regressed on the price change on time previous day. (ΔP_{t-k}).

Notionally, it can be given as:

$$\Delta P_t = a + b\Delta P_{t-k} \quad \text{---------- (6.5)}$$

ΔP_t: one day's change in share price;

ΔP_t: one day's change on some previous day;

a: the intercept term that measures the expected price change unrelated to previous price change and the coefficient;

b: is the coefficient; and

k: the number of days lag.

Since the random-walk theory essentially test for independence between successive price changes, correlation tests are particularly useful. The serial-correlation tests check if price changes or proportionate price changes in some future period are related.

Correlation coefficient for such tests can take on a value ranging from -1 to +1. A positive number indicates a direct correlation. A negative value implies an inverse relationship. Finally, a value close to zero implies no relationship, and is most desirable.

It should be noted that the serial correlation coefficient "r" is a measure of the relationship between the value of a random variable in time t and its value in n periods earlier. We have presented the notations earlier in pages 86 and 87. Essentially, it is a regression analysis which tends to correlate the changes in the log price at time t to earlier periods. Essentially, the sample coefficients tell us whether any of the price changes in the past period are likely to be of much help in predicting subsequent changes.

From the standpoint of consistency with efficient markets, the most important feature of the sample coefficient must be very close to zero which implies that some changes correlated with past changes in stock prices are quite

unrelated and thus unfit for predicting future trends in price changes thereby increasing expected profits.

6.3.2 Simulation Tests

The exercise here relates to comparing actual levels and changes to a simulated set of graphs. Here, a series of price changes can be generated from random-number tables and then converted to graphs. This will therefore be compared to the simulated graphs. The similarity in the patterns will be observed, between the actual and the simulated series. An inference can therefore be made, same as the result of random stock price movements.

6.3.3 Runs Tests

Correlation coefficients can be dominated by extreme values. The runs test can be used to overcome this problem since they (run tests) ignore the absolute values of the numbers in the series and observe only their sign. Here, the researcher merely counts the number of runs (i.e., consecutive sequence of signs) in the same direction and compare this with the number of runs, that are expected from a series of randomly generated price changes. When this is done, no significant differences should be observed.

6.3.5 Filter Tests

Filter tests have been developed as direct tests of specific mechanical trading strategies. The approach is to examine directly the validity of specific systems. The test

is based on the premise that once a movement in price has surpassed a given percentage movement, the security's price will continue to move in the same direction. The famous rule here is:

> If the daily closing price of a security moves up at least x%, buy the security until its price moves down at least x% from a subsequent high, at which time simultaneously sell and go short. The short position should be maintained until the price rises at least x% above a subsequent low, at which time cover and buy (see Fama and Blume, 1966; Brealey, 1969).

Evidences have shown that in some cases, filter rule procedure out perform a simple buy-and-hold strategy, but only before transaction costs were considered (Brealey, 1969; Fama, 1965).

6.3.6 Normal Distribution Tests

By statistics rule, the sum of, or the distribution of random occurrences will conform to a normal distribution. By implication, if a proportionate price changes are randomly generated events, then their distribution should be approximately normal. This type of distribution is a member of the stable paretian family, usually with location parameter and an index of skewness. Generally, the actual distribution of stock price changes can be superimposed on a

normal probability distribution and the deviation observed. Often, small differences between these two distributions are overlooked so long the deviations are not remarkably large.

It should be stressed further that the principles of the normal distribution tests, according to Bachelier (1900) and Osborne (1959), are based on certain assumptions.

The basic assumptions of Bachelier - Osborne model stipulates that:

(i) prices changes from transactions to transaction in an individual security are independent, identically distributed random variables;

(ii) transactions are fairly uniformly spread over time, and that the distribution of price changes from transaction to transaction has finite variance.

Consequently, if the number of transactions per day, week or month is very large, then price changes across the difference intervals will be sums of many independent variables. Under this condition, the central limit theorem portends that the daily, weekly and monthly price changes will each have Normal or Gaussion distributions (Osborne, 1959; More, 1962).

6.3.6.1 Generalized Central-Limit Theorem

The distribution of price changes according to Mandelbrot (1963), can be located within the **Generalised Central-Limit Theorem**. Mandelbrot's main assertion is that there can be Leptokurtosis in an empirical distribution. A

Leptokurtosis refers to a case where more observations struggle into the extreme tails of a distribution than does a normal distribution.

In recognition of the significance of others, Mandelbrot identified some properties of a stable paretian distribution to include the following:

(i) location parameter denoted δ;

(ii) scale " " μ;

(iii) index of skewness " ß; and

(iv) Measure of height of extreme tails denoted α.

These properties can take the following values:

μ can be any positive real number, i;

α can only take values in the interval $-1 \leq ß \leq 1$; therefore, when

ß = 0, the distribution is symmetric;

ß > o, the distribution is skewed right.

The larger the value of ß, the larger the degree of skewness.

α also denoted the characteristic exponent i.e., the height of extreme tails, can take any value in the interval of 0 to 2.

i.e., $0 < \alpha < 2$.

6.3.7 Frequency Distribution Graphs:

The curves in the empirical frequency distribution graphs provides a better insight into the nature of the empirical distributions. The curves represent the normal

density function which portrays the general shape of the empirical distributions. The curves of the empirical distribution can then be compared to the curve of normal distributions thereby detecting the standard deviation from the mean.

We have attempted here to provide the empirical frequency distribution graphs for our analysis. It should be noted that there is a direct relationship between the frequency distributions graphs and the normal probability graph. The tails of the empirical distribution represents the extreme tails in the curvature of the normal probability graphs. Hence, when the tails of empirical distribution are longer than those of the normal distribution, the shapes in the extreme tails of the normal probability graphs should be lower than those in the central parts of the graphs. The shapes of normal probability graph take the form of an elongated S with the curvature at the top and bottom varying directly with the excess of relative frequency in the tails of the usual bell shaped empirical distribution graphs. First, the central bells of the empirical frequency distributions are higher and clearly seen than those of a normal distribution. Second, it would also enable us to see the peak of our distributions which have been found to be zero, or the probability of no change. From these points, we can then observe the evidence for the extreme tails and also

observe the heights of the tails directly as a way of cross-checking our earlier findings.

6.4 Before/After Analytical Framework

Generally, it is evident in the literature that most researchers have adopted the "Before/After" approach in evaluating the impact of public policy. As the name implies, this traditional approach entails the evaluation and comparison of pre and post policy performance of selected economic indicators of the relevant country (Nnanna, 1987).

Another contending methodology is known as the counter-factual framework. This approach has two versions, namely the "absolute" and "relative". The former is purely an exercise in econometric simulation, as it involves the fitting of some selected historic time series data, on a trend equation; from which a "reference forecast" of the likely behaviour of these variables could be made. On the other hand, the latter, simply compares the performances of countries that adopt a given policy, vis-a-vis those that needed the policy, but did not adopt it during the same period (Nnanna 1987; Donovan 1982).

We have chosen to adopt the "Before/After" traditional approach and the counter factual framework in this study in order to determine the possible impact of liberalization policy on the stock market efficiency. It should be noted that the adoption of "before/after" approach that we have

chosen is not without its limitations. For instance, this analytical approach may likely reflect developments arising from other factors unrelated to financial liberalization. However, by delineating the analysis by different periods which characterized the pre and post policy periods, the results were shown to be largely influenced by the policy adopted. Furthermore, we also estimated the policy variables that affect the stock prices in order to buttress our assumption.

The following tests are therefore carried out:

1. frequency distribution test;
2. serial correlation test; and
3. runs tests
4. normal probability graph approach.

In addition, we examined the overall performance through econometric analysis using the operational performance of selected stock market indicators. In line with the absolute version of the counter factual framework, we compared the actual performance with the simulated values. The difference between the trends thus form the basis for the assessment and conclusion.

Our stock market indicators include the following:

1. volume of government securities;
2. value of government securities;
3. volume of industrial stocks;
4. value of industrial stocks;
5. total volume of securities;

6. total value of securities;
7. stock price indices;
8. new capital issues;
9. market capitalization; and
10. number of listed companies.

For the purpose of simulating for the determinants of Stock prices, we have chosen some indicators that are directly related to the financial liberalization. These are:

(i) exchange rates; and;

(ii) interest rates.

The two variables no doubt constitute the key elements of the liberalization policy in Nigeria. Evidence shows that they have great influence on other macroeconomic variables. The study explores this in relation to the performance of the Nigerian stock market.

It is re-emphasized here that our analysis is based on the assumption of the "Fair Game Model" of Fama which is used in measuring the weak form of market efficiency. In this case, the information set includes past prices only.

6.5 Data Requirements and Sources

The data used in this study included the following:

(i) daily stock prices of 25 companies between 1984 and 1991;

(ii) value and volume of various securities;

(iii) stock price index;

(iv) market capitalization;

(v) exchange rates; and

(vi) interest rates.

The data were obtained from the following offices:

(i) Nigerian Stock Exchange;

(ii) Securities and Exchange Commission;

(iii) Federal Office of Statistics;

(iv) The Central Bank of Nigeria; and

(v) International Finance Corporation and various publications.

CHAPTER SEVEN

ANALYSIS OF RESULTS

7.1 Introduction

We present in this chapter the empirical results of the various tests of market efficiency conducted on the Nigerian stock market using the daily stock prices of twenty five active quoted companies. The selection of the industries cut across various sectors for fair and adequate representation and removal of bias in the survey. In addition, the performance of specific stock markets indicators were examined before and after the financial liberalization.

It must be stressed here that the selection of given tests for the Nigerian case was not without genuine reasons. First, it must be admitted that some sufficient conditions for determining capital market efficiency as highlighted by Fama (1970) do not strictly hold in Nigeria. For instance, trading in securities attract some transaction costs in Nigeria contrary to Fama's market conditions (See N.S.E. Factbook, 1992). Similarly, information is not necessarily costless to market participants. However, the choice rests on the assertion by Fama that these conditions are sufficient for market efficiency but not strictly necessary. To this end, our findings, conclusions and inferences must be appraised with caution.

It must also be stressed that we have taken some careful steps to enhance the reliability of the tests. For instance, before using the data for statistical tests, they were transformed and screened for errors, using some diagnostic tests to be discussed later. Consequently the actual tests were performed not on the daily prices themselves, but on the first differences for their natural logarithms. There are reasons for this approach. First, besides the fact that it has often been used in empirical research of this nature, it has been contended that the change in the log price is the yield with continuous compounding, from holding the stock for that day (Fama, 1965). This can be expressed thus:

$$\frac{P_{t+1}}{P_t} = \frac{\exp(\log_e P_{t+1})}{P_t} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad 7.1$$

$$P_{t+1} = P_t \frac{\exp(\log_e P_{t+1})}{P_t} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad 7.2$$

$$P_{t+1} = P_t \frac{\exp(\log_e P_{t+1} - \log_e)}{P_t} \quad \ldots\ldots\ldots\ldots \quad 7.3$$

This can be seen as claiming that proportional changes in share prices are deemed more important than their absolute values.

Second, Moore (1965), asserted that the variability of price changes for a given stock is an increasing function of the price level of the stock, hence, taking logarithms seems to neutralize most of the price level effects. In view of

all these, we have decided to use the first differences of natural logarithms of the selected stock prices. However, in the case of the other stock market indices, such as volume and value of shares traded, new capital issues, market capitalization, the actual volume and levels were used.

Before examining our data, we shall briefly consider the theoretical expected patterns of the frequency distribution that conforms with the market efficiency.

First, we present the empirical result of our frequency distribution test. Next we shall examine the distribution and shapes of the normal probability graphs, followed by a display and analysis of the serial correlation tests's results. The analysis of the Runs tests is presented next. Finally, the result of the overall performance test will be analyzed.

7.2 **Empirical Frequency Distributions**

We proceed here by examining first, the evidence for the central limiting theorem. Here, we shall examine the performance of the following statistics of the distribution of daily, weekly, bi-monthly and monthly changes and in stock prices of our selected quoted companies in line with the model-based expected results. They include the mean, median, mode, range, variance and standard deviation of the distribution of stock price changes. We shall also examine the index of skewness as well as the Kurtosis of the distribution and thereby examine the pattern and shape of the distributions.

The main issue considered here is whether or not stock prices follow a random walk. Hence, we utilize the Fama's approach for the analysis of the frequency distribution. The thinking is that in a perfectly competitive stock market, stock prices presently equal their intrinsic values. Thus, gross rates of return, discounted for the risk of every individual stock, would be the same for all stocks. Consequently, prices that fully reflect the available information will be the correct signal that guides the efficient allocation of investible resources. Therefore, if share price related information could be generated randomly during the day-to-day operation of the economy, the stock prices would adjust **randomly upwards or downwards** with respect to new information in case where the market is efficient.

(a) *Mean, Median, Mode of the Distribution of Stock Prices*

Table 7.1 to 7.6 shows the result of the mean, median and mode of the frequency distribution of stock price changes for the daily, weekly, bi-monthly and monthly cycles. The overall averages are as follows:

Table 7.1: Overall Averages of the Mean and Mode of Periodical Changes in Stock Prices

Periodicity	Before Liberalization			After Liberalization		
	Mean	Median	Mode	Mean	Median	Mode
Daily Average	0.00016	0.0	0.0	0.0028	0.0	0.0
Weekly Average	0.00180	0.0002	0.0	0.00384	0.00032	0.0
Bi-Monthly Average	0.00300	0.0020	0.0	0.00600	0.00100	0.0
Monthly Average	0.00664	0.0042	0.0096	0.01528	0.00856	0.0

Source: Computed from the Data set for the 25 Quoted companies.

From the above, it can be noted that the theoretical expectations that the mean, median and mode of the distribution should cluster around the mean value is also applicable here and particularly more pronounced in the distribution of the daily price changes of stocks.

A closer look at the results shows that well over 80 per cent of the stock have the same values as mean, median and mode before the liberalization (See Tables 7.7 - 7.10). Indeed, the same position can be ascertained after the liberalization except for some improvements in the mean of the distribution.

One important feature of the distribution that is worthy

of note relates to the general trend of stock prices in Nigeria. It can be noticed that the mode of the distribution both for the daily, weekly, bi-monthly and monthly data is zero. This implies that the probability of no change (i.e. Pr.(0)) is predominant. This therefore buttress the view that some share prices in Nigeria exhibit relative stagnancy. In other words, the expected velocity of activities of an active stock market is largely low. One possible reason for this phenomenon as itemized earlier is the paucity of market participants in the Nigerian stock market. It was opined that a larger number of market participants would make the market dynamic and competitive. This no doubt was behind the decision to fully deregulate the Nigeria capital market.

That liberalization could increase competitiveness of the stock market relative to the money market, and also enhance the performance of securities prices is tenable. For instance, the mean of the distribution of the daily stock prices increased by about 75 per cent after the liberalization from an average of 0.00016 to 0.00028. Similarly, for the weekly changes in stock prices, the mean of the distribution increased by about 110 per cent after the liberalization of the economy from 0.00018 to 0.0038 on the average after the liberalization from an average of 0.0002 to 0.00032. Also, the mean of the distribution of the semi-monthly stock price changes on the average and improved by

100 per cent after the liberalization. However, the median fell by same value. Similar increase is recorded by the mean of the monthly changes in stock prices. For instance, the mean of the monthly distribution improved by about 100 per cent while that of the median also increased by about 100 per cent. This trend implies that the stock market becomes more active with the liberalization of the financial system in Nigeria.

In all, it can be seen that the results of the samples are very close to normal distribution. However, the issue of the shape of the distribution and the values of our indexes shall be examined later. Notwithstanding, one quick conclusion that can be drawn from this analysis is that stock prices distribution in Nigeria exhibit the characteristics of a normal distribution, and by implication tends towards a random-walk distribution. Second, the randomness of stock prices improved sometimes by about 100 per cent under liberalization than before it.

It should be recalled that stock prices changes can come in three forms namely:

- Positive;
- Negative; and
- No change.

Clearly, it can be seen that though the probability of no change was large in our samples, there were more positive and

negative changes after the liberalization than before it. (See Tables 7.7 and 7.10 in the appendix).

(b) Measures of Dispersion of the Distribution of the Selected Stock Prices

We analyse in this section, the result of the various measures of dispersion of the distribution of the stock prices for the daily, bi-monthly, and monthly changes. The measures considered include the Range, Variance and Standard Deviation of the distribution of stock price changes.

Table 7.2: Range of Frequency Distribution of Changes in Stock Prices for Selected Companies

Periodical Averages	Before Liberalization				During Liberalization			
	Range	Min.	Max.	Sum.	Range	Min.	Max.	Sum
Daily Changes	0.80	-0.402	0.382	0.179	1.50	0.76	0.76	0.44
Weekly Changes	0.263	-0.154	0.115	0.181	1.133	0.672	0.46	0.57
Bi-Monthly Changes	0.243	-0.132	0.110	0.181	1.069	0.627	0.44	0.52
Monthly Changes	0.168	-0.088	0.075	0.179	0.932	0.521	0.41	0.57

Source: Extracted from the Computed Results

As it could be seen above, the range of the distribution is greater than zero. In particular, the range is large for distribution of daily changes in stock prices. However, and perhaps more importantly for our analysis, the range of the distribution expanded by about 87.5 per cent for the daily changes; 450 per cent for the weekly changes; 300 per cent for the bi-monthly changes and above 400 per cent for the monthly changes in stock prices after the liberalization of

the economy. These findings reinforced the earlier contention that the stock market is more active after the liberalization. A further breakdown is shown in Tables 7.11 - 7.14 in the appendix.

(ii) **Variance Analysis**

From Table 7.3, it can be seen that about 54 per cent of the quoted companies have variances greater than zero before the liberalization. Notably, this has increased to about 84 per cent after the liberalization. In specific terms, the coefficient of variance, on average has increased by about 300 per cent consequent to the liberalization of the financial sector i.e., from about 0.001 on average before liberation to about 0.004 after it. This implies that stock prices vary more under liberalization than before it. This also is an indication of relative improvements in the performance of stock prices of the selected quoted companies. After liberalization, as it could be noticed, the empirical distributions of 21 among 25 samples vary more in terms of changes during liberalization era whereas it was only 13 out of the 25 samples that actually changed before the liberalization.

(iii) **Standard Deviations of the Distribution**

From Table 7.3, it can be seen that standard deviation of the distribution ranges from 0.003 to 0.08 before liberalization. On the average, the standard deviation value

stood at 0.025 before the liberalization but increased by about 108 per cent to 0.052 after the liberalization. Although it may be contended that these values are relatively small, the fact that they are not only positive but also increasing shows that there are improvements in the performance of the stock prices.

Table 7.3: Standard Deviation Variance of Frequence of Frequency Distribution of Daily Changes In Stock Prices of Selected Companies

Companies Code	Before Liberalization		During Liberalization	
	Std. Dev.	Variance	Std. Dev.	Variance
V1	0.012	0.000	0.022	0.000
V2	0.013	0.000	0.019	0.000
V3	0.039	0.001	0.040	0.002
V4	0.030	0.001	0.219	0.046
V5	0.016	0.000	0.132	0.017
V6	0.024	0.001	0.044	0.002
V7	0.028	0.001	0.087	0.008
V8	0.045	0.002	0.039	0.002
V9	0.025	0.001	0.013	0.000
V10	0.011	0.000	0.049	0.002
V11	0.008	0.000	0.034	0.001
V12	0.014	0.000	0.035	0.001
V13	0.011	0.000	0.024	0.001
V14	0.080	0.000	0.050	0.003
V15	0.016	0.006	0.024	0.001
V16	0.025	0.000	0.058	0.003
V17	0.016	0.001	0.048	0.002
V18	0.046	0.000	0.086	0.007
V19	0.004	0.002	0.077	0.006
V20	0.005	0.000	0.040	0.002
V21	0.054	0.003	0.027	0.001
V22	0.056	0.003	0.040	0.002
V23	0.025	0.001	0.048	0.002
V24	0.031	0.001	0.020	0.000
V25	0.003	0.001	0.025	0.001
TOTAL	0.637	0.024	1.300	0.113
AVERAGE	0.025	0.001	0.052	0.004

Source: Computed from the data collected.

(c) *Normal Distribution Evidence*

The evidence here will be presented in sequence. We shall first present and examine the evidence of the index of skewness of the distribution.

(i) **Index of Skewness**

We have earlier on denoted skewness as "ß". According to Fama (1965), this index of skewness ß is one of the parameters of a stable Paretian distribution, which can only take values in the interval $-1 \leq ß \leq 1$. When $ß = 0$, the distribution is symmetric. When $ß > 0$, the distribution is skewed right (i.e., has a long tail to the right), and the degree of right skewness is larger the larger the value of ß. Similarly, when $ß < 0$, the distribution is skewed left and the degree of the left skewness is larger, the smaller the value of ß. We shall now go ahead to examine the evidence as shown in Table 7.4.

Table 7.4: Coefficient of Skewness of Frequency Distribution of Daily Changes in Stock Prices

Code No.	Name of Companies	Before Liberalization		During Liberalization	
		Skewness	Std. Error	Skewness	Std. Error
V1	Union Bank	-1.967	0.090	-14.917	0.070
V2	First Bank	-2.965	0.090	-2.395	0.070
V3	U.B.A.	-0.271	0.090	13.182	0.070
V4	B.F.N.	-0.016	0.090	-0.364	0.070
V5	Merchantile Bank	1.207	0.090	-1.829	0.070
V6	Alumaco	-0.005	0.090	0.110	0.070
V7	Berec	-0.123	0.090	-6.233	0.070
V8	Cadbury	0.030	0.090	-0.163	0.070
V9	Guiness	-0.928	0.090	-1.106	0.070
V10	Metal Box	1.688	0.090	0.134	0.070
V11	N.B.L	-20.629	0.090	-0.177	0.070
V12	Nigerian Texile	1.122	0.090	-0.229	0.070
V13	Food Specialities	-2.963	0.090	-0.243	0.070
V14	Flour Mills	0.011	0.090	0.014	0.070
V15	Beecham	0.824	0.090	-1.801	0.070
V16	C.F.A.O.	0.048	0.090	-0.041	0.070
V17	John Holt	-7.209	0.090	1.626	0.070
V18	S.C.O.A	-0.027	0.090	0.303	0.070
V19	U.T.C	-2.849	0.090	0.004	0.070
V20	U.A.C.N.	3.387	0.090	-1.081	0.070
V21	Total Petrol	0.255	0.090	-9.788	0.070
V22	N.C.R.	0.000	0.090	-3.362	0.070
V23	University Press	-2.588	0.090	0.313	0.070
V24	Daily Times	0.268	0.090	0.069	0.070
V25	Julius Berger	-13.001	0.090	-0.050	0.070
TOTAL		64.381		59.534	
AVERAGE		2.575	0.090	2.381	0.070

Source: Computed from the data collected.

The table above reveals that 54 per cent of the samples, i.e., about 13 quoted companies out of the 25 exhibit the characteristics of a stable Paretian distribution before the liberation. Also, 60 per cent of the companies have negative skewness while the rest skewing right if we go by the distribution of the daily changes of their stocks. However,

the number of companies conforming to the stable Paretian distribution went up to 58 per cent after the liberalization. Also, 17 out of the 25 companies exhibit a negative skewness.

The picture changes slightly when considering the evidence from the weekly, bi-monthly and monthly data. Here, before the liberalization, 32 per cent from weekly, 28 per cent for bi-monthly and 48 per cent for the monthly changes exhibit the stable Paretian distribution features whereas 24 per cent for the weekly, 28 per cent for bi-monthly changes conform to the stable Paretian distribution (See Tables 7.15 - 7.17 in the Appendix). This trend perhaps could be explained by the view that most of the information revealed using the daily data have been subsummed in the weekly, bi-monthly and monthly data. However, it should be noted that we have not seriously tested for stability or invariant under addition, in the view that this study only serve as a spot check or base. Consequent exercises which take off from here may then attempt that by adding on to what we already have here.

(ii) Characteristic Exponent - Kurtosis:

Another parameter of a stable Paretian distribution is the characteristic exponent denoted α which is also the Kurtosis of the frequency distribution. The characteristic exponent α of a stable Paretian distribution determines the height of, or total probability contained in the extreme

tails of the distribution. It can take any value in the interval of $0 < \alpha \leq 2$. In principle, when $\alpha = 2$, the relevant stable Paretian distribution is the Normal or Gaussian distributions are higher than those of the normal distribution, and the total probability in the extreme tails is larger, the smaller the value of α (Fama 1965).

Mandelbrot hypothesis states that for the distributions of price changes in speculative series, α is in the interval $1 < \alpha < 2$, so that the distributions have means while their variances are infinite. On the other hand, Gaussian hypothesis portends that α is exactly equal to 2. We now go on to examine the evidence from our data. As we have noted earlier, the frequency of our distributions cluster around zero due to the high probability of no change which characterizes majority of the stock prices. As such, the values in extreme tails are very marginal. In fact, the extreme tails do not have any significant heights, perhaps the only evidence we have in this regard comes from the monthly data. Regardless, only 5 out of the 25 quoted companies in our study exhibits the characteristics contained in the Mandelbrot hypothesis before the liberalization. Only 4 seems close to this range after the liberalization, as shown in Table 7.5 below, and also Tables 7.18 - 7.20 in the Appendix.

Table 7.5: Kurtosis of the Frequency Run of Monthly Changes In Stock Prices

Code No.	Names of Companies	Before Liberalization		During Liberalization	
		Kurtosis	Std. Error	Kurtosis	Std. Error
V1	Union Bank	-0.021	0.887	18.977	10.709
V2	First Bank	0.873	0.887	14.524	0.709
V3	U.B.A.	6.368	0.887	13.505	0.709
V4	B.F.N	3.203	0.887	2.453	0.709
V5	Merchantile Bank	26.000	0.887	2.132	0.709
V6	Alumaco	5.445	0.887	13.651	0.709
V7	Berec	9.445	0.887	14.323	0.709
V8	Cadbury	3.337	0.887	2.112	0.709
V9	Guiness	7.109	0.887	3.702	0.709
V10	Metal Box	2.753	0.887	5.556	0.709
V11	N.B.L.	14.247	0.887	4.720	0.709
V12	Nigerian Textile	9.820	0.887	11.035	0.709
V13	Food Specialties	2.291	0.887	8.370	0.709
V14	Flour Mills	3.671	0.887	6.574	0.709
V15	Beecham	2.721	0.887	2.687	0.709
V16	C.F.A.O	1.341	0.887	7.460	0.709
V17	John Holt	3.366	0.887	17.304	0.709
V18	S.C.O.A	-0.203	0.887	28.958	0.709
V19	U.T.C	0.191	0.887	4.582	0.709
V20	U.A.C.N.	2.443	0.887	10.465	0.709
V21	Total Petrol	7.398	0.887	29.280	0.709
V22	N.C.R.	1.968	0.887	13.483	0.709
V23	University Press	3.991	0.887	3.210	0.709
V24	Daily Times	1.204	0.887	25.633	0.709
V25	Julius Berger	6.156	0.887	20.752	0.709
TOTAL		126.293	22.175	285.41	18.081
AVERAGE		5.052	0.887	11.416	0.723

Source: Computed from the data collected.

The views reinforced by this section is the point raised earlier on about the relative inactivity of the Nigerian stock market, which reveals in the considerably large number of no change in stock prices over a given period. However, it is contended that as the market becomes more active and

competitive, variations in large measures will be exhibited. In turn, tails of the distributions can attract more values and have greater heights that conforms more either with the Mandelbrot hypothesis or the Gaussian distribution theorems. The evidence here is not in any way to suggest that the frequency distribution of the Nigerian stock prices is not normal. Rather the disagreement relates only to the shape of extreme tails which is only an extension of normal distribution. However, and more interestingly, our results conform perfectly with the views expressed by Schiller (1987), that stock price change distributions, in a highly competitive economy, indicate high Kurtosis or Fat tails. Theoretical expectation therefore indicates that the distribution of stock price changes in a more competitive economy will be normally distributed and in fact show higher Kurtosis or Fat tails.

7.3 Serial Correlation Results

We present in this section the result of the serial correlation tests. The table below shows the serial correlations between successive changes in the natural log of price for each of the twenty-five stocks selected on the Nigerian Stock Market, covering the periods before and after liberalization separately. The table shows the serial correlations of successive changes in log price for

differencing interval of one day (i.e daily changes in stock prices).

The result shows no evidence of substantial linear dependence between lagged price changes. Indeed, evidence abounds that the correlation between the variables and their lags are pretty weak, as can be seen from the table.

The result below is interesting in a sense, it shows that there is no significant correlation between the daily stock price changes over time. For both periods, 24 out of the 25 observations have correlation coefficients that are below 0.5. This weak correlation conforms to the theory of random-walk which expects the correlation coefficients between the distribution to tend to zero, implying absence of any systematic relationship between the two observations.

On the average, the correlation coefficient before the liberalization stood at 0.271 with a marginal increase to 0.320 after it. No doubt, the average correlation coefficient in both cases are pretty weak. Thus, they are in support of the efficiency of the Nigerian stock price distribution. It can also be noticed that the mean values tend to be very small approaching 0 in most cases.

Table 7.6: Daily Serial Correlation Coefficient

Code No.	Names of Companies	Before Liberalization		During Liberalization	
		Corre. Coeff.	Mean	Corre. Coeff.	Mean
V1	Union Bank	-0.177	0.0003	-0.071	-0.0007
V2	First Bank	-0.324	0.0003	-0.305	-0.0005
V3	U.B.A.	-0.434	0.0000	-0.008	0.0006
V4	B.F.N	-0.419	-0.0001	-0.177	-0.0007
V5	Merchantile Bank	-0.006	-0.0002	-0.043	0.0005
V6	Alumaco	-0.009	0.0002	-0.440	0.0005
V7	Berec	-0.453	-0.0001	-0.044	0.0002
V8	Cadbury	-0.497	0.0001	-0.443	0.0004
V9	Guiness	-0.433	0.0000	-0.112	0.0005
V10	Metal Box	-0.069	-0.0001	-0.427	0.0004
V11	N.B.L.	-0.037	-0.0002	-0.326	0.0004
V12	Nigerian Textile	-0.279	-0.0004	-0.440	0.0004
V13	Food Specialties	-0.288	0.0003	-0.419	0.0000
V14	Flour Mills	-0.508	-0.0002	-0.159	0.0002
V15	Beecham	-0.174	0.0003	-0.308	0.0002
V16	C.F.A.O	-0.486	0.0007	-0.477	0.0004
V17	John Holt	0.003	0.0005	-0.108	0.0000
V18	S.C.O.A	-0.494	0.0005	-0.469	0.0005
V19	U.T.C	-0.226	-0.0001	-0.482	-0.0007
V20	U.A.C.N.	0.120	0.0004	-0.293	0.0004
V21	Total Petrol	0.001	0.0002	-0.244	0.0002
V22	N.C.R.	-0.434	0.0005	-0.353	0.0003
V23	University Press	-0.396	0.0000	-0.456	-0.0004
V24	Daily Times	-0.432	0.0003	-0.737	0.0291
V25	Julius Berger	-0.038	-0.0001	-0.467	0.0004
TOTAL			0.0050		0.0450
AVERAGE		0.271	0.0002	-0.3200	0.0015

Source: Computed from the data collected.

7.4 The Runs Tests Results

We present in this section, the results of the runs analysis for the monthly price changes. The choice for the monthly stock price changes is influenced by the fact that stock prices on daily and weekly basis exhibit relative stagnancy. However, the variation becomes more glaring when

the monthly data is used. Besides, runs analysis, it should be noted is based primarily on the signs of the price changes generated by an independent process with probabilities P(+), P(-) and P(o): In the case of our data, monthly price changes appear to be more appropriate as it is characterized by more changes.

As mentioned earlier, the amount of dependence implied by the runs tests can be depicted by the size of the differences between the total actual numbers of runs and the total expected numbers. To be consistent with independence principle, the actual number of runs should be lesser than the expected numbers for the differencing intervals. (Fama, 1965:76). In other words, the randomness conforming to market efficiency occurs when the total actual number of runs is less than the total expected number of runs.

The result in table 7.6.1 tendsto lend support to the evidence from our serial correlation results in the sense that the total actual number of runs is less than the expected in twenty-four out of twenty-five cases, both before and after liberalization.

Table 7.6.1: Runs Analysis: Total Actual and Expected Numbers of Runs for Monthly Stock Price Changes

Number	Name of Company	Before Liberalization			After Liberalization		
		Actual	Expected	Actual - Expected	Actual	Expected	Actual - Expected
1	Union Bank	27	53.5	-26.5	25	56.9	-31.99
V2	First Bank	38	44.9	-6.9	27	56.0	-29.00
V3	U. B. A.	33	44.9	-11.9	27	55.9	-28.9
V4	B. F. N.	31	50.6	-19.6	41	43.9	-2.9
V5	Merchantile Bank	53	14.4	38.6	44	28.8	15.2
V6	Alumaco	36	46.9	-10.9	31	52.9	-21.9
V7	Berect	37	40.5	-3.5	42	40.7	1.3
V8	Cadbury	35	45.6	-10.6	31	51.6	-20.6
V9	Guiness	25	53.5	-28.5	35	49.8	-14.8
V10	Metal Box	28	53.8	-25.8	32	54.3	-22.3
V11	N. B. L.	21	57.1	-36.1	33	45.9	-12.9
V12	Nigerian Textile	32	45.9	-13.9	37	45.5	-8.5
V13	Food Specialties	27	53.5	-26.5	37	43.5	-6.5
V14	Flour Mills	34	54.0	-20.0	39	50.1	-11.1
V15	Beecham	23	53.6	-30.6	27	52.7	-25.7
V16	C.F.A.O.	33	51.5	-98.5	34	54.3	-20.3
V17	John Holt	26	53.2	-27.2	29	55.5	-26.5
V18	S.C.O.A.	30	54.3	-24.3	25	52.2	-27.2
V19	U. T. C.	36	52.2	-16.2	23	57.9	-34.9
V20	U. A. C. N.	18	58.0	-40.0	32	46.9	-14.9
V21	Total Petrol	39	43.1	-4.1	32	48.4	-16.4
V22	N. C. R.	37	40.5	-3.5	27	51.9	-24.9
V23	University Press	35	45.8	-10.8	31	50.6	-19.6
V24	Daily Times	21	58.5	-37.5	42	36.8	5.6
V25	Julius Berger	35	42.8	-7.8	24	56.1	-32.1
	Averages	31.6	48.5	-14.5	32.3	49.6	-17.3

Source: Computed

Table 7.6.2: Runs Analysis: Standardized Variables and Percentage Differences for Monthly Changes

No.	Names of Companies	Before Liberalization		After Liberalization	
		K	(R-m)/m	K	(R-m)/m
V1	Union Bank	-15.02	-0.495	-21.95	-01.561
V2	First Bank	-1.45	-0.154	-18.26	-0.518
V3	U. B. A.	-7.16	-0.265	-11.93	-0.517
V4	B. F. N.	-9.78	-0.387	-3.24	-0.066
V5	Merchantile Bank	88.86	2.681	4.53	.528
V6	Alumaco	-2.56	-0232	-10.38	-0.414
V7	Berec	-1.78	-0.086	0.85	.032
V8	Cadbury	-5.37	-0.232	-11.22	-0.399
V9	Guiness	-17.94	-0.533	-7.37	-0.297
V10	Metal Box	-15.24	-0.480	-11.47	-0.411
V11	N.B.L.	-21.31	-0.632	-7.00	-0.287
V12	Nigerian Textile	-7.70	-0.303	-4.10	-0.187
V13	Food Specialties	-15.02	-0.495	-3.19	-0.149
V14	Flour Mills	-9.70	-0.370	-4.75	-0.222
V15	Beecham	-19.67	-0.571	-15.27	-0.488
V16	C.F.A.O.	-8.37	-0.359	-9.85	-0.374
V17	John Holt	-16.18	-0.511	-15.02	-0.477
V18	S.C.O.A.	-12.72	-0.448	-78.52	-0.521
V19	U.T.C.	-8.39	-0.310	-30.17	-0.603
V20	U.A.C.N.	-38.72	-0.690	-8.32	-0.318
V21	Total Petrol	0.76	-0.095	-8.64	-0.939
V22	N.C.R.	-1.78	-0.086	-14.43	-0.480
V23	University Press	-5.72	-0.236	-10.10	-0.387
V24	Daily Times	-34.90	-0.641	-2.88	-0.141
V25	Julius Berger	-4.24	-0.182	-20.25	-0.572
	Averages	-7.70	-0.244	-12.65	-0.327

Source: Computed

More importantly, the difference between the total actual number of runs and total expected number of runs

increased by 16.2 per cent under liberalization than before it. The implication of this is that it can be concluded that the degree of independence of stock price changes becomes higher under liberalization than before it by about 16 per cent going by the result from the differences between the actual and expected number of runs. Consequently, the evidence from this runs tests has two implications. The first is that stock prices in Nigeria in spite of the relative stagnancy on daily basis, still exhibits some randomness conforming to market efficiency, at least at the week form level, using the monthly data. The other implication is that the degree of randomness of the stock price changes on the monthly basis increased by about 16 per cent under the liberalization.

We went further to standardize these differences in two ways, first by expressing the difference between the actual number of runs "R" and the expected number "m" by the standardized variable "K" defined earlier (see page 88) Secondly, we examined the differences between the actual and expected number of runs as proportions of the expected numbers labeled (R - m)/m.

The values of "K" show that for twenty-one stocks out of twenty-five, the actual number of runs is more than two standard errors less than the expected number. In fact, some standardized variables are as large 38.7 and even 88.86 in

some cases. The implication of this is that there is a large difference between the total actual number of runs and the total expected number of runs and the total expected number of runs. On the average, the standardized variable stood at -7.7 before liberalization. This declined further by 64.2 per cent to -12.65 on the average after liberalization. This implies that the margin between the actual number of runs and the expected number of runs widened further, indicating improved independence in the series.

In conclusion, as far as the run tests are concerned, there is a remarkable degree of independence in the series of stock price changes conforming to market efficiency. As a result, the series cannot be used to increase the expected profit of the trader. It also conforms with normality expected in the empirical distribution of stock prices in line with the efficient market hypothesis. More importantly, evidence presented on tables 7.6.1 and 7.6.2 shows that the degree of independence in the series increased by about 16.2 per cent on the average after liberalization using the difference between actual and expected number of runs and the coefficients of the standardized variable.

In the next section, we shall examine further, evidences from the frequency distribution graphs.

7.5 Empirical Frequency Distribution Graphs

The graphs for the frequency distributions are displayed in the appendix. In the graphs, we have succeeded in providing the picture both before and after the liberalization side by side. This is made possible by a package which perfectly superimposes one graph on another in order to clearly show the difference and provide the basis for quick comparison. We have therefore chosen ten representative quoted companies for this analysis. The thinking is that almost all the stocks exhibit similar characteristics in their normal distribution graphs, and are therefore repetitive. However, we have also carefully selected the most active ones across all the sectors.

A first glance through all the graphs provided in the appendix shows that the distribution of daily stock price changes are peaked at zero values with negligible tails. The left panel represents the scenarios before liberalization while the ones on the right indicates the position after it. The same position is maintained for the weekly and monthly stock price changes distribution graphs (see graphs in Appendix II).

A second look at the graphs especially for the weekly stock price changes shows that the tails are becoming glaring when weekly price changes are observed. Also, it can be noticed that most graphs skewed to the right more, which

shows that there are probably more of stock price increases than price decreases. Indeed, there are more of either positive or negative changes after the liberalization than before it. This shows that the market, as we have already noticed is becoming more active during liberalization, than before it was introduced.

Finally, the graphs for the monthly stock price changes are more revealing as they bring out most of troughs and peaks in the frequency distribution of the monthly stock price changes. The monthly data shows that stock price changes which are relatively stable on the daily basis, exhibit considerable movement over time especially when monthly transactions are considered. These cases of share price movements are particularly more significant and noticeable during the liberalization. Other inferences can also be drawn from the graph. One, the fact remains that the distribution of stock price changes in the Nigerian stock market conforms to an extent with the efficient market hypothesis. Second, the post-liberalization tempo of activities represent an improvement over the earlier period. However, it is contended that this tempo can be accelerated further if complimentary policy measures conducive to the development of the capital market are undertaken.

In the next section, we intend to move further to provide additional evidences relating to the overall

performance of the Nigerian stock market both before and during liberalization. This will provide more basis for our general conclusion.

CHAPTER EIGHT

OVERALL PERFORMANCE ANALYSIS

8.1 Introduction

We will attempt in this section to provide a simple econometric model that will simulate for some key indicators of the stock markets as earlier identified in chapter six. We will employ the ordinary least square technique for our analysis. However, in estimating the structural equations, that will be specified later, we shall draw on recent developments of cointegration analysis and error correction model (ECM) (see Gilbert 1986). To start with, we evaluate the time series characteristics of all the dependent variables using unit root tests. Actually, these tests are required in order to ascertain the number of times a variable has to be differenced to arrive at stationarity. The essence of these tests are to eliminate the problems of spurious regression and inconsistent regression that usually emanated when dealing with the ordinary least square (OLS) method.

Admittedly, there are a number of methods of determining the order of integration of a series ranging from the Dickey-Fuller (DF) Augmented Dickey-Fuller (ADF) to Sargan-Bhargava Durbin-Watson Tests (SBDW). The method highlighted and adapted here is the Augmented Dickey-Fuller (ADF). The ADF is identical to the standard DF test but is constructed within a regressional model of the form:

$$\Delta y_t = \beta y_{t-1} + \sum_{i=1} \alpha_i \Delta y_{t-j} + E_t \ldots\ldots\ldots\ldots\ldots\ldots \quad (8.1)$$

In order to run the lag, length j in equation (8.1) is set so as to ensure that the error term is distributed as white-noise. Also, in order to capture the equilibrium relationship between any stationary series (if such equilibrium relationship exists) within our model, we employed the tests of cointegration between the dependent and explanatory variable (time). This method helps in avoiding both the spurious and inconsistent regression problems which would have occurred in our model due to the regression of non-stationary data series. Furthermore, the tests permitted us to determine whether there is a long-run relationship between the regressed and regressor. To accomplish this, we employed the Granger-Engle Theorem (Granger and Engle(1987), which stated that if two series are cointegrated, then they will be most efficiently represented by an error correction specification, and that the coefficient of the ECM vector will be cointegrating coefficient estimated in a static regression (Adam 1993). In testing for cointegration, both DF and SBDW are used and they are applied to the tests of the residual of the cointegrating regression, rather than the levels of the series (see Adam, 1992). Thus, we could have:

$$E_t = (Y_t - \alpha_0 - \alpha_1 Z) \ldots\ldots\ldots\ldots\ldots \quad (8.2)$$

Against this background, an econometric software, called PC-Generalized Instrumental Variables Estimators (PC-GIVE),

developed by Hendry (1989) and made available by the African Economic Research Consortium, based in Nairobi, Kenya has been used to perform all the stated statistical tests on the equations based on OLS techniques.

We will therefore proceed to compare and contrast the actual performance to the projected estimates. This will provide the basis for isolating the probable impact of financial reforms on the selected indicators. We have chosen this approach for two reasons. First, the Gaus-Markov Theorem portends that the Least Square technique is the best linear unbiased estimator, with which straight line trend equations could be estimated. Second, this version of the straight line trend model has been used by Ike (1984) and more recently by Soyode (1990) with good results to conduct an appraisal of the Nigerian capital market prior to financial reforms and post financial reforms respectively.

Admittedly, it may not be easy to delineate the impact of liberalization on the stock market in a water-tight compartment. However, in an attempt to establish a link between the macro-economic policy regimes and the selected stock market indicators, we have resolved to specify some of our regression equations using time as a surrogate for the explanatory variable.

The straight line trend is therefore given as:

$$y = a + bt + e$$

"y" represents our computed value for the time series in the year t.

"t" stands for the relevant year, and

"a" is the constant i.e. value of y when t = 0

"e" is the error term.

We shall include the following indicators in our specification of y.

1. VIS = Volume of Industrial Securities
2. VGS = Volume of Government Securities
3. VTS = Volume of Total Securities
4. VAI = Value of Industrial Securities
5. VAG = Value of Government Securities
6. VAT = Value of Government Securities
7. MKC = Market Capitalization
8. SPI = Stock Price Index
9. NCI = New Capital Issues
10. NLS = Number of Listed Securities

Our specification therefore takes the following form.

$$VIS = a + bt + e$$

This is repeated for all the indicators. Next, we also specify two additional equations with stock price indices and average stock prices as dependent variables, while interest rates and exchange rates and their lags serve as explanatory

variables. A discussion of theoretical link of the financial reforms and the stock market has been provided in the earlier sections. We shall now present the table of the regression results for a cursory look and some revealing observations concerning the role of our explanatory variable (i.e. time) influencing our indicators.

8.2 The Regression Results

The results of the first set of the regression equations are presented in Table 8.1 below. At a glance, the regression results show that the performance of the dependent variables or indicators have been considerably influenced by time characterizing the macro-economic policy regimes.

At first, we examine the coefficient of determination "R^2" which determines the proportion of the variation in the dependent variables. However, we admit that the "R^2" may be misleading because adding any additional variables to the regression may increase the coefficient even when they are not theoretically related. Therefore, we also examine the Standard Errors and F- statistics. The standard error, in particular provides a better comparative statistics as it is adjusted by the degrees of freedom (Hendry, 1989: 35). The F-statistics, on the other hand, tests whether the regression does in fact explain a significant proportion of the variation in the dependent variable. Furthermore, the probability value of F where the null hypothesis, H_o is false

or acceptable is shown in the squared parentheses. They are calculated using a given algorithm (Hendry 1989: 35).

Table. 8.1: **Results of Regression Equations 1**

Eq. No.	Depd Var.	Ind. Var	Coeff.	Std Err	t-val.	R^2	σ	D.W	F-Statistics
1.	VGS	t1 t1 Const	0.994 -0.005 25.0937	0.021 0.021 34.497	-2.49 0.751 0.751	0.99	125.3	1.31	(2.18)=1074.0[.0000]
2.	VIS	t1 t0 Const	0.971 -0.050 269.441	0.136 0.136 215.594	7.11 -0.36 1.240	0.75	783.6	1.14	(2.18)=26.73[.0000]
3.	VTS	t1 t0 Const	1.023 -0.020 135.159	0.035 0.035 56.239	28.761 -0.571 2.401	0.98	204.4	1.30	(2.18)=430.54[.0000]
4.	VAI	t1 t0 Const	1.117 -0.063 448.974	0.147 0.147 232.988	7.579 -0.429 1.927	0.77	846.8	1.38	(2.18)=30.38[.0000]
5.	VAG	t1 t0 Const	1.051 -0.230 1727.2	0.582 0.583 920.150	1.804 -0.396 1.877	0.17	3344.5	1.30	(2.18)=1.90[.1791]
6.	VAT	t1 t0 Const	1.092 -0.278 2112.865	0.722 0.583 1141.42	1.511 -0.384 1.851	0.13	4148.8	1.29	(2.18)=1.36[.2807]
7.	MKC	t1 t0 Const	1.405 -0.502 4011.47	1.437 1.439 2271.15	0.977 -0.348 1.766	0.06	9383.7	1.28	(2.18)=0.62[.5492]
8.	SPI	t1 t0 Const	1.570 -0.663 4697.7	1.634 1.635 2581.65	0.960 -0.405 1.819	0.06	9383.7	1.28	(2.18)=0.63[.5418]
9.	NCI	t1 t0 Const	2.676 -0.635 5219.1	1.949 1.951 3079.14	1.373 -0.325 1.690	0.10	11192.0	1.26	(2.18)=1.11[.3506]
10.	NLS	t1 t0 Const	0.354 -1.001 7641.15	2.774 2.776 4382.24	1.569 -0.360 1.743	0.13	15928.0	1.29	(2.18)=1.44[.2618]

Additionally, we will examine the Durbin-Watson statistic and t-values. It should be recalled that the Durbin-Watson statistic ensures that the stationarity conditions are not violated. Consequently, when the value moves close to 2, it indicates that the error term is pure

white-noise. On the other hand, the t statistic which is estimated by dividing the least square estimate of bi (i.e., relevant coefficient) by its standard error, enables us to either accept or reject the null hypothesis and therefore decide if the estimate of bi is statistically significant.

A look at the regression results in Table 8.1 reveals the following. The overall measure of the goodness of fit, R^2 for equations 1 to 4 are statistically significant. Similarly, the standard errors of the explanatory variables, except for the lags and some constants are quite below half of their coefficients. Equally, the t-values of equations 1 to 4 are either greater than 2 or below 2 in line with theoretical expectations. However, the Durbin-Watson statistic for all the equations are fairly weak, although they are approaching 1.5 in all cases. On the other hand, the F-Statistic for all the equations are quite significant except for equations 7 and 8 that are fairly approaching zero. The two equations also have significant probability of the F-statistic indicating that we accept the null hypothesis in such cases.

8.2.1 Implication of Results

Overall evidence from the regression results tend to suggest that the volume of shares (both government and industrial) significantly relate to time, and by implication, the macroeconomic environment prevailing at different times. Equally, equation 4 strongly suggests that the value of

individual shares was equally influenced substantially by time.

However, the result shows that the stock market has a very short memory. Consequently, lags of the time period by one appears to be insignificant in all the cases going by all the significant tests. In other words, volume of shares and value of industrial shares react only to current macroeconomic events.

Furthermore, the value of government securities, market capitalization, stock price index, new capital issues and the number of listed securities appear to react less to the explanatory variables (i.e., time and its lag). However, the regression results in Table 8.2 is more interesting and particularly more revealing. In it, we showed the link between exchange rates and interest rates, both representing key financial liberalization variables and the stock prices as a key stock market indicator.

Theoretically, with the financial liberalization policy in place, we would expect the coefficients of equation 2 to 10 excluding five to be positive. This is because liberalization is expected to ease the financial intermediation process. Also, by leading to increased mobilization of savings, the financial reform is expected to bring a boost to the stock market operations in a Kick-start fashion. On the other hand, as privatization progresses,

government is expected to surrender part of its ownership base thereby reducing the volume and value of government securities. The most significant relationship is between the volume of various securities and time. The tentative general conclusion one can make for now, based on the regression results, is that the performance of the Nigerian stock market especially the volume of shares traded has been greatly influenced by the reforms characterizing the period in consideration.

The results of the second sets of our regression equations is presented in the table below. Here, we attempt to see how exchange rates and interest rates influence stock prices. In this specification, we expressed stock prices, both index and averages as being influenced by two key macroeconomic reform variable namely; exchange rates and interest rates as well as their lags. In effect, we have the following specifications.

(1) $SPI = f[X_{a1}, X_{a0}, X_{b1}, X_{b0}]$

and

(2) $ASP = f[X_{a1}, X_{a0}, X_{b1}, X_{b0}]$

SPI = Stock price indices

ASP = Average stock prices of the twenty-five stocks covered in this study.

X_{a1} = Exchange rate in the current year

X_{a0} = Exchange rate in the preceding year

X_{b1} = Interest rate in the current year

X_{b0} = Interest rate in the past year.

The results of these regression equations are presented in Table 8.2.

Briefly, a cursory look at the regression results in Table 8.2 shows the functional relationships between stock prices in Nigeria on the one hand and exchange rates and interests with their lags on the other. The results attempt to confirm the theoretical postulates highlighted in chapter four in which the financial reforms was linked to the stock market operations through the improvement in the financial intermediation process based on the Mckinnon-Shaw hypothesis.

For instance, the goodness of fit of both equations i.e., stock prices indices and average stock prices are quite significant at 0.98 and 0.99 respectively. The standard errors of all the explanatory variables except for their lags are also less than half of the respective coefficients. The t-values of the actual explanatory variables also conform with expectation.

The Durbin-Watson statistic are around 2 while the F-statistics are quite significant with zero probability of accepting H_o. These results, no doubt, provide a firm ground to conclude that the performance and efficiency of the Nigerian stock market is influenced by the financial liberalization.

Table 8.2: Results of Regression Equations 2

Eq. No.	Depd Var.	Ind. Var	Coeff.	Std Err	t-val.	R^2	σ	D.W	F-Statistics
1.	SPI	Xa1	0.280	0.121	2.314	0.98	5.881	1.70	(4.26)=499.9[.000]
		Xa0	-0.079	0.121	0.651				
		Xb1	0.377	0.094	4.006				
		Xb0	0.064	0.094	0.691				
		Const	-4.434	2.193	-1.980				
2.	ASP	Xa1	0.425	0.127	3.338	0.99	6.201	2.11	(4.26)=658.9[.000]
		Xa0	0.128	0.128	-0.783				
		Xb1	0.390	0.098	3.929				
		Xb0	0.082	0.098	0.835				
		Const	-4.493	2.312	-2.138				

8.3 Diagnostic Tests for the Models

In this section we will be attempting to unfold the probable presence of any spurious regression which arises where the regression of non-stationary series, which are known to be un-related, indicates that the series are correlated, the result of which would be misleading. Consequently, a few tests, as our data set would permit are carried out.

It may be necessary to briefly highlight the role of unit root tests here, with the Dickey-Fuller and Sargan-Bhargava test statistics. The Dickey-Fuller test, for instance, examines the size of the coefficients in the equation varying with the sample size.

Interestingly, Dickey and Fuller (1976) have tabulated the distribution of the statistic, which, of course, varies with how the model is estimated whether it is with a constant or trend. We shall present the critical values of the test

for the existence of unit roots (i.e., where $\alpha = 1$). Additionally, we shall present the critical values for the second form of testing for the presence of unit roots using the Sargan-Bhargava and Durbin-Watson tests which is based on the standard Durbin-Watson statistic.

Table 8.3.1: Dickey-Fuller Test Statistic

Sample Size	Critical Value 5%
20	-3.00
50	-2.93
100	-2.89
∞	-2.86

Source: Adam, C.S. (1992). Table 2(a) P.23

Table 8.3.2: Sargan-Bhargava Test Statistics

Sample Size	Critical Value 5%
20	0.78
100	0.39
200	0.20

Source: Adam, C.S. (1992). Table 2(b) P.23

It should be noted that the tests performed in this study have a sample size of 32 based on the quarterly data series. Hence, we shall be focussing more on applying the Dickey-Fuller test statistic for our unit root testing. In Table 8.3.3 below, we reported the results of the tests on the significance of each variable and the lags including the unit root t-tests.

First, we present the results of the tests of significance of each variable and that of the lags for stock price index.

Table 8.3.3: Tests on the Significance of Each Variable and lag for SPI

Variable	F-Statistics	Probability	Unit Root t-test
Xa	(2,26) = 3.157	.059	1.099
Xb	(2,26) = 8.041	.002	3.139
CONSTANT	(1,26) = 3.923	.058	-1.981
LAG(1)	(2,26) = 0.260	.778	-

Next we present similar results for the Average Stock Prices for our sample firms. They are as follows:

Table 8.3.4 Tests on the Significance of Each Variable and lag for ASP

Variable	F-Statistics	Probability	Unit Root t-test
Xa	(2,26) = 6.355	.006	1.688
Xb	(2,26) = 7.775	.002	3.182
CONSTANT	(1,26) = 4.573	.047	-2.138
LAG(2)	(2,26) = 0.384)	.685	-

From Tables 8.3.1 and 8.3.2 above, we can further confirm and buttress our earlier assertion. Except for the lags in both cases, the F-statistics for all the variable are quite significant and considerably greater than zero. Equally, the probability for F-statistics are quite low except for the lags. This shows that we equally reject in this case, the null hypothesis on the basis of the F-statistics.

Next, we examine the diagnostic test of Heteroscedasticity error.

From Table 8.3.5 below we can notice that the probabilities of heteroscedasticity (reported in parenthesis) are very low except for only two observations. This further reinforced the reliability of the models in explaining the specified functional relationships.

Table 8.3.5: Test for Heteroscedasticity Error

```
F(8,17) =    .4087[.9001]
F(4,13) =    .6462[.6001]
F(1,17) =   2.2850[.1157]
F(8,17) =   8.8665[.0001]
F(4,13) = 12.7873[.0002]
F(4,13) = 14.2399[.0001]
F(4,13) =   2.5314[.0910]
F(4,13) = 10.8762[.0004]
F(4,13)   =   9.7631[.0007]
```

Finally, we examine the Jarque-Bera Test for Error Distribution below:

Table 8.3.6: ARCH Test Results

LAG	CONST	1	2	3
COEFFICIENT	1.037	-.067	-.079	-.064
S.E.s	.8099	.223	.222	.225

F(3,20) = .09[.9643]

The results above show the insignificant nature of the lags as indicated by high probability of F-statistics.

Equally, the standard errors are greater than half of the corresponding coefficients. This also shows that we have to accept the null hypothesis as far as the lags of the variables are concerned. As noted earlier, this results indicate that the stock market has a short memory. In other words, events in the preceding years do not necessarily influence the current activities of the market. In a way, this can be in support of the random-walk theorem which claims that the distribution of stock prices are essentially **stochastic.**

We shall now proceed to examine the growth of the Nigerian stock market and also employ the counter-factual framework to analyze the simulations as a basis of assessing the operational performance of the market in the view of the financial liberalization policies adopted.

8.4 Analysis of Growth Rates and Simulations

In this section, we attempted to examine the impact of reforms on the growth rates of our indicators. Furthermore, we compared the actual values to the simulated ones for more meaningful assessment. The growth rates of our key indicators both before and after liberalization are presented in the table below. In order to enable us have a clear picture of the impact of financial reform on the performance of the stock market, we presented a simple summary of the growth rates of the important indicators. This shows more

clearly, the position before and after the financial reforms. However, we went further to see other possibilities through a simulation exercise. This is expected to tell us if the actual performance can further be improved upon and possibly forms the basis for our recommendations.

Table 8.4: GROWTH RATES OF INDICATORS (1981-91) (%)

No.	Stock Market Indicators	Before Reforms (1981 - 85)	During Reforms (1985 - 91)
1.	Volume of Government Securities	173.5	-83.8
2.	Value of Government Securities	-14.5	-80.37
3.	Volume of Industrial Stocks	128.2	57.9
4.	Value of Industrial Stocks	128.2	530.3
5.	Volume of Total Securities	128.8	57.1
6.	Value of Total Securities	-39.9	-51.1
7.	Market Capitalization	34.0	233.4
8.	Stock Price Indices	22.6	47.17
9.	New Capital Issues	100.8	58.51
10.	Number of Listed Companies	3.2	141.4
	Overall Average Growth Rate	66.4	67.7

Source: Computed.

8.4.1 Government Securities

From Table 8.4 above we can see that the growth rate of volume of government securities fell from 173.5 per cent before the reform, and declined by 83.8 per cent after the reforms. Similarly, the value of government securities which fell by 14.5 per cent before the reforms fell further by 80.37 per cent after the reforms. This shows a decline both in the value and volume of government securities after the reforms. Noticeably too, both the volume and value of government securities fell short of the projected figures by about 86 per cent and 28.4 per cent in 1988 and 1991 respectively. (See Table 8.4.1 below).

Table 8.4.1: Volume of Government Securities

Year	Actual	Simulated	% Difference
1980	211	223.0654	-5.72
1981	117	218.5446	-86.79
1982	188	214.0238	-14.84
1983	291	209.503	28.01
1984	195	204.9823	-5.12
1985	320	191.42	37.36
1986	279	200.4615	29.77
1987	230	191.42	16.77
1988	100	186,8992	-86.90
1989	171	182.3784	-6.65
1990	111	177.8577	-6.65
1991	45	173.3370	-284.44

Consequently, the actual value of government securities fell from ₦472.3 million in 1986 to ₦92.7 million in 1991, although there was an up-surge in 1989 to ₦490.3 million. However, on the whole, between 1986 and 1991, the value of government securities declined by well over 80 per cent (see Table 8.4).

This trend was expected with the call for the shrinkage of the public sector as embedded in the Structural Adjustment Programme. The trend can thus be explained by the implementation of privatization and commercialization of public enterprises policy which intended to reduce Government's participation in equity ownership. Indeed, one of the explicitly stated objectives of the privatization and commercialization programmes was to restructure and rationalize the public sector in order to lessen the dominance of unproductive investments in the sector. It was also stated that the policy intended to initiate the process of gradual cession to the private sector, of such public enterprises which, by their native type of operations, are best performed by the private sector.

Table 8.4.2: Value of Government Securities

Year	Actual	Simulated	% Difference
1980	503.4	226.6246	54.98
1981	326	245,1653	24.80
1982	206.5	263.7061	-27.70
1983	384.7	282.2469	26.63
1984	402.8	300.7876	25.33
1985	296	319.3284	-7.88
1986	472.3	337.8692	28.46
1987	307.9	356.4099	-15.76
1988	217.1	374.9507	-72.71
1989	490.5	393.4915	19.78
1990	153.9	412.0323	-167.73
1991	92.7	430.5731	-367.39

To this extent, the decline in government securities can thus be explained as a consequence of gradual transfer of ownership of some enterprises to the private sector through privatization. However, a major concern in the future would be how to determine if such privatized enterprises have become more efficient and significantly more productive as envisaged in the policy.

8.4.2 Industrial Securities

Contrary to the performance of government securities, industrial stocks show some growth. However, the growth rate of the volume of industrial securities declined from 128.2 per cent before the reforms to 57.9 per cent after the

reforms. Although there was a growth in absolute terms, the growth rate declined by about 70 per cent.

On the other hand, the growth rate of the value of industrial securities which was 286.2 per cent before the reforms increased to about 530.3 per cent after the reform. The plausible explanation for this performance would be that the industrial sector has witnessed the increase owing to the transfer of hitherto public enterprises to the private sector.

Furthermore, the actual performance of the industrial stocks is so overwhelming that it even exceeded the simulated values by 35.3 per cent in 1986, 5.04 per cent in 1987, 8.32 per cent in 1988, 36.97 per cent in 1989 and lastly by 77.01 per cent in 1991 (see Table 8.4.3 below). . This is an indication of the absorptive capacity of the stock market and its potential for handling increased activities. This therefore underscores the need for complementary policies to enhance the operations of the stock market.

Table 8.4.3: Volume of Industrial Stock

Year	Actual	Simulated	% Difference
1980	6846	9299.24	-35.89
1981	10101	10596.22	-4.90
1982	9218	11893.21	-29.02
1983	11625	13190.20	-13.46
1984	17171	14487.19	15.62
1985	23060	15784.18	31.55
1986	26404	17081.16	35.31
1987	19353	18378.15	5.04
1988	21460	19675.14	8.32
1989	33273	20972.13	36.97
1990	3381	22269.12	74.59
1991	41716	23566.11	77.01

Table 8.2.4: Industrial Stocks (Value of Securities)(₦'million)

Year	Actual	Simulated	% Difference
1980	8.6	17.49004	-103.37
1981	8.1	20.89233	-242.50
1982	8.3	24.29463	-192.71
1983	13.0	27.69693	-113.05
1984	15.44	31.09923	-101.42
1985	23.56	34.50153	-46.44
1986	23.7	37.90382	-59.93
1987	40.08	41.30612	-3.06
1988	32.5	44.70842	-37.56
1989	62.7	48.11072	23.27
1990	118.9	51.51302	56.68
1991	149.4	54.91532	172.05

8.4.3 All Securities

It should be noted that the volume of all securities increased nominally at both periods. However, the growth rate after the reforms declined to 57.1 per cent from 128.8 per cent before the reforms. More importantly, the value of total securities which declined by 39.9 per cent before the reforms declined further by 51.1 per cent after the reforms. This implies that securities prices have not appreciated significantly. Rather, the claim that securities were undervalued seems to hold in this case.

Consequently, the actual value of securities fell below the simulated values by 14.28 per cent in 1987, 68.13 per cent in 1989 and by 69.92 per cent in 1990 and by 50.13 per cent in 1991 (see Table 8.4.5 below). This trend calls for a closer look at the share valuation procedure. Indeed, studies have asserted that the share pricing of the recently privatized enterprises fell below their model based prices (Ariyo, 1991). A consideration of all current market prices may be desirable.

8.4.4 Market Capitalization

Noticeably, market capitalization which is the value of all firms as determined by the market price of their issues and outstanding common stock, grew by 34.0 per cent between 1981 and 1985. However, there was a phenomenal growth in the market capitalization to 234.4 per cent after the reforms (1986-91). This can be explained by the sharp increase in

the number of listed companies by about 141.4 per cent between 1986 and 1991.

Table 8.4.5: Total Volume of Securities

Year	Actual	Simulated	% Difference
1980	7054	11203.44	-58.82
1981	10218	12949.31	-26.73
1982	9406	14695.19	-56.23
1983	11916	16441.07	-37.97
1984	17365	18186.95	-4.73
1985	23380	19932.83	14.74
1986	26583	21678.70	18.45
1987	19583	23424.58	-19.62
1988	21560	25170.46	-16.75
1989	33444	26916.34	19.52
1990	38999	28662.22	26.51
1991	41770	30408.10	37.36

Table 8.4.6: Total Value of Securities (Value of Securities) (₦'million)

Year	Actual	Simulated	% Difference
1980	512	244.1042	52.32
1981	532.1	266.0479	50.00
1982	214.8	287.9917	-34.07
1983	397.7	309.9355	22.07
1984	418.19	331.8793	20.64
1985	319.58	353.8231	-10.72
1986	495.99	375.7669	24.24
1987	348.01	397.7107	-14.28
1988	249.6	419.6545	-68.13
1989	553.2	441.5983	20.17
1990	272.8	463.5421	-69.92
1991	242.1	485.4859	-50.13

Equally, the simulated exercise shows that the actual market capitalization exceeded the simulated by about 4 per cent in 1988, 19.19 per cent in 1989 and 92.26 per cent in 1991. Compared to periods before the reforms, the performance of the market capitalization after the reforms is much better. It can be noticed that the market capitalization had increased by five times in the last decade. Specifically, it has increased by about three and a half times after the restructuring. If the trend continues, it signals a rapid development and phenomenal growth of the market in the near future.

Table 8.2.7: Market Capitalization (₦'million)

Year	Actual	Simulated	% Difference
1980	4464.2	4066.076	8.92
1981	4976.8	4767.892	4.20
1982	4025.7	5469.708	-35.87
1983	5768	6171.524	-7.00
1984	5514.9	6873.34	-24.63
1985	6670	7575.157	-13.57
1986	6794.8	8276.973	-21.81
1987	8297.6	8978.789	-8.21
1988	10020.8	9680.605	3.39
1989	12848.7	10382.42	19.19
1990	16000	11084.23	30.72
1991	22660.0	11786.04	92.26

8.4.5 Stock Price Indices

The stock exchange price index is a means of detecting the extent and direction of the general price level on the Nigerian Stock Exchange. It was initiated in 1984.

From Table 8.4, we will note that between 1984 and 1985 i.e., before the reforms, stock price index appreciated by 22.6 per cent. After the reforms, that is, between 1986 and 1991, the index rose by 47.1 per cent. This perhaps is a reflection of buoyant trading activity on the exchange, as well as the improved profit performance of a substantial number of the companies noted on the Nigerian Stock Exchange.

Table 8.4.8: Stock Price Indices (₦'million)

Year	Actual	Simulated	% Difference
1980	0	45.39892	-
1981	0	54.44437	-
1982	0	63.48982	-
1983	0	72.53528	-
1984	100	81.58073	18.42
1985	122.6	90.62619	26.08
1986	130.8	99.67164	23.80
1987	133.1	108.717	18.32
1988	139	177.7625	15.28
1989	152.5	126.808	16.85
1990	175.1	135.8534	22.41
1991	192.5	144.854	33.68

It can also be noted from Table 7.4.8 that the performance of the stock price index was much better than

anticipated from the simulated result. The index, right from inception, had continued to be higher than the projected values by between 15 to 26 per cent. It can be contended that the reform had considerably enhanced the share price appreciation over time. The importance of this in attracting more industries to become listed on the stock exchange cannot be over-emphasized, if complementary policies are put in place.

8.4.6 New Capital Issues

New capital issues grew from year to year. No doubt the trend was highly remarkable after the reforms. For example, between 1981 and 1985, there was an increase of about 100.8 per cent whereas between 1986 and 1990, the growth rate had increased to about 1,442.4 per cent. This shows that new capital issues had grown to about 2 times in 1991 than what it was in 1986.

Although the value of new capital issues fell below the projected values regularly between 1980 and 1989, the year 1990 witnessed an increased in the new capital issues above the projected value by well over 75 per cent. This may be traceable to the sale of several public enterprises under the privatization programme.

Table 8.4.9: New Capital Issues (₦'million)

Year	Actual	Simulated	% Difference
1980	372.3	721.19	-93.71
1981	336.2	888.164	-164.18
1982	454.3	1055.13	-132.25
1983	479.4	1222.1	-154.92
1984	25.0	1389.07	-5456.28
1985	675.4	1556.04	-130.39
1986	646.0	1723.01	-166.72
1987	285.8	1889.98	-561.29
1988	280.9	2056.95	-632.27
1989	1626.6	2223.92	-36.72
1990	964.4	2390.89	86.01
1991	1024.0	2557.91	-59.95

8.4.7 Number of Listed Companies

Prior to the reforms, the growth rate of listed companies in the stock market was 3.2 per cent. After the reforms, the growth rate rose to 165.5 per cent between 1980 and 1990. The implication of this trend is that it appears the stock market is increasingly becoming attractive to unlisted companies.

Indeed, there was the contention that this development was influenced by the sharp rise in interest rates which makes the cost of borrowing in the money market very high as well as the sale of some privatized enterprises to the public through the capital market.

Companies continued to approach the capital market due to its attractivess in the mobilization of long-term funds in view of the scarcity of funds and the consequent high rates of interest in the money.

However, a comparison of the simulated values to the actual number shows that the increase in the number of listed companies is still below the expected number given by the simulation. Hence, the number fell below the expected by 10.32 per cent in 1987, 14.33 per cent in 1988, 10.74 per cent in 1989. The actual number, however exceeded the projected by 76.36 per cent in 1991. Perhaps more could be achieved given the fact that there are about 3,000 duly registered companies in the country to date which are yet to be listed on the stock market.

Table 8.4.10 Number of Listed Companies

Year	Actual	Simulated	% Difference
1980	90	66.22798	26.41
1981	93	72.52668	22.01
1982	93	78.82538	15.24
1983	93	85.12408	8.47
1984	93	91.42278	1.70
1985	96	97.72148	-1.79
1986	99	104.0201	-5.07
1987	100	110.3188	-10.32
1988	102	116.6175	-14.33
1989	111	122.9162	-10.74
1990	131	129.2149	1.36
1991	239	135.5136	76.36

8.4.8 Overall Average Growth Rate

Crudely, the overall average growth rate stood at 82.3 per cent before the reforms. After the reforms, the average growth rate of all indicators rose to 187.6 per cent. Although this overall average growth rate do not particularly test any significant indicator, we are only as a rule of thumb, using it as a simple surrogate to measure in general terms, the current position, judging by the pre-reform position.

8.5 Graphical Presentation

The trends in the actual and simulated indicators of the stock market are depicted in figures 1 to 10. The figures portray the points of convergence and divergence between the actual values and the simulated or projected values, both before and after the financial reforms. Hence, the figures used 1980 as their base. The purpose of this section is only to reinforce all our previous observations and remarks on the tables.

For instance, Figure 1 shows that actual number of government securities declined below the projected values between 1980 and 1982. It rose above the projected values between 1982 and mid 1987. However it has continued to fall below the projected values since. Even the increase in the securities in 1989 still fell below the projected figures. This has been adduced to the transfer of public enterprises

from the government to the private sector.

In Figure 2, the number of industries stocks fell below the projected values between 1980 and 1983. It rose beyond the simulated values between 1984 and 1991. The trend is traceable to the boost of the stock market by the privatization exercise. In Figure 3, total volume of securities fell below the projected values between 1980-84, and 1986-88. However, there were increases above the projected in 1984-86, and 1988 to date. Figure 4 shows that the actual value of government securities continues to exceed the projected in the last decade with few exceptions. In fact, mostly after the reforms, the value had considerably fallen below the projected trend. This again had been explained through the sale of public enterprises to the private sector thereby reducing government involvements in equity ownership. It has been noted that the Federal Government has surrendered a total of 76 seats on Boards of Directors of the affected enterprises. At the end of privatization, 300 seats are expected to be surrendered to the private sector.

In Figure 5, we see that the actual value of industrial stocks continued to fall below the simulated value until mid 1988. The value of industrial stocks has since been on the increase growing faster than the projected estimate. Figure 6 shows that the value of all securities continue to rise but

falls below the projected value in the past decade. The value had since 1989 been falling below the projected values, largely due to persistent fall in the volume and value of government securities.

Figure 7 shows that market capitalization which tends to be below the projected value earlier on picked up and rose beyond the simulated values since 1987. The phenomenal growth has been an indication of increased capital accumulation in the capital market.

In Figure 8, the stock price index is shown. The observation is that the real stock price index continues to rise beyond the projected values since its inception in 1984. This represents an enhancement of the profitability of investments in the stock market. It reflects the aggregate capital gains through share price appreciation. However, sectoral increases in the stock price index is more informative to a potential investor.

Equally, the trend in Figure 9 shows that new capital issues only rose beyond the projected values from 1989 onward. However, the nominal performance had been remarkable but the contention is that it could be improved upon given an enabling environment and appropriate policies.

Lastly, Figure 10 shows that the number of listed companies only exceeded the projected values between 1980 and 1984 the number had continuously fallen below the projected

values between 1985 and 1990. However, there appears to be a convergence in 1990 and an increase in 1991 between the simulated values and the actual values signalling that there are more rooms for improvement, especially with well over 3,000 registered companies in Nigeria.

Notably, this result confirms similar results obtained by Soyode (1991) and also extends the analysis. Similar results were also obtained in Korea (See Koh, 1989).

FIG.1: VOLUME OF

GOVERNMENT SECURITIES

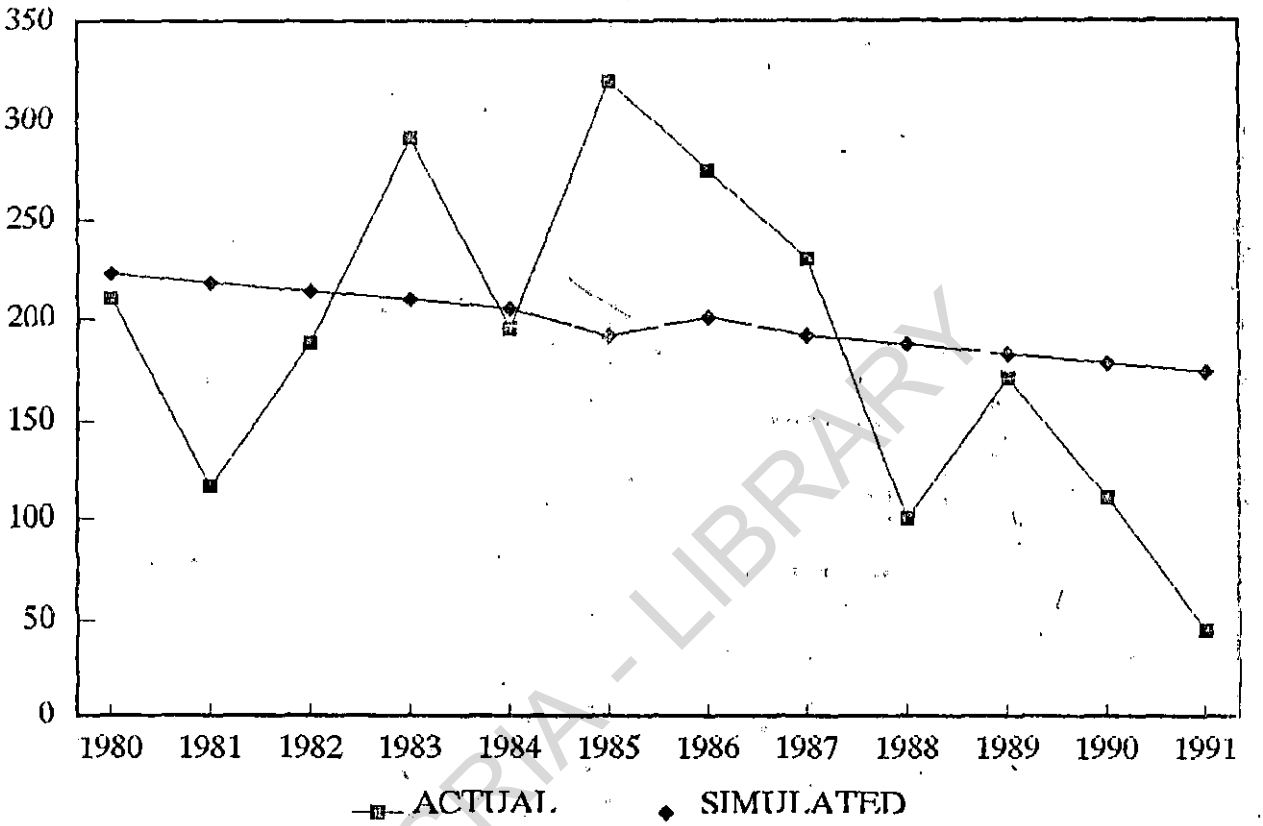


FIG.2: VOLUME OF

INDUSTRIAL STOCKS

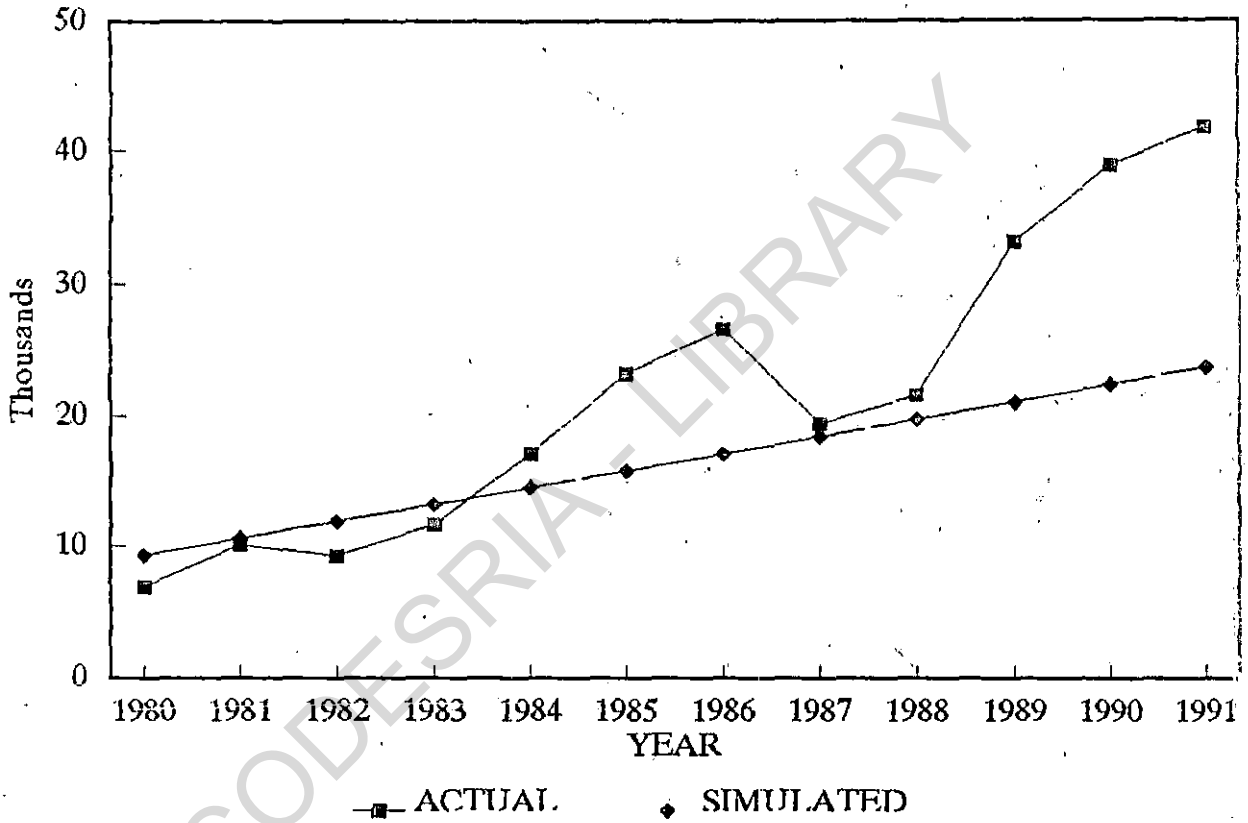


FIG.3: VOLUME OF SECURITIES

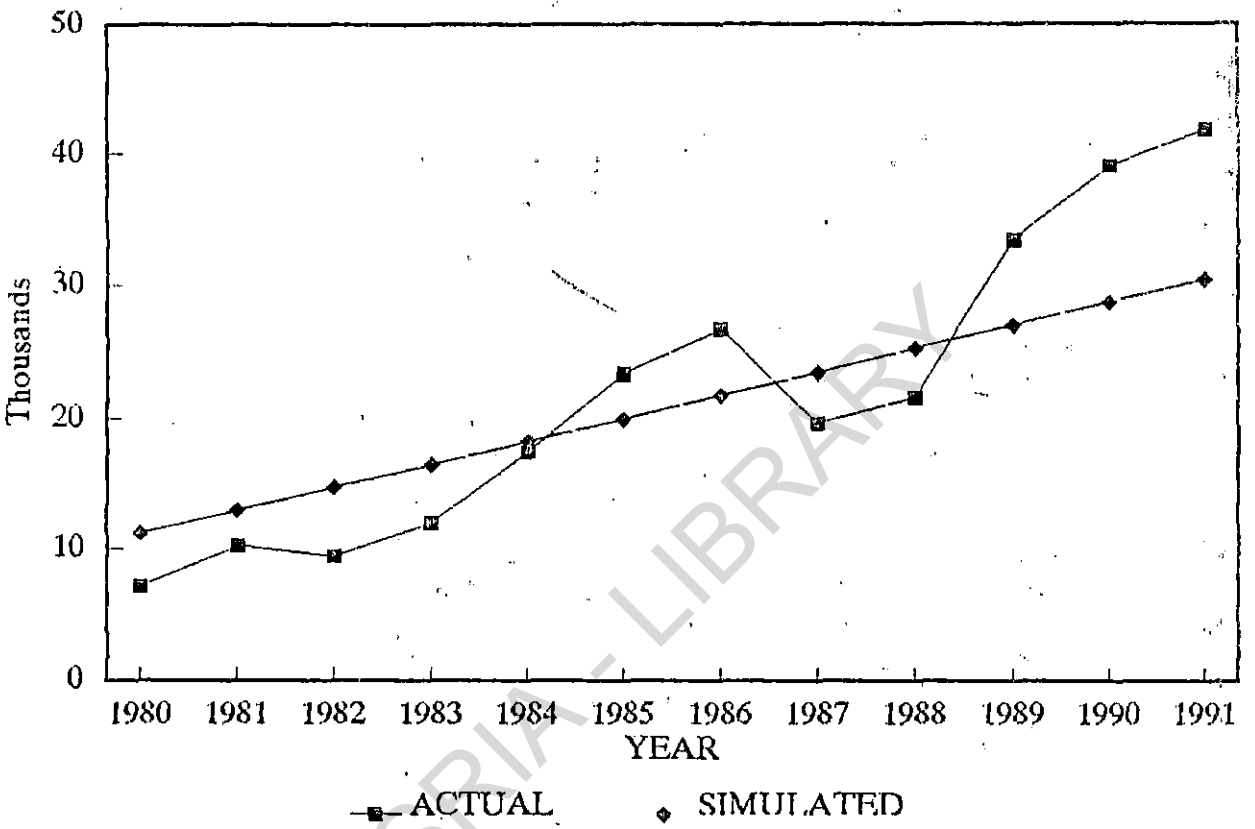


FIG.4: VALUE OF

GOVERNMENT SECURITIES

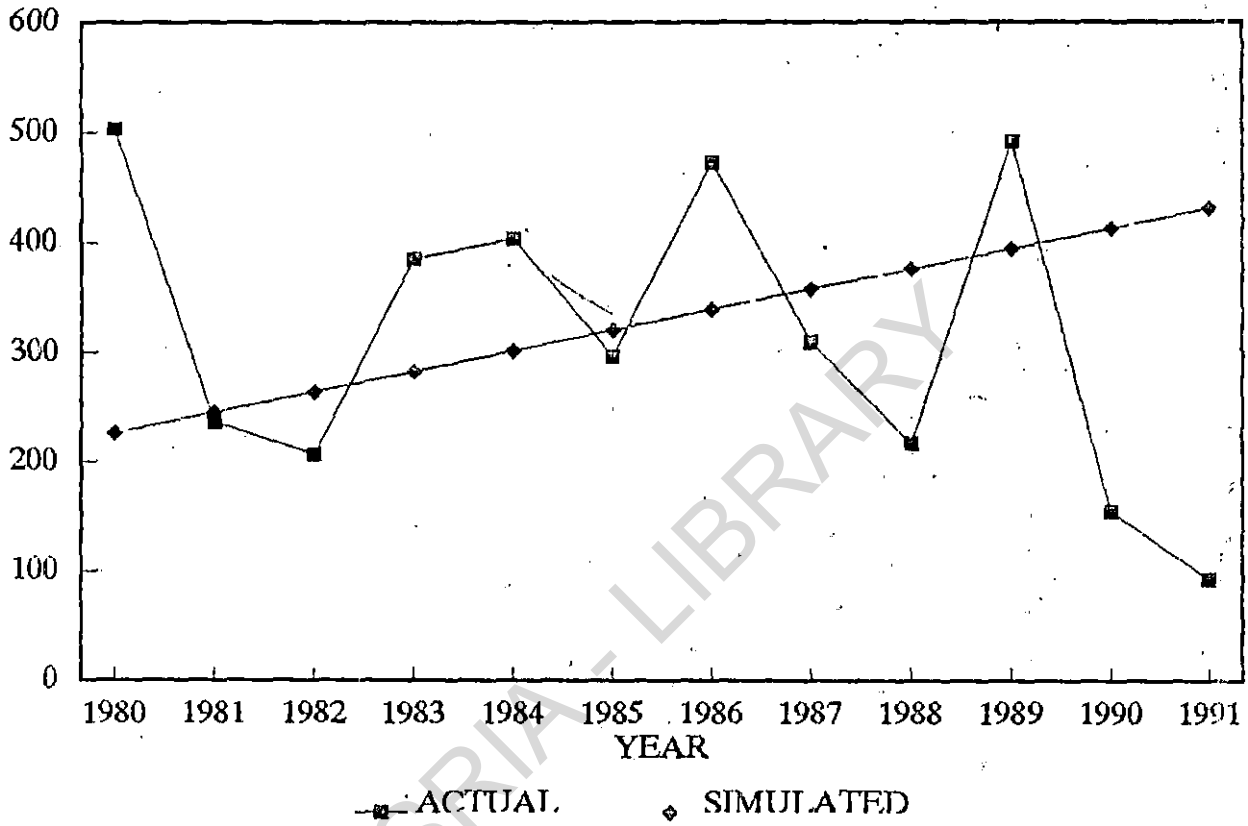


FIG.5: VALUE OF

INDUSTRIAL STOCKS

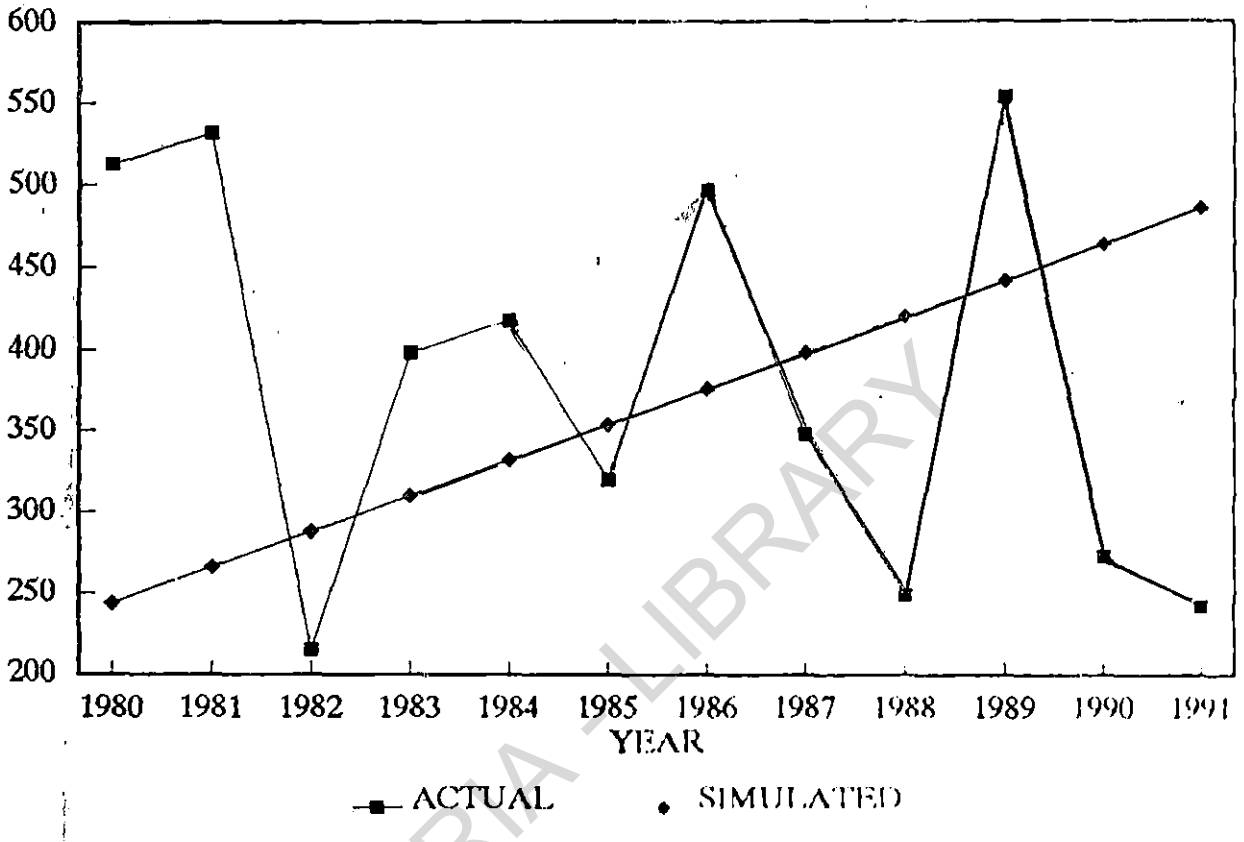


FIG.6: TOTAL VALUE OF ALL SECURITIES

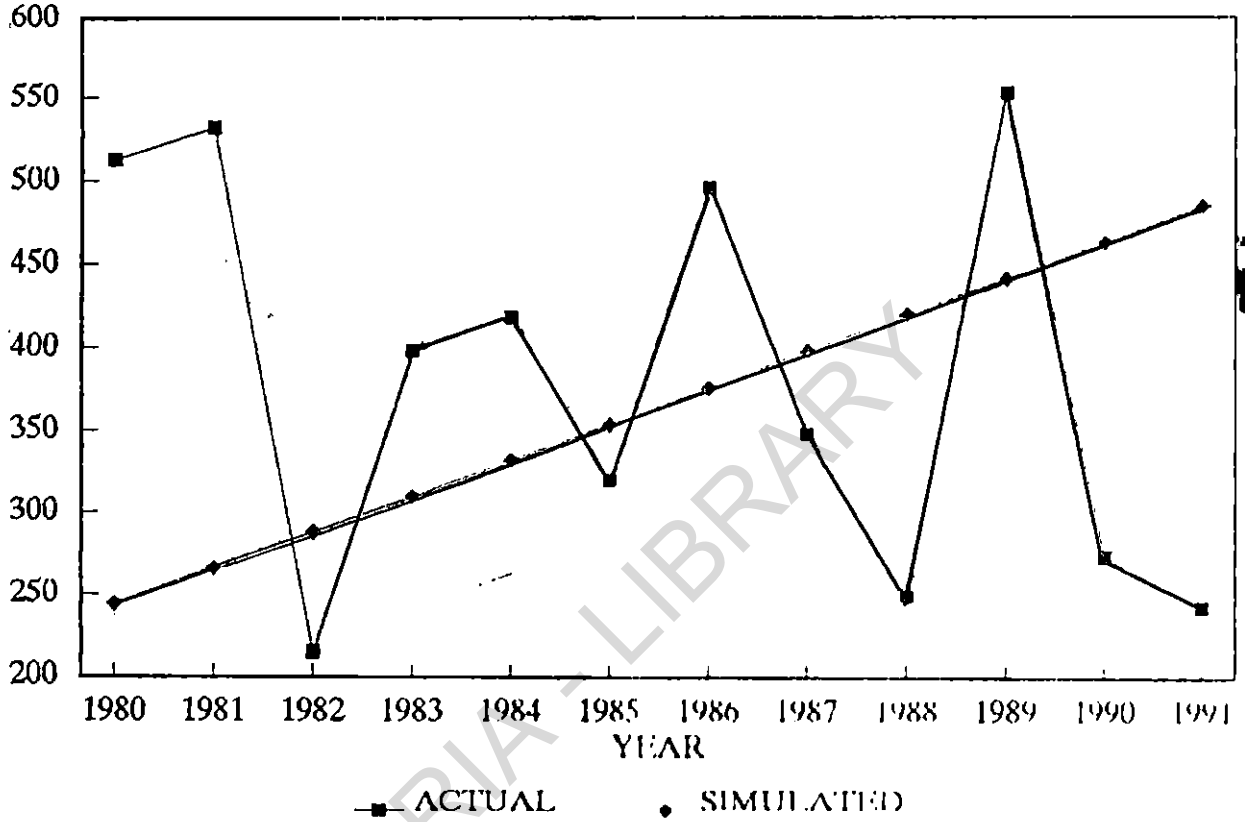


FIG.7: MARKET CAPITALIZATION

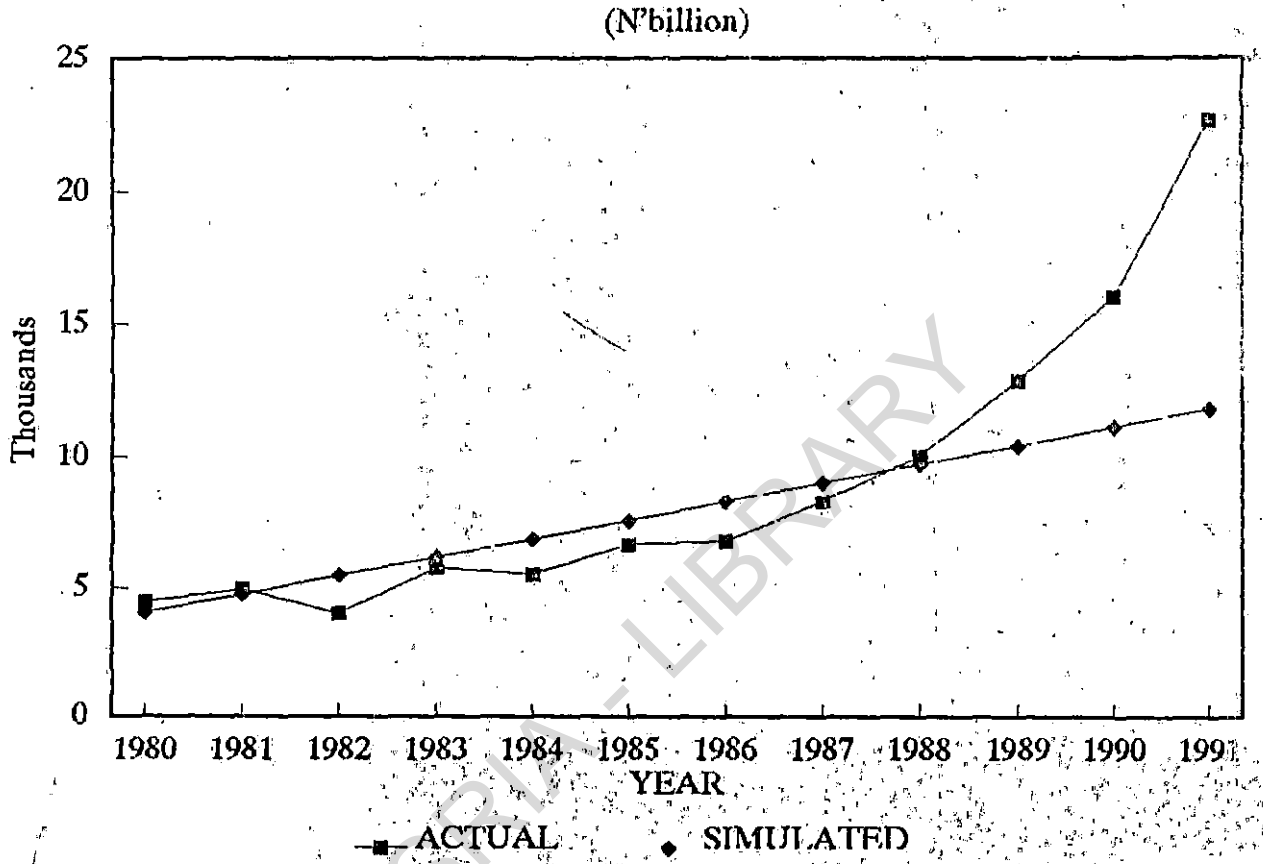


FIG.8: STOCK PRICE INDICES

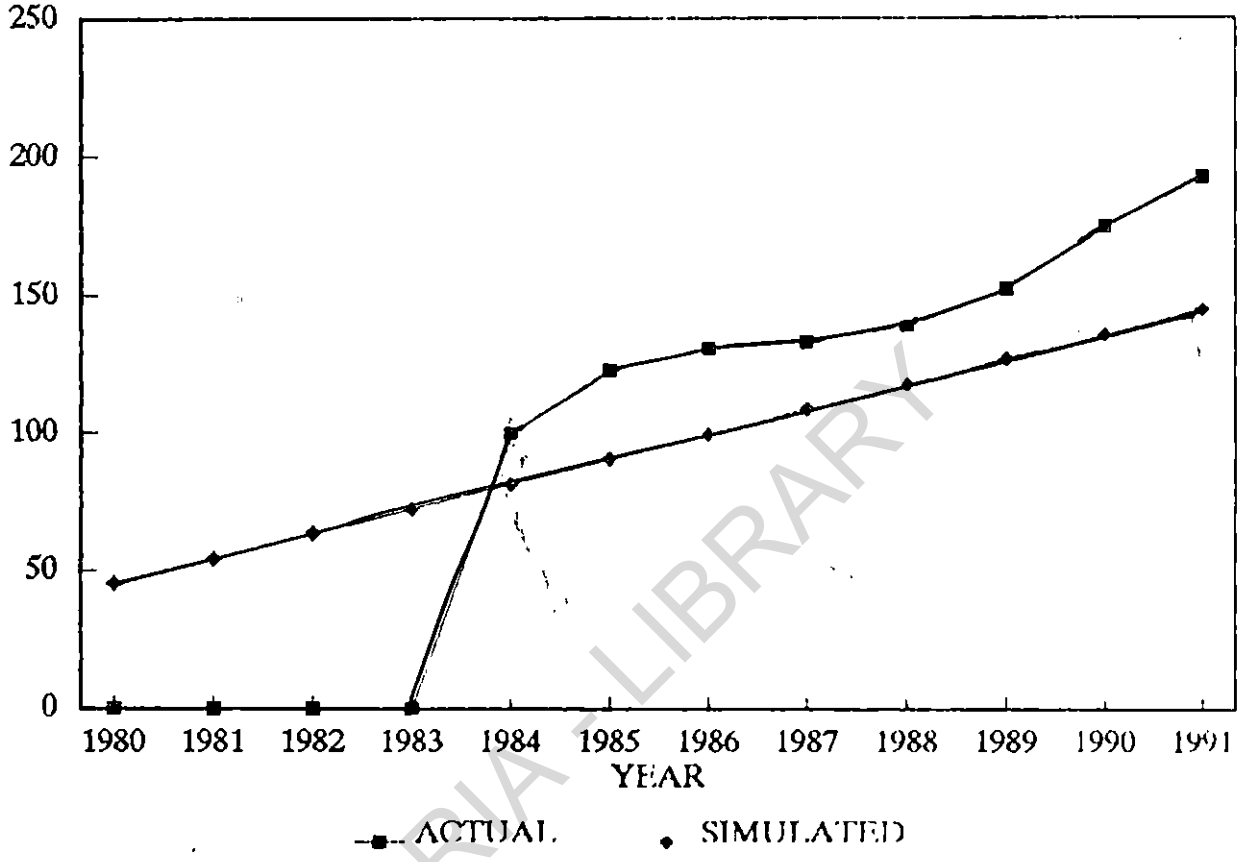


FIG.9: NEW CAPITAL ISSUES

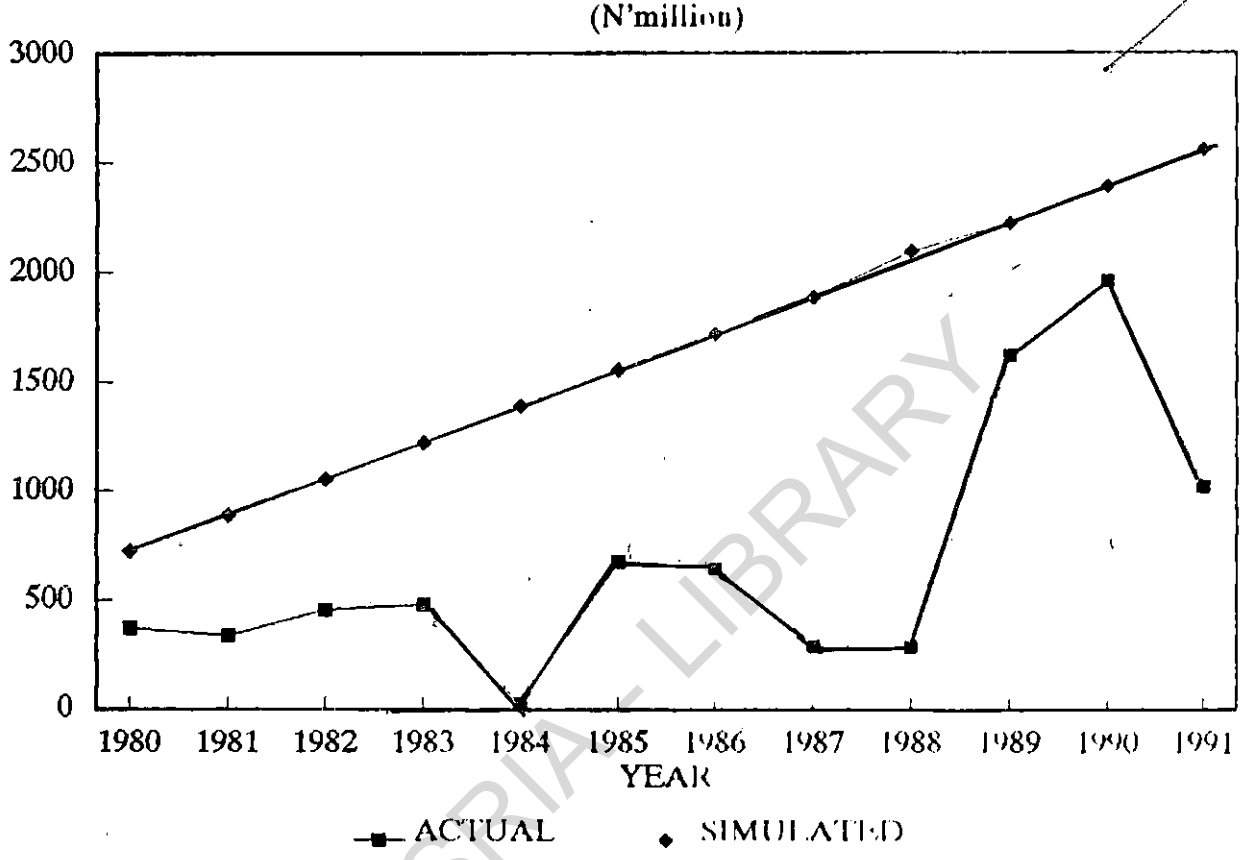
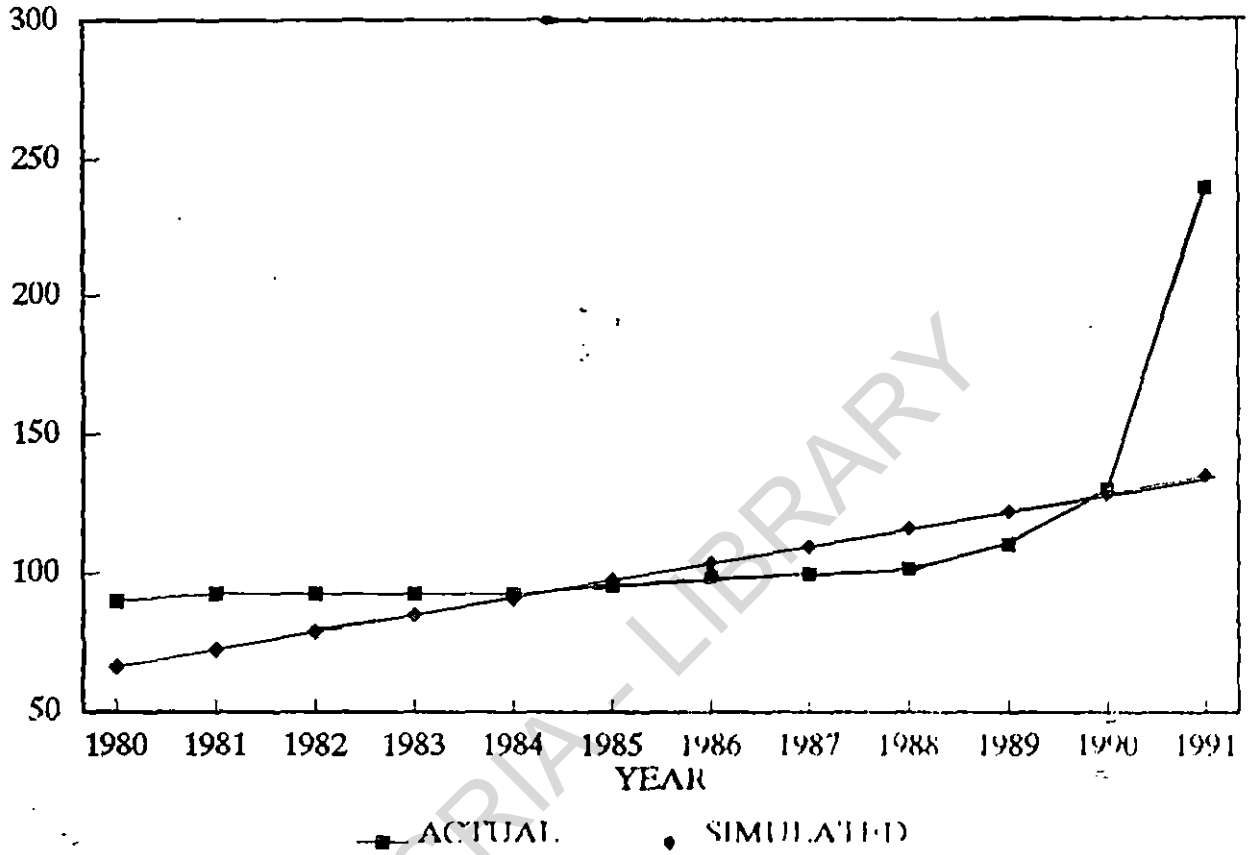


FIG.10: NUMBER OF LISTED COMPANIES



CHAPTER NINE

CONCLUSIONS

9.1 SUMMARY AND CONCLUSIONS

The purpose of this study was to evaluate the impact of financial liberalization on the market efficiency of the Nigerian stock market and the overall performance of the stock market. Hence, this research has concentrated on the following areas.

(a) The analysis of the efficiency of the Nigerian stock market applying the weak-form efficient market tests for the periods before and after economic liberalization.

(b) The subsequent evaluation of the impact of financial liberalization on the efficiency of the Nigerian stock market.

(c) An assessment of the overall performance of the Nigerian stock market using some key indicators before and after liberalization, and the highlight of some major problems confronting the market.

The main results obtained are summarized as follows:

1. In the frequency distribution tests, the average results indicate weak conformity with efficient market model with relatively fat tails for the monthly data combined with peakedness at zero changes and occasional leptokurtosis;

2. In the serial correlation analysis, most of the firms have very low serial correlation coefficients in their stock price changes and their differencing which also supports the view that past price changes must not significantly correlate with changes for given lags in order to prevent investors from increasing their profits by mere chart reading;
3. The results from the runs test shows that there is a remarkable degree of independence in the series of stock price changes thereby conforming to the weak form market efficiency. More importantly, the degree of independence in the series of stock price changes increased during liberalization by about 16.0 per cent.
4. The results from the empirical frequency distribution graphs also confirms and further buttressed the results from frequency distribution tests. It shows that the modal class for most of the stocks fall in the probability of no change region, this confirms the view that the Nigerian stock market in its operation is less active probably due to paucity of market operators or other factors earlier identified;
5. Most samples exhibited the random-walk behaviour, but few insignificant ones appeared to deviate slightly from a random-walk. Their presence however is not significant enough to reject validity of the weak form

efficient market hypothesis for the Nigerian stock market;

6. Furthermore, comparing the few different periods i.e., periods before and after the liberalization, most of the results suggest that conformity to the random walk hypothesis is slightly higher and much better after the liberalization than before it.
7. More significantly, the overall performance analysis shows that the Nigerian stock market is growing and becoming more active after the liberalization than before it, thereby, indicating that market competitiveness and efficiency is larger under economic liberalization.

In general the Nigerian stock market could be said to be efficient at least at the weak form level. The observed efficiency through the application of the weak form tests can be viewed as potential reason for expecting the market to be more efficient to permit both the semi-strong and strong form tests, given that the capital market has just been fully deregulated recently.

From the available evidence it may be correct to assert that the economic reform measures initiated under the new economic dispensation i.e., economic liberalization tend to give some impetus to the activities and efficiency of stock market in Nigeria. So far, available evidence strongly

indicates that the reform measures have had a significant impact on the financial market in general, and the stock market in particular.

Furthermore, it appears the liberalization of the financial sector has not only triggered the efficiency of this sector, but has also brought the resource mobilization through the stock market into a clearer focus. Evidenced by the increased number of participating agents and investors now patronizing the stock market and the greater volume of transaction on the stock exchange. It is also interesting to note that some factors seemingly hindering the performance of the capital market in Nigeria (e.g. low stock pricing) are now receiving considerable attention under the current deregulation of the capital market which is now being embarked upon.

Thus, it appears the on-going developments are laudable. It can therefore be claimed that a sound foundation is gradually being laid not only to improve the efficiency of the stock market but also for a successful take-off of a viable internationalized capital market. The pace no doubt, can be accelerated if relevant complementary measures are taken.

9.2 POLICY RECOMMENDATIONS

In view of the evidence gathered so far from this study, it is pertinent to highlight some additional

measures that might be taken for further development of the Nigerian Capital Market.

(i) Completely deregulate the whole trading process in the stock market so that prices quoted for listed securities can be more indicative of the true value of stocks, determined only by market forces based on investors's assessment of the performance of the listed companies. This in turn, will not only increase the volume of secondary trading and new issues but also enhance the efficiency of the capital market.

(ii) Relax and simplify the statutory listing requirements in order to attract a larger number of unquoted companies. Possible areas for relaxation include for instance, the capital requirements and the procedure for disclosure to enable them come within the financial capabilities of most firms and also facilitate minimum confidentiality desired by competing firms.

(iii) Reduction in the acclaimed high and positive transactions cost of new issues in order to get quoted. This will facilitate greater access to the stock market by large spectrum of smaller firms who at present are shying away from the market.

(iv) A review, and very urgently too, of certain aspects of the law dealing on securities which appears to be restrictive, or at best only serve to channel funds to a few gilt-edge (government) securities to the detriment of

other more efficient investments in the capital market. Examples of such laws include: The Insurance (miscellaneous provision) Act 1962; The Insurance Act (1976); and the Income Tax Management Act (1961) among others.

(v) Educate and enlighten further, the generality of Nigerians on the modalities and benefits of a capital market. The government, as well as, the Stock Exchange as the apex of the capital market should propagate much more, series of public awareness programmes by using various schemes including conferences, workshops, lectures, seminars, print and electronics media in this regard. Such programmes will go a long way to increase public participation and also boost the activities of the stock market.

(vii) Improvement of the stock market generally. Liberalization it appears would facilitate the rapid development of the Nigeria capital market.

9.3 SUGGESTIONS FOR FURTHER RESEARCH

Given the limited data available for this research, this work has to be ended at this point. Clearly, many aspects of the Nigerian capital market remain that still require further and more in-depth research, especially, as the conditions of the market changes over time. Consequently, many suggestions have emerged, which can be useful to both academic researchers and policy makers. We have identified many areas where useful further research

may be carried out. They are as follows.

(1) **Extending the weak form efficient market tests.**

It should be recalled that owing to the available information as well as the level of sophistication of the Nigeria capital market, our study has employed in the main, the weak form empirical tests of market efficiency. As the market develops further, it will be interesting to investigate the reaction of stock prices to accounting information, mergers and acquisitions, seasonality, public offers or underwriting portfolio performance measurement, etc.

(ii) **Effects of Internationalizing the Capital Market.**

The world economy is changing. The world financial environment no doubt influences the capital market, it will therefore be worthwhile to investigate the effects of opening the Nigeria capital market to international investors.

Equally, the optimum degree of openness of the stock market could be investigated. Also the possible impact of liberalizing the foreign exchange market could be verified.

(iii) **Modification of the Efficiency Market Theory.**

Admittedly the efficient market hypothesis is a fairly limited concept. Moreso, the assumption that information is costless is not seriously tenable in developing countries including Nigeria (Ariyo and Soyode, 1985). Hence, we have attempted to simplify the basic properties of the efficient

market tests in this study. However, future efforts may be directed towards a complete modification of the efficient market theory which is currently being challenged (see Engel and Moris, 1991; Leroy 1990; Roll 1988; Poterba and Summers, 1988; and Cecceti, Lam and Mark, 1990). Such effort could be in terms of developing other indices or properties of market efficiency, such generalized-form indicators are to be applicable both to the advance markets and the emerging ones. If achieved, it will constitute a major contribution.

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APPENDIX I

Table 7.7: Mean, Median and Mode of Frequency Distribution of Daily Changes in Stock Prices

Code No.	Names of Companies	Before Liberalization			After Liberalization		
		Mean	Median	Mode	Mean	Median	Mode
V1	Union Bank	0.000	0.0	0.0	0:001	0.0	0.0
V2	First Bank	0.000	0.0	0.0	-0.001	0.0	0.0
V3	U.B A	0.000	0.0	0.0	0.001	0.0	0.0
V4	B.F.N	0.000	0.0	0.0	-0.001	0.0	0.0
V5	Mercantile Bank	0.000	0.0	0.0	0.000	0.0	0.0
V6	Alumaco	0.000	0.0	0.0	0.001	0.0	0.0
V7	Berec	0.000	0.0	0.0	0.000	0.0	0.0
V8	Cadbury	0.000	0.0	0.0	0.000	0.0	0.0
V9	Guinness	0.000	0.0	0.0	0.001	0.0	0.0
V10	Metal Box	0.000	0.0	0.0	0.000	0.0	0.0
V11	M.B.L	0.000	0.0	0.0	0.000	0.0	0.0
V12	Nigerian Textile	0.000	0.0	0.0	0.000	0.0	0.0
V13	Food Specialties	0.000	0.0	0.0	0.000	0.0	0.0
V14	Flour Mills	0.000	0.0	0.0	0.000	0.0	0.0
V15	Beecham	0.000	0.0	0.0	0.000	0.0	0.0
V16	C.F.A.O	0.001	0.0	0.0	0.000	0.0	0.0
V17	John Holt	0.001	0.0	0.0	0.000	0.0	0.0
V18	S.C.O.A	0.001	0.0	0.0	0.000	0.0	0.0
V19	U.T.C	0.000	0.0	0.0	0.000	0.0	0.0
V20	U.A.C.N	0.000	0.0	0.0	0.000	0.0	0.0
V21	Total Petrol	0.000	0.0	0.0	0.000	0.0	0.0
V22	N.C.R	0.001	0.0	0.0	0.000	0.0	0.0
V23	University Press	0.000	0.0	0.0	0.000	0.0	0.0
V24	Daily Times	0.000	0.0	0.0	0.000	0.0	0.0
V25	Julius Berger	0.000	0.0	0.0	0.000	0.0	0.0
SUM		0.004	0.0	0.0	0.001	0.0	0.0
MEAN		0.0016	0.0	0.0	0.004	0.0	0.0

Table 7.8: Mean, Median and Mode of Frequency Distribution of Weekly Changes in Stock Prices

Code No.	Names of Companies	Before Liberalization			After Liberalization		
		Mean	Median	Mode	Mean	Median	Mode
V1	Union Bank	0.002	0.002	0.0	-0.005	0.000	0.0
V2	First Bank	0.002	0.000	0.0	-0.003	0.000	0.0
V3	U.B A	0.000	0.000	0.0	0.004	0.000	0.0
V4	B.F.N	-0.001	0.000	0.0	-0.005	0.000	0.0
V5	Mercantile Bank	-0.001	0.000	0.0	0.003	0.000	0.0
V6	Alumaco	0.002	0.000	0.0	0.004	0.000	0.0
V7	Berec	0.000	0.000	0.0	0.001	0.000	0.0
V8	Cadbury	0.001	0.000	0.0	0.003	0.002	0.0
V9	Guinness	0.000	0.000	0.0	0.004	0.003	0.0
V10	Metal Box	-0.001	0.000	0.0	0.003	0.000	0.0
V11	M.B.L	-0.001	0.000	0.0	0.003	0.000	0.0
V12	Nigerian Textile	0.003	0.000	0.0	0.000	0.000	0.0
V13	Food Specialties	0.002	0.000	0.0	0.001	0.000	0.0
V14	Flour Mills	-0.002	0.000	0.0	0.002	0.000	0.0
V15	Beecham	0.002	0.000	0.0	0.001	0.000	0.0
V16	C.F.A.O	0.005	0.000	0.0	-0.002	0.000	0.0
V17	John Holt	0.004	0.000	0.0	0.000	0.000	0.0
V18	S.C.O.A	0.004	0.000	0.0	0.004	0.000	0.0
V19	U.T.C	-0.001	0.000	0.0	0.005	0.003	0.0
V20	U.A.C.N	0.003	0.000	0.0	0.003	0.000	0.0
V21	Total Petrol	0.001	0.003	0.0	-0.001	0.000	0.0
V22	N.C.R	0.004	0.000	0.0	-0.002	0.000	0.0
V23	University Press	0.000	0.000	0.0	0.003	0.000	0.0
V24	Daily Times	0.002	0.000	0.0	-0.017	0.000	0.0
V25	Julius Berger	-0.001	0.000	0.0	-0.017	0.000	0.0
SUM		0.045	0.005	0.00	0.096	0.008	0.0
MEAN		0.0018	0.0002	0.00	.00384	.00032	0.0

Table 7.9: Mean, Median and Mode of Frequency Distribution of Semi-Monthly Changes in Stock Prices

Code No.	Names of Companies	Before Liberalization			After Liberalization		
		Mean	Median	Mode	Mean	Median	Mode
V1	Union Bank	0.004	0.004	0.0	-0.010	0.000	0.0
V2	First Bank	0.004	0.003	0.0	-0.006	0.000	0.0
V3	U.B.A	0.000	0.004	0.0	0.008	0.000	0.0
V4	B.F.N	-0.002	0.000	0.0	-0.009	0.000	0.0
V5	Mercantile Bank	-0.002	0.000	0.0	0.007	0.000	0.0
V6	Alumaco	0.003	0.000	0.0	0.008	0.000	0.0
V7	Berec	-0.001	0.000	0.0	0.002	0.000	0.0
V8	Cadbury	0.002	0.004	0.0	0.005	0.003	0.0
V9	Guinness	0.000	0.004	0.0	0.007	0.007	0.0
V10	Metal Box	-0.002	0.000	0.0	0.005	0.000	0.0
V11	M.B.L	-0.003	0.000	0.0	0.006	0.004	0.0
V12	Nigerian Textile	0.006	0.000	0.0	-0.001	0.000	0.0
V13	Food Specialties	0.004	0.005	0.0	0.002	0.002	0.0
V14	Flour Mills	-0.003	0.000	0.0	0.003	0.000	0.0
V15	Beecham	0.004	0.004	0.0	0.002	0.003	0.0
V16	C.F.A.O	0.010	0.006	0.0	-0.005	0.000	0.0
V17	John Holt	0.007	0.005	0.0	0.000	0.000	0.0
V18	S.C.O.A	0.007	0.000	0.0	0.007	0.003	0.0
V19	U.T.C	-0.002	0.000	0.0	0.010	0.006	0.0
V20	U.A.C.N	0.006	0.005	0.0	0.006	0.008	0.0
V21	Total Petrol	0.002	0.004	0.0	-0.003	0.002	0.0
V22	N.C.R	0.007	0.008	0.0	-0.004	0.000	0.0
V23	University Press	0.001	0.000	0.0	0.006	0.000	0.0
V24	Daily Times	0.004	0.000	0.0	-0.003	0.000	0.0
V25	Julius Berger	-0.001	0.000	0.0	-0.033	0.000	0.0
SUM		0.087	0.056		0.158	0.038	0.0
MEAN		0.003	0.002		0.006	0.001	0.0

Table 7.10: Mean, Median and Mode of Frequency Distribution of Monthly Changes in Stock Prices

Code No.	Names of Companies	Before Liberalization			After Liberalization		
		Mean	Median	Mode	Mean	Median	Mode
V1	Union Bank	0.007	0.006	0.000	-0.020	-0.003	0.0
V2	First Bank	0.008	0.008	0.000	-0.013	-0.004	0.0
V3	U.B A	0.000	0.008	0.002	0.017	0.000	0.0
V4	B.F.N	-0.004	0.000	0.000	-0.019	0.000	0.0
V5	Mercantile Bank	-0.005	0.000	0.000	0.014	0.000	0.0
V6	Alumaco	0.006	0.000	0.000	0.015	0.000	0.0
V7	Berec	-0.001	0.000	0.000	0.004	0.000	0.0
V8	Cadbury	0.004	0.010	0.010	0.010	0.009	0.0
V9	Guinness	0.000	0.006	0.015	0.015	0.014	0.0
V10	Metal Box	-0.004	0.000	0.011	0.011	0.000	0.0
V11	M.B.L	-0.006	0.000	0.011	0.011	0.012	0.0
V12	Nigerian Textile	0.012	0.000	-0.001	-0.001	0.000	0.0
V13	Food Specialties	0.008	0.005	0.000	0.004	0.008	0.0
V14	Flour Mills	-0.007	0.000	0.000	0.006	0.000	0.0
V15	Beecham	0.009	0.009	0.000	0.004	0.007	0.0
V16	C.F.A.O	0.019	0.008	0.000	-0.010	0.000	0.0
V17	John Holt	0.015	0.012	0.000	0.000	0.000	0.0
V18	S.C.O.A	0.014	0.000	0.000	0.015	0.005	0.0
V19	U.T.C	0.001	0.000	0.000	0.021	0.120	0.0
V20	U.A.C.N	0.011	0.000	0.000	0.012	0.018	0.0
V21	Total Petrol	0.004	0.010	0.000	-0.006	0.005	0.0
V22	N.C.R	0.015	0.016	0.008	-0.008	0.002	0.0
V23	University Press	0.001	0.000	0.000	0.013	0.000	0.0
V24	Daily Times	0.008	0.000	0.000	-0.067	0.000	0.0
V25	Julius Berger	-0.002	0.000	0.000	-0.066	0.007	0.0
SUM		0.166	0.106	0.024	0.382	0.214	0.0
MEAN		.00664	.00424	.00096	.01528	.00856	0.0

Table 7.11 Range of Frequency Distribution of Daily Changes in Stock Prices

Code No.	Names of Companies	Before Liberalization				After Liberalization			
		Range	Min.	Max.	Sum.	Range	Min.	Max.	Sum
V1	Union Bank	0.038	-0.019	0.019	0.196	0.915	-0.601	0.309	-.87
V2	First Banl.	0.121	-0.063	0.058	0.212	0.583	-0.298	0.285	-.55
V3	U.B A	0.902	-0.451	0.451	0.006	1.572	-0.573	0.999	.714
V4	B.F.II	0.666	-0.333	0.333	-0.095	3.262	-1.656	1.606	-.80
V5	Mercantile Bank	0.580	-0.280	0.300	-0.117	2.527	-1.421	1.106	.595
V6	Alumaco	0.892	-0.446	0.446	0.164	1.536	-0.768	0.768	.645
V7	Berec	1.010	-0.505	0.505	0.037	2.101	-1.187	0.914	.187
V8	Cadbury	1.226	-0.613	0.613	0.107	1.316	-0.658	0.658	.451
V9	Guinness	0.892	-0.446	0.446	0.004	0.412	-0.205	0.207	.641
V10	Metal Box	0.261	-0.107	0.154	-0.072	1.992	-0.996	0.996	.450
V11	M.B.L	0.229	-0.198	0.031	-0.151	1.302	-0.651	0.651	.512
V12	Nigerian Textile	0.394	-0.197	0.197	0.300	1.268	-0.634	0.634	-.05
V13	Food Specialties	0.312	-0.154	0.158	0.217	0.718	-0.359	0.359	.188
V14	Flour Mills	2.078	-1.039	1.039	-0.177	1.992	-0.996	0.996	.274
V15	Beecham	0.181	-0.070	0.111	0.232	0.972	-0.486	0.486	.188
V16	C.F.A.O	2.110	-1.052	1.058	0.502	0.921	-0.958	0.963	-.43
V17	John Holt	0.160	-0.105	0.055	0.383	2.060	-0.996	1.064	-.02
V18	S.C.O.A	1.890	-0.945	0.945	0.368	2.044	-1.022	1.022	.645
V19	U.T.C	0.084	-0.042	0.043	-0.084	2.026	-1.013	1.013	.891
V20	U.A.C.II	0.095	-0.031	0.064	0.279	1.220	-0.610	0.610	.511
V21	Total Petrol	2.018	-1.002	1.016	0.118	1.031	-0.621	0.410	-.24
V22	N.C.R	1.996	-0.998	0.998	0.385	1.250	-0.641	0.609	-.36
V23	University Press	0.722	-0.361	0.361	0.032	1.900	-0.950	0.950	.540
V24	Daily Times	1.084	-0.542	0.542	0.003	0.714	-0.357	0.357	-.05
V25	Julius Berger	0.067	-0.051	0.016	-0.055	0.918	-0.459	0.459	.290
SUM		20.008	10.05	9.558	4.496	37.55	19.00	18.93	11.1
MEAN		0.800	0.402	0.382	0.179	1.500	0.76	0.757	0.44

Table 7.12 Range of Frequency Distribution of Weekly Changes in Stock Prices

Code No.	Names of Companies	Before Liberalization				After Liberalization			
		Range	Min.	Max.	Sum.	Range	Min.	Max.	Sum
V1	Union Bank	0.031	-0.141	0.017	0.192	0.785	-0.601	0.184	-.87
V2	First Bank	0.114	-0.055	0.059	0.206	0.496	-0.298	0.198	-.55
V3	U.B A	0.902	-0.451	0.451	0.007	1.572	-0.573	0.999	.714
V4	B.F.N	0.666	-0.333	0.333	-0.095	3.212	-1.606	1.606	-.80
V5	Mercantile Bank	0.580	-0.280	0.300	-0.117	2.527	-1.421	1.106	.597
V6	Alumaco	0.892	-0.446	0.446	0.163	1.413	-0.154	0.259	.645
V7	Berec	1.147	-0.107	0.040	0.038	2.101	-1.187	0.914	.176
V8	Cadbury	1.082	-0.065	0.017	0.105	0.329	-0.171	0.158	.452
V9	Guinness	0.234	-0.197	0.037	-0.006	0.293	-0.172	0.121	.639
V10	Metal Box	0.284	-0.130	0.154	-0.093	0.459	-0.159	0.300	.451
V11	M.B.L	0.221	-0.193	0.028	-0.154	0.674	-0.339	0.335	.499
V12	Nigerian Textile	0.279	-0.143	0.136	0.300	1.018	-0.506	0.512	-.05
V13	Food Specialties	0.185	-0.131	0.054	0.214	0.718	-0.359	0.359	.187
V14	Flour Mills	2.183	-1.049	0.034	-0.178	1.992	-0.996	0.996	.278
V15	Beecham	0.181	-0.070	0.111	0.232	0.493	-0.238	0.255	.186
V16	C.F.A.O	2.259	-0.175	0.084	0.503	0.427	-0.266	0.161	-.42
V17	John Holt	0.165	-0.101	0.064	0.384	1.992	-0.996	0.996	-.02
V18	S.C.O.A	0.130	-0.051	0.079	0.367	1.738	-0.801	0.377	.646
V19	U.T.C	0.058	-0.039	0.019	-0.091	0.419	-0.201	0.218	.892
V20	U.A.C.N	0.119	-0.031	0.088	0.297	0.800	-0.433	0.367	.508
V21	Total Petrol	0.276	-1.232	0.044	0.116	0.761	-0.621	0.143	-.24
V22	N.C.R	0.132	-0.091	0.041	0.388	0.751	-0.641	0.110	-.36
V23	University Press	0.166	-0.095	0.071	0.032	0.527	-0.309	0.218	.55
V24	Daily Times	0.222	-0.087	0.135	0.204	1.767	-1.692	0.075	-1.7
V25	Julius Berger	0.072	-0.051	0.021	-0.054	2.068	-2.000	0.068	-1.7
SUM		6.576	3.844	2.863	4.536	28.34	16.80	11.54	14.2
MEAN		0.263	0.154	0.115	0.181	1.133	0.672	0.461	0.57

Table 7.13 Range of Frequency Distribution of Semi Monthly Changes in Stock Prices

Code No.	Names of Companies	Before Liberalization				After Liberalization			
		Range	Min.	Max.	Sum.	Range	Min.	Max.	Sum
V1	Union Bank	0.036	-0.013	0.023	0.190	0.794	-0.601	0.193	-.87
V2	First Bank	0.088	-0.055	0.033	0.206	0.497	-0.298	0.199	-.56
V3	U.B A	0.438	-0.223	0.215	0.003	1.572	-0.573	0.999	.72
V4	B.F.N	0.484	-0.242	0.242	-0.096	2.637	-1.220	1.417	-.80
V5	Mercantile Bank	0.600	-0.300	0.300	-0.117	2.478	-1.372	1.106	.596
V6	Alumaco	0.898	-0.446	0.442	0.163	0.413	-0.154	0.259	.645
V7	Berec	0.126	-0.086	0.040	0.038	1.914	-1.914	1.000	.175
V8	Cadbury	0.081	-0.061	0.020	0.102	0.315	-0.164	0.151	.453
V9	Guinness	-0.257	-0.200	0.057	-0.006	0.296	-0.164	0.132	.638
V10	Metal Box	0.284	-0.130	0.154	-0.092	0.521	-0.221	0.300	.452
V11	M.B.L	0.229	-0.193	0.036	-0.156	0.677	-0.335	0.342	.496
V12	Nigerian Textile	0.413	-0.143	0.270	0.299	0.507	-0.286	0.221	-.05
V13	Food Specialties	0.185	-0.131	0.054	0.214	0.338	-0.161	0.177	.187
V14	Flour Mills	0.183	-0.145	0.038	-0.179	1.992	-0.996	0.996	.276
V15	Beecham	0.181	-0.070	0.111	0.232	0.497	-0.238	0.259	.181
V16	C.F.A.O	0.270	-0.154	0.016	0.501	0.451	-0.266	0.185	-.43
V17	John Holt	0.165	-0.097	0.068	0.383	1.992	-0.996	0.996	-.02
V18	S.C.O.A	0.130	-0.051	0.079	0.368	0.738	-0.801	0.877	.644
V19	U.T.C	0.067	-0.039	0.028	-0.090	0.425	-0.201	0.224	.887
V20	U.A.C.N	0.118	-0.038	0.080	0.298	0.799	-0.427	0.372	.507
V21	Total Petrol	0.276	-0.212	0.064	0.114	0.764	-0.621	0.143	-.24
V22	N.C.R	0.135	-0.091	0.044	0.388	0.751	-0.641	0.110	-.36
V23	University Press	0.167	-0.046	0.071	0.032	0.506	-0.268	0.238	.542
V24	Daily Times	0.233	-0.087	0.146	0.202	1.767	-1.692	0.075	-1.7
V25	Julius Berger	0.072	-0.051	0.021	-0.054	2.074	-2.000	0.074	-1.7
SUM		6.066	3.304	2.762	4.523	26.72	15.67	11.05	13.1
MEAN		0.243	0.132	0.110	0.181	1.069	0.627	0.442	0.52

Table 7.14 Range of Frequency Distribution of Monthly Changes in Stock Prices

Code No.	Names of Companies	Before Liberalization				After Liberalization			
		Range	Min.	Max.	Sum.	Range	Min.	Max.	Sum
V1	Union Bank	0.044	-0.010	0.034	0.190	0.751	-0.562	0.189	-.87
V2	First Bank	0.074	-0.026	0.048	0.207	0.489	-0.298	0.191	-.55
V3	U.B A	0.386	-0.224	0.162	0.002	1.551	-0.552	0.999	.713
V4	B.F.N	0.135	-0.079	0.162	-0.103	2.391	-1.118	1.273	-.80
V5	Mercantile Bank	0.117	-0.117	0.000	-0.117	2.364	-1.185	1.179	.595
V6	Alumaco	0.091	-0.018	0.073	0.163	0.454	-0.154	0.300	.645
V7	Berec	0.126	-0.080	0.040	-0.038	1.897	-0.663	1.234	.179
V8	Cadbury	0.094	-0.058	0.036	0.102	0.303	-0.152	0.151	.449
V9	Guinness	0.192	-0.143	0.049	-0.004	0.280	-0.146	0.140	.637
V10	Metal Box	0.317	-0.154	0.163	-0.092	0.503	-0.203	0.300	.452
V11	M.B.L	0.235	-0.193	0.042	-0.156	0.382	-0.191	0.191	.491
V12	Nigerian Textile	0.127	0.000	0.127	0.299	0.481	-0.260	0.221	-.04
V13	Food Specialties	0.177	-0.074	0.043	0.213	0.232	-0.151	0.081	.188
V14	Flour Mills	0.191	-0.143	0.010	-0.131	0.337	-0.195	0.142	.277
V15	Beecham	0.170	-0.059	0.111	0.230	0.277	-0.156	0.121	.181
V16	C.F.A.O	0.222	-0.106	0.016	0.495	0.456	-0.266	0.190	-.42
V17	John Holt	0.190	-0.097	0.093	0.380	1.992	-0.996	0.996	-.02
V18	S.C.O.A	0.128	-0.043	0.083	0.369	0.759	-0.152	0.607	.645
V19	U.T.C	0.116	-0.039	0.047	-0.091	0.409	-0.138	0.271	.890
V20	U.A.C.N	0.160	-0.067	0.093	0.295	0.503	-0.332	0.171	.504
V21	Total Petrol	0.313	-0.209	0.104	0.114	0.745	-0.621	0.124	-.24
V22	N.C.R	0.147	-0.064	0.083	0.389	1.079	-0.641	0.438	-.36
V23	University Press	0.122	-0.051	0.071	0.032	0.441	-0.203	0.238	.542
V24	Daily Times	0.262	-0.091	0.171	0.202	1.767	-1.692	0.075	-1.7
V25	Julius Berger	0.072	-0.051	0.021	-0.054	2.442	-2.000	0.445	-1.7
SUM		4.208	2.196	1.876	4.467	23.29	13.03	10.27	14.1
MEAN		0.168	0.088	0.075	0.179	0.932	0.521	0.411	0.57

Table 7.15: Coefficient of Skewness of frequency Distribution of Weekly changes in Stock Prices

Code No.	Names of Companies	Before Liberalization		After Liberalization	
		Skewness	Std. Error	Skewness	Std. Error
V1	Union Bank	-0.832	0.237	-7.845	0.185
V2	First Bank	-0.456	0.237	-3.990	0.185
V3	U.B A	-0.273	0.237	5.006	0.185
V4	B.F.N	0.008	0.237	0.182	0.185
V5	Mercantile Bank	0.385	0.237	-1.267	0.185
V6	Alumaco	-0.050	0.237	4.112	0.185
V7	Berec	-5.493	0.237	-1.887	0.185
V8	Cadbury	-4.524	0.237	-1.332	0.185
V9	Guinness	-6.382	0.237	-1.536	0.185
V10	Metal Box	0.338	0.237	2.647	0.185
V11	M.B.L	-7.244	0.237	-0.453	0.185
V12	Nigerian Textile	1.237	0.237	-0.165	0.185
V13	Food Specialties	-4.117	0.237	-0.273	0.185
V14	Flour Mills	-5.667	0.237	-0.035	0.185
V15	Beecham	0.641	0.237	-1.411	0.185
V16	C.F.A.O	-4.246	0.237	-4.218	0.185
V17	John Holt	-2.179	0.237	0.012	0.185
V18	S.C.O.A	1.056	0.237	1.050	0.185
V19	U.T.C	-1.929	0.237	1.300	0.185
V20	U.A.C.N	2.952	0.237	-2.270	0.185
V21	Total Petrol	-7.918	0.237	-8.926	0.185
V22	N.C.R	-2.800	0.237	-11.042	0.185
V23	University Press	-1.639	0.237	-1.569	0.185
V24	Daily Times	1.703	0.237	-10.076	0.238
V25	Julius Berger	-4.902	0.237	-10.058	0.238
SUM		68.971	5.925	82.662	4.731
MEAN		2.759	0.237	3.306	0.189

Table 7.16 Coefficient of Skewness of frequency Distribution of Semi-monthly changes in Stock Prices

Code No.	Names of Companies	Before Liberalization		After Liberalization	
		Skewness	Std. Error	Skewness	Std. Error
V1	Union Bank	-0.071	0.330	-5.271	0.260
V2	First Bank	-1.710	0.330	-2.615	0.260
V3	U.B A	-0.982	0.330	3.519	0.260
V4	B.F.N	0.015	0.330	0.171	0.260
V5	Mercantile Bank	-0.106	0.330	-1.303	0.260
V6	Alumaco	0.003	0.330	2.719	0.260
V7	Berec	-3.013	0.330	-0.598	0.260
V8	Cadbury	-2.966	0.330	-1.188	0.260
V9	Guinness	-4.276	0.330	-1.187	0.260
V10	Metal Box	0.508	0.330	0.952	0.260
V11	M.B.L	-5.183	0.330	-0.202	0.260
V12	Nigerian Textile	3.624	0.330	-1.736	0.260
V13	Food Specialties	-2.917	0.330	-0.778	0.260
V14	Flour Mills	-3.432	0.330	-0.060	0.260
V15	Beecham	0.376	0.330	-0.866	0.260
V16	C.F.A.O	-1.656	0.330	-2.325	0.260
V17	John Holt	-1.364	0.330	0.018	0.260
V18	S.C.O.A	0.949	0.330	0.719	0.260
V19	U.T.C	-1.136	0.330	0.833	0.260
V20	U.A.C.N	1.529	0.330	-1.578	0.260
V21	Total Petrol	-5.070	0.330	-6.563	0.260
V22	N.C.R	-2.419	0.330	-7.833	0.260
V23	University Press	1.126	0.330	0.016	0.260
V24	Daily Times	1.200	0.330	-7.142	0.330
V25	Julius Berger	-3.394	0.330	-7.140	0.330
SUM		49.025	8.250	57.332	6.640
MEAN		1.961	0.330	2.293	0.266

Table 7.17 Coefficient of Skewness of frequency Distribution of Monthly changes in Stock Prices

Code No.	Names of Companies	Before Liberalization		After Liberalization	
		Skewness	Std. Error	Skewness	Std. Error
V1	Union Bank	0.625	0.456	-3.447	0.361
V2	First Bank	0.412	0.456	-1.495	0.361
V3	U.B A	-1.872	0.456	2.508	0.361
V4	B.F.N	-1.139	0.456	0.105	0.361
V5	Mercantile Bank	-5.099	0.456	-0.132	0.361
V6	Alumaco	2.316	0.456	2.309	0.361
V7	Berec	-2.096	0.456	2.043	0.361
V8	Cadbury	-1.851	0.456	-0.329	0.361
V9	Guinness	-2.369	0.456	-0.462	0.361
V10	Metal Box	0.018	0.456	0.878	0.361
V11	M.B.L	-3.427	0.456	-0.449	0.361
V12	Nigerian Textile	3.072	0.456	-0.987	0.361
V13	Food Specialties	-1.240	0.456	-1.922	0.361
V14	Flour Mills	-1.900	0.456	-1.065	0.361
V15	Beecham	0.561	0.456	-1.204	0.361
V16	C.F.A.O	-0.262	0.456	-1.350	0.361
V17	John Holt	-0.900	0.456	0.025	0.361
V18	S.C.O.A	0.687	0.456	4.725	0.361
V19	U.T.C	-0.440	0.456	1.513	0.361
V20	U.A.C.N	0.592	0.456	-2.420	0.361
V21	Total Petrol	-2.160	0.456	-4.953	0.361
V22	N.C.R	-0.791	0.456	-2.110	0.361
V23	University Press	0.445	0.456	0.591	0.361
V24	Daily Times	0.848	0.456	-5.047	0.456
V25	Julius Berger	-2.292	0.456	-4.331	0.456
SUM		37.414	11.40	46.700	9.215
MEAN		1.497	0.456	1.868	0.369

Table 7.18 Kurtosis of frequency Distribution of Daily changes in Stock Prices

Code No.	Names of Companies	Before Liberalization		After Liberalization	
		Skewness	Std. Error	Skewness	Std. Error
V1	Union Bank	37.62	0.180	484.32	0.141
V2	First Bank	112.67	0.180	166.76	0.141
V3	U.B A	88.94	0.180	409.47	0.141
V4	B.F.N	100.51	0.180	29.74	0.141
V5	Mercantile Bank	310.08	0.180	60.34	0.141
V6	Alumaco	327.56	0.180	185.17	0.141
V7	Berec	301.74	0.180	115.99	0.141
V8	Cadbury	176.93	0.180	193.33	0.141
V9	Guinness	270.67	0.180	144.39	0.141
V10	Metal Box	97.45	0.180	283.35	0.141
V11	M.B.L	498.74	0.180	239.44	0.141
V12	Nigerian Textile	133.67	0.180	259.53	0.141
V13	Food Specialties	169.70	0.180	164.22	0.141
V14	Flour Mills	140.36	0.180	269.32	0.141
V15	Beecham	61.85	0.180	276.02	0.141
V16	C.F.A.O	319.95	0.180	182.99	0.141
V17	John Holt	166.50	0.180	362.21	0.141
V18	S.C.O.A	357.45	0.180	127.45	0.141
V19	U.T.C	59.55	0.180	147.25	0.141
V20	U.A.C.N	48.30	0.180	148.86	0.141
V21	Total Petrol	338.05	0.180	302.76	0.141
V22	N.C.R	280.89	0.180	169.30	0.141
V23	University Press	172.57	0.180	278.95	0.141
V24	Daily Times	272.61	0.180	285.89	0.141
V25	Julius Berger	227.09	0.180	304.11	0.141
SUM		5068.47	-	5596.16	-
MEAN		202.73	0.180	223.84	0.141

Table 7.19 Kurtosis of frequency Distribution of Weekly changes in Stock Prices

Code No.	Names of Companies	Before Liberalization		After Liberalization	
		Skewness	Std. Error	Skewness	Std. Error
V1	Union Bank	3.987	0.469	484.32	0.368
V2	First Bank	19.369	0.469	166.76	0.368
V3	U.B A	27.635	0.469	409.47	0.368
V4	B.F.N	17.136	0.469	29.74	0.368
V5	Mercantile Bank	41.625	0.469	60.34	0.368
V6	Alumaco	46.250	0.469	185.17	0.368
V7	Berec	51.735	0.469	115.99	0.368
V8	Cadbury	24.194	0.469	193.33	0.368
V9	Guinness	49.327	0.469	144.39	0.368
V10	Metal Box	15.103	0.469	283.35	0.368
V11	M.B.L	59.899	0.469	239.44	0.368
V12	Nigerian Textile	24.782	0.469	259.53	0.368
V13	Food Specialties	32.595	0.469	164.22	0.368
V14	Flour Mills	43.515	0.469	269.32	0.368
V15	Beecham	15.448	0.469	276.02	0.368
V16	C.F.A.O	34.925	0.469	182.99	0.368
V17	John Holt	18.641	0.469	362.21	0.368
V18	S.C.O.A	10.654	0.469	127.45	0.368
V19	U.T.C	6.195	0.469	147.25	0.368
V20	U.A.C.N	16.271	0.469	148.86	0.368
V21	Total Petrol	72.613	0.469	302.76	0.368
V22	N.C.R	14.479	0.469	169.30	0.368
V23	University Press	27.324	0.469	278.95	0.368
V24	Daily Times	10.748	0.469	285.89	0.472
V25	Julius Berger	32.692	0.469	304.11	0.472
SUM		717.144	11.725	5596.16	9.408
MEAN		28.686	0.469	223.84	0.376

Table 7.20 Kurtosis of frequency Distribution of Monthly changes in Stock Prices

Code No.	Names of Companies	Before Liberalization		After Liberalization	
		Skewness	Std. Error	Skewness	Std. Error
V1	Union Bank	0.739	0.650	41.668	0.514
V2	First Bank	9.431	0.650	30.066	0.514
V3	U.B A	11.325	0.650	28.433	0.514
V4	B.F.N	9.470	0.650	2.315	0.514
V5	Mercantile Bank	20.731	0.650	7.034	0.514
V6	Alumaco	24.334	0.650	24.603	0.514
V7	Berec	20.484	0.650	8.225	0.514
V8	Cadbury	9.791	0.650	8.972	0.514
V9	Guinness	22.777	0.650	13.942	0.514
V10	Metal Box	6.407	0.650	17.141	0.514
V11	M.B.L	31.367	0.650	16.847	0.514
V12	Nigerian Textile	27.427	0.650	26.779	0.514
V13	Food Specialties	15.537	0.650	14.434	0.514
V14	Flour Mills	16.034	0.650	38.976	0.514
V15	Beecham	8.147	0.650	10.206	0.514
V16	C.F.A.O	10.849	0.650	17.219	0.514
V17	John Holt	7.835	0.650	34.930	0.514
V18	S.C.O.A	4.305	0.650	27.537	0.514
V19	U.T.C	1.926	0.650	6.724	0.514
V20	U.A.C.N	5.660	0.650	17.039	0.514
V21	Total Petrol	32.177	0.650	54.538	0.514
V22	N.C.R	7.804	0.650	68.126	0.514
V23	University Press	11.504	0.650	9.720	0.514
V24	Daily Times	3.974	0.650	51.321	0.650
V25	Julius Berger	15.075	0.650	51.306	0.650
SUM		335.113	16.250	628.121	13.122
MEAN		13.405	0.650	25.125	0.525

APPENDIX II

FIG. A.1: DAILY STOCK PRICE CHANGES

– UNION BANK

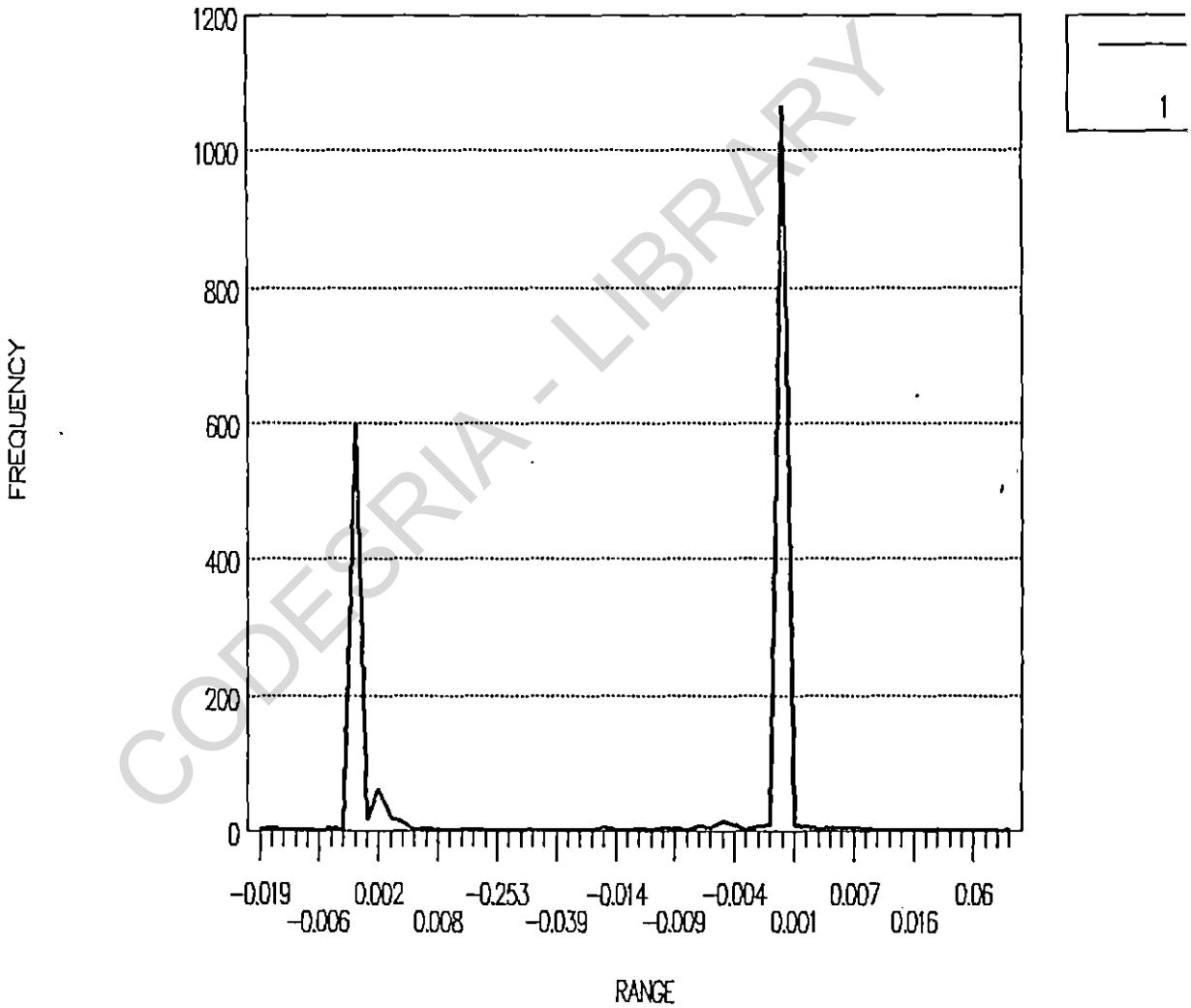


FIG. A.2: DAILY STOCK PRICE CHANGES

- GUINESS

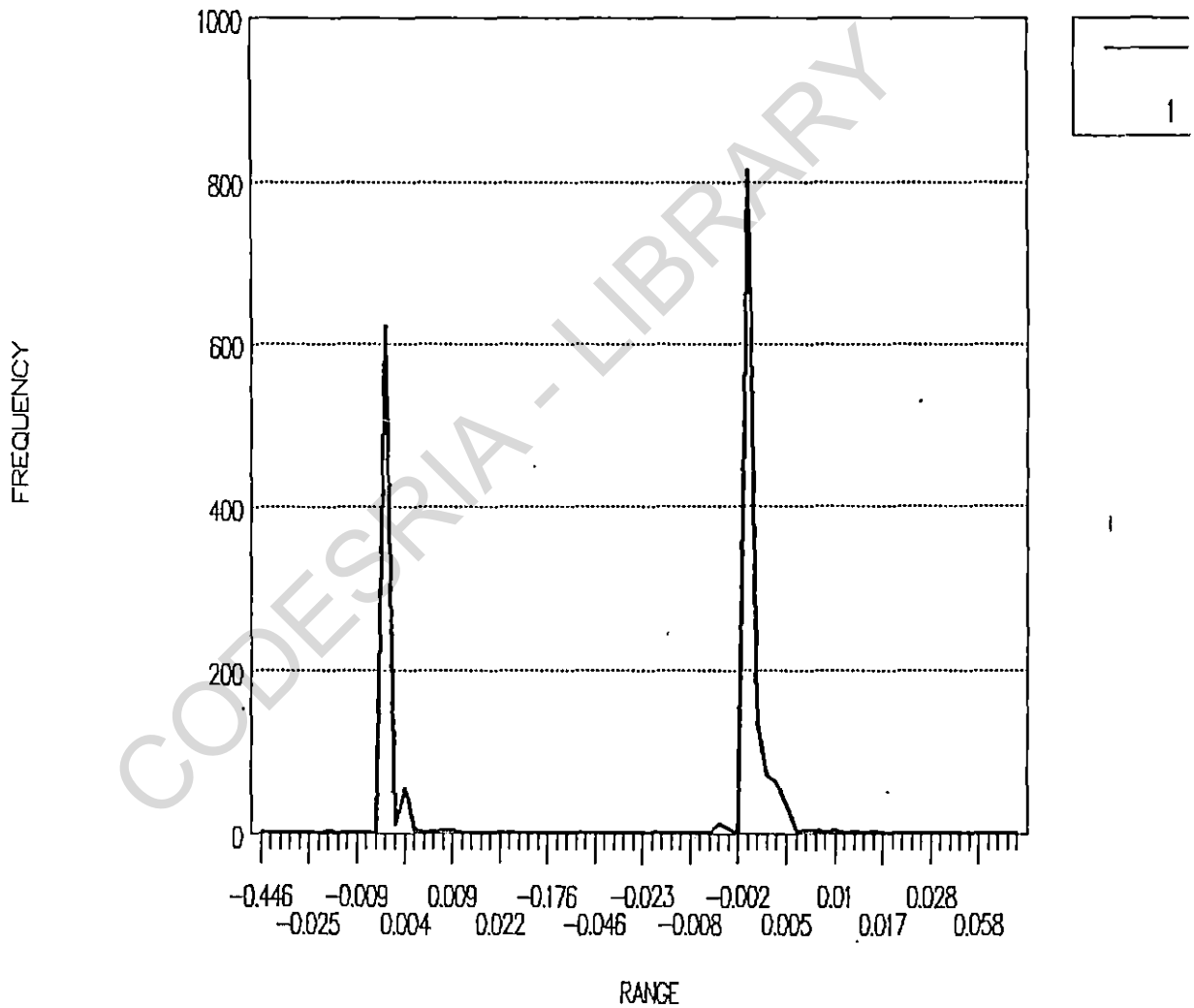


FIG. A.3: DAILY STOCK PRICE CHANGES

– NIGERIAN TEXTILE

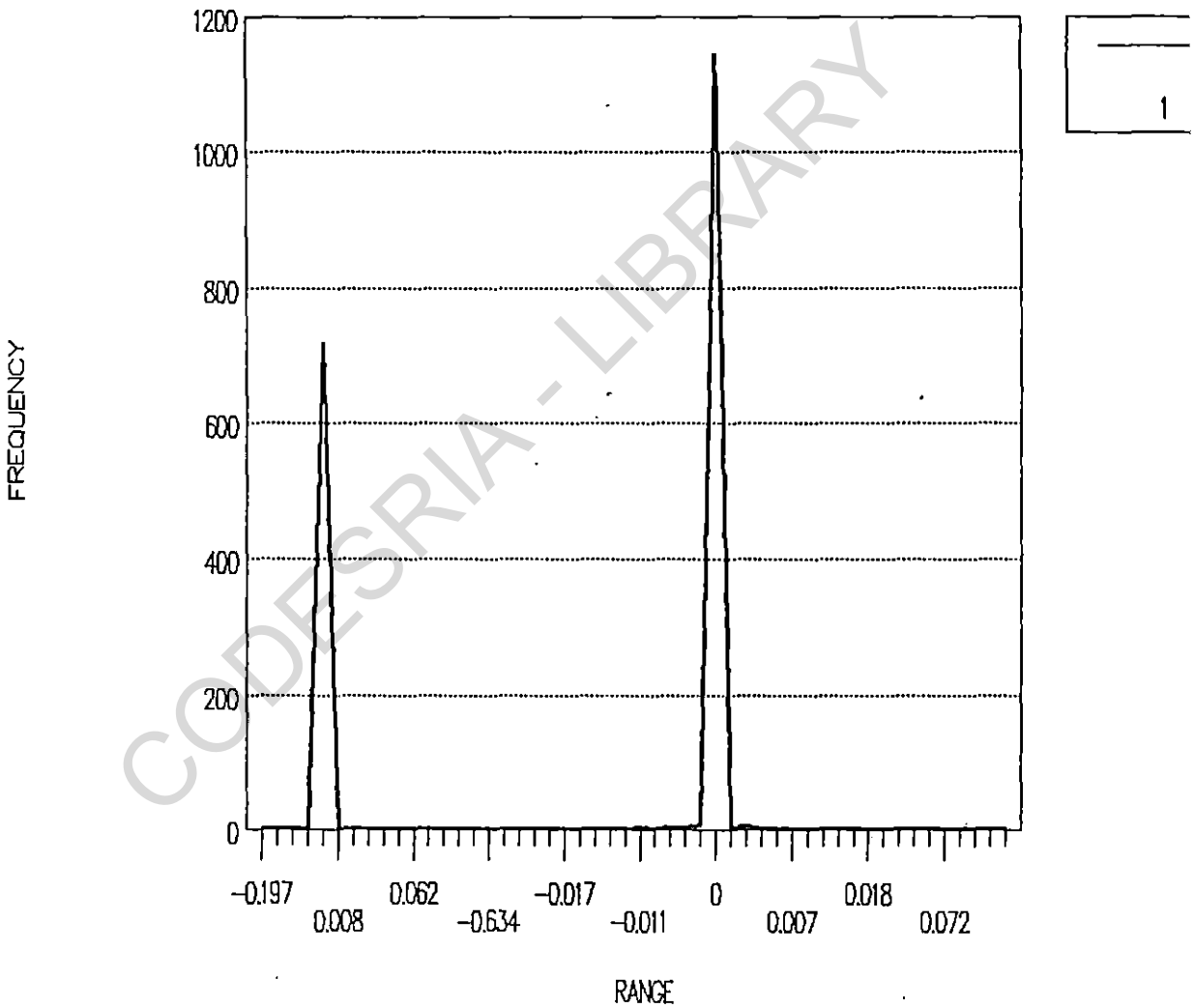


FIG. A.4: DAILY STOCK PRICE CHANGES

– N.C.R

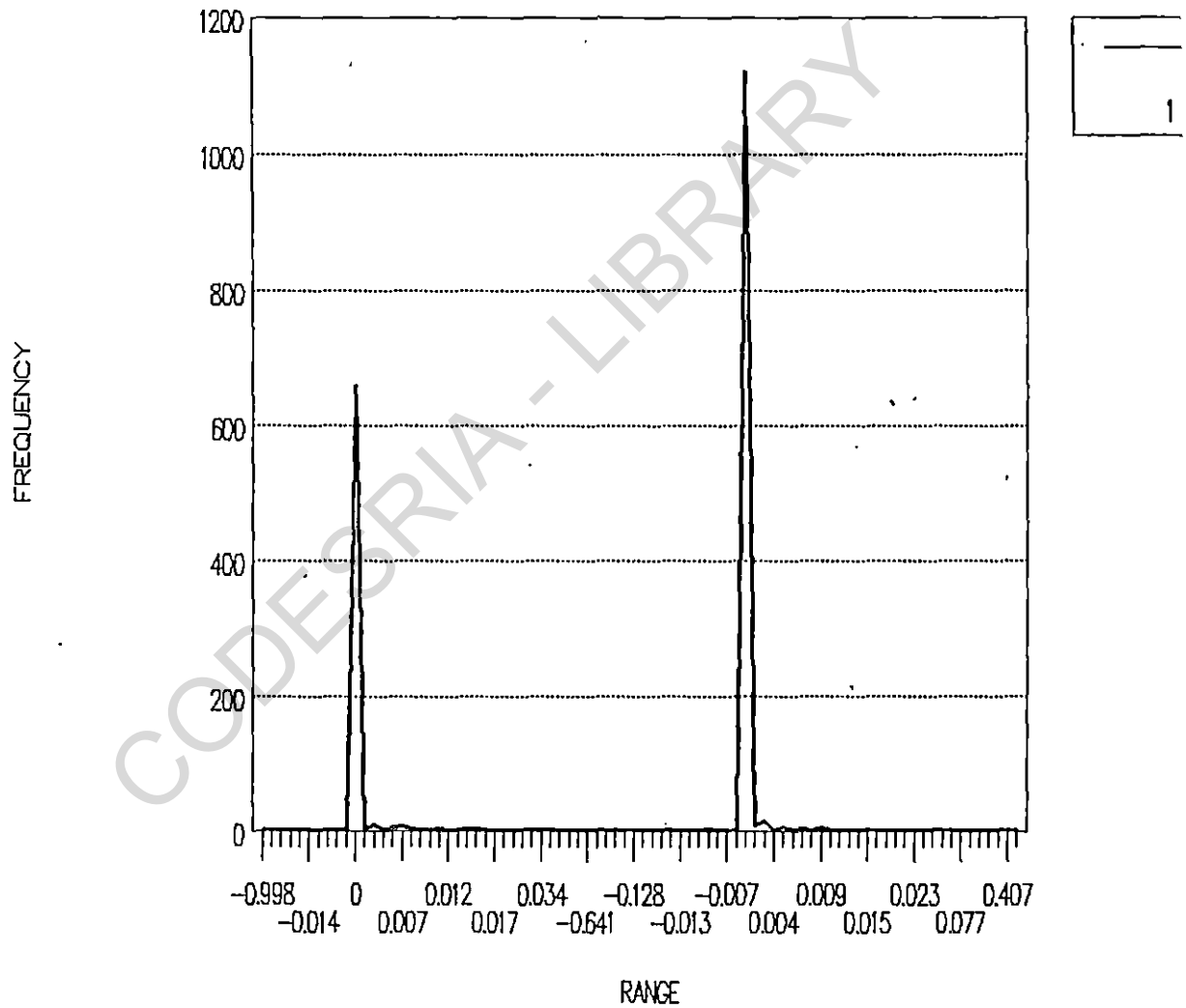


FIG. A.5: DAILY STOCK PRICE CHANGES

– JOHN HOLT

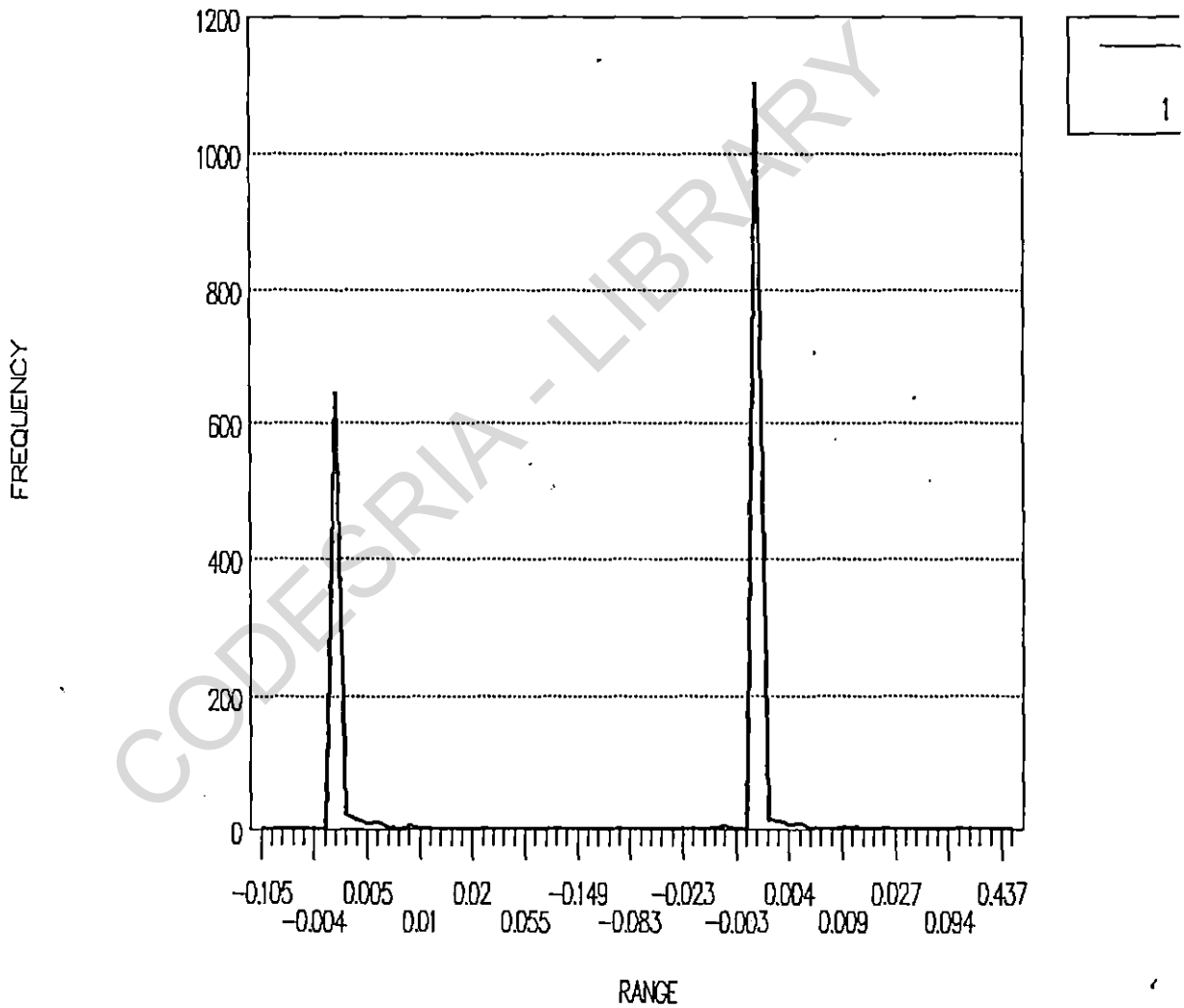


FIG. A.6: DAILY STOCK PRICE CHANGES

– U.A.C.N

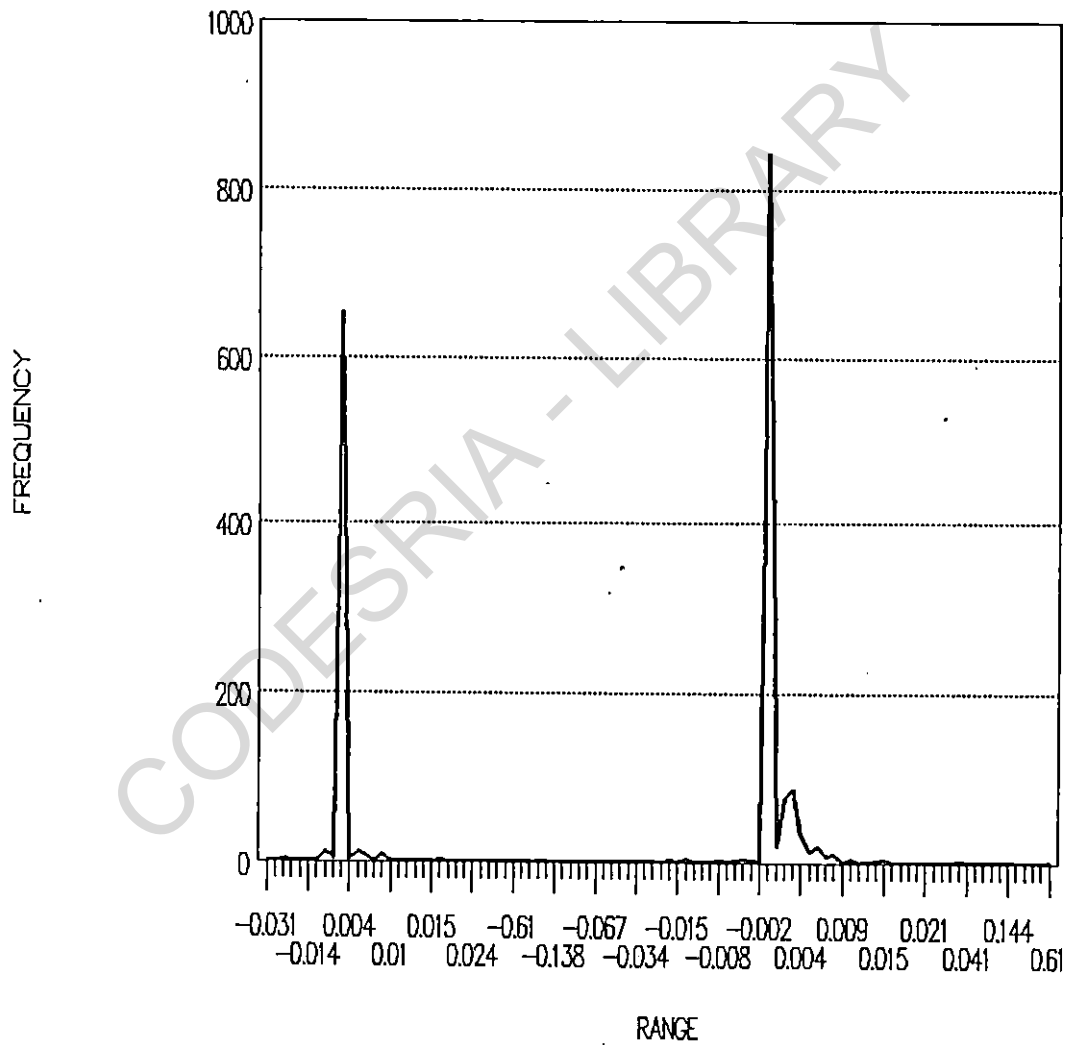


FIG. A.7: DAILY STOCK PRICE CHANGES

– JULIUS BERGER

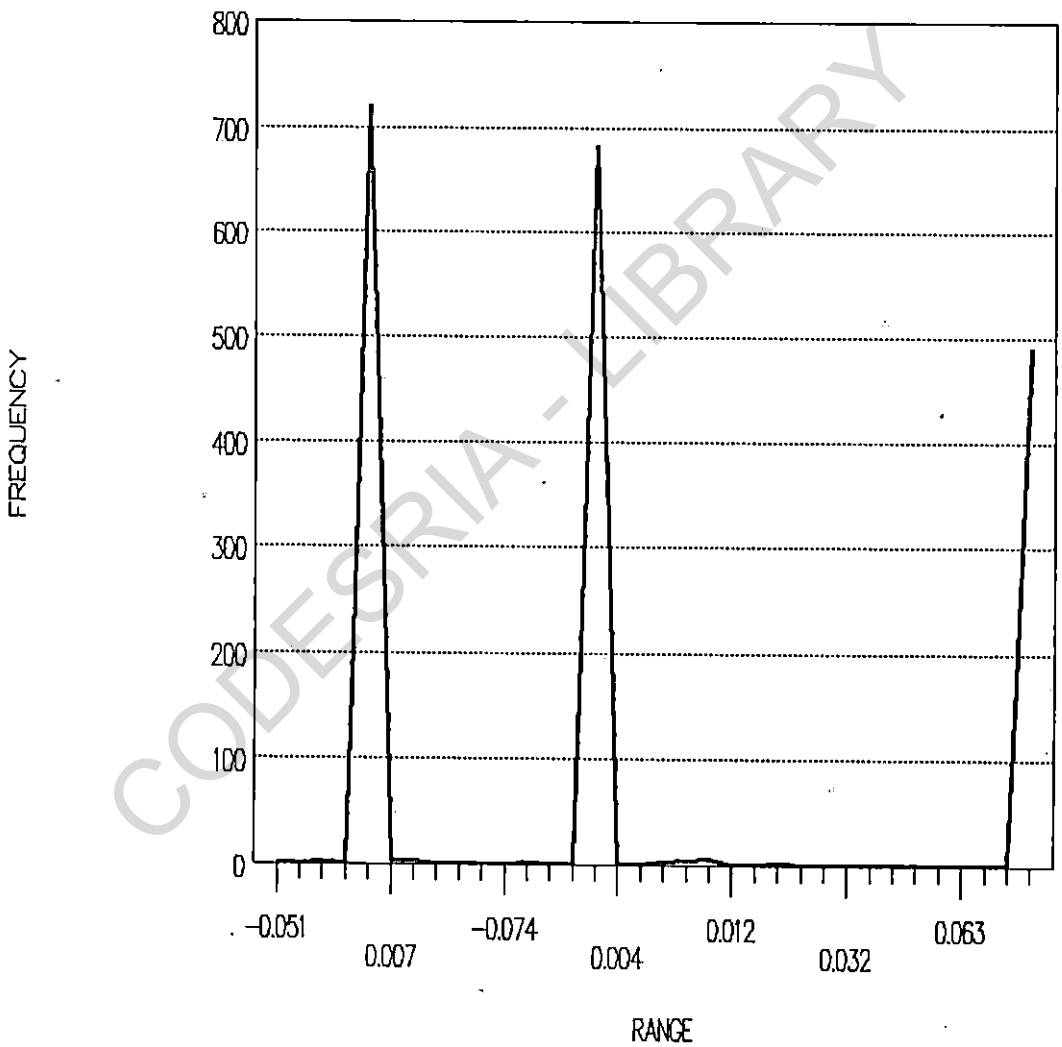


FIG. A.8: DAILY STOCK PRICE CHANGES

– DAILY TIMES

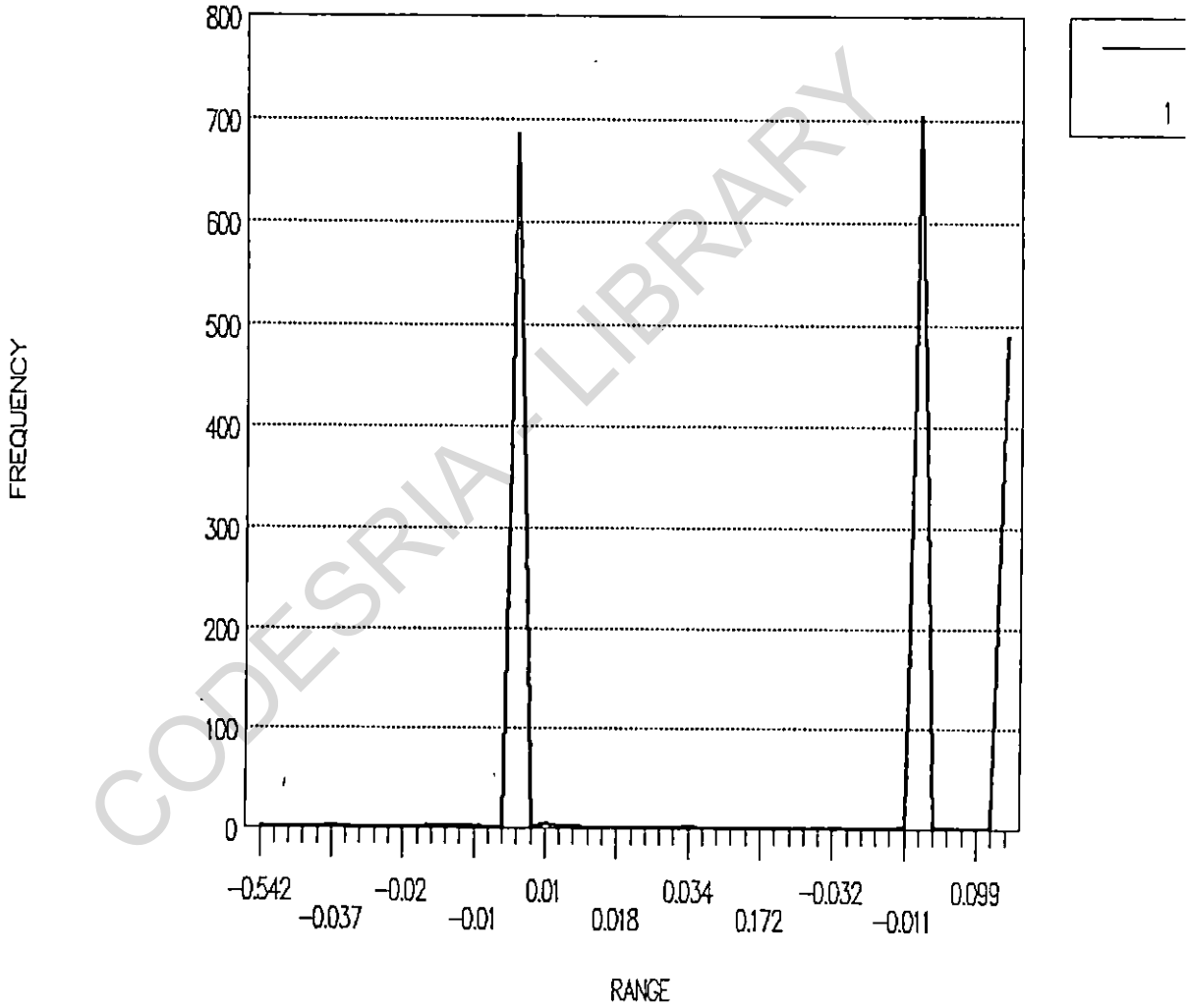


FIG. A.9: DAILY STOCK PRICE CHANGES

- TOTAL PETROL

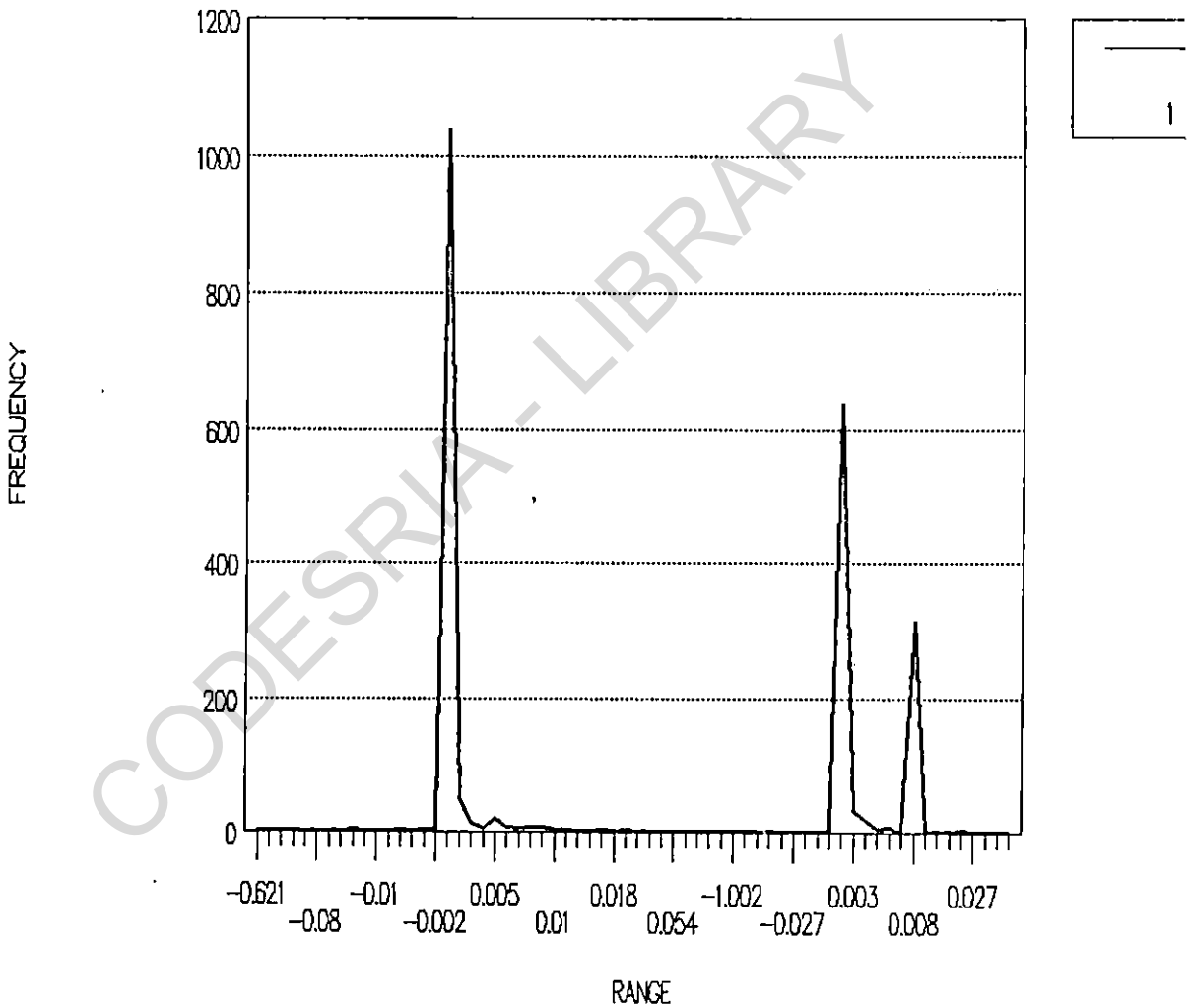


FIG. A.10: DAILY STOCK PRICE CHANGES

– FOOD SPECIALITIES

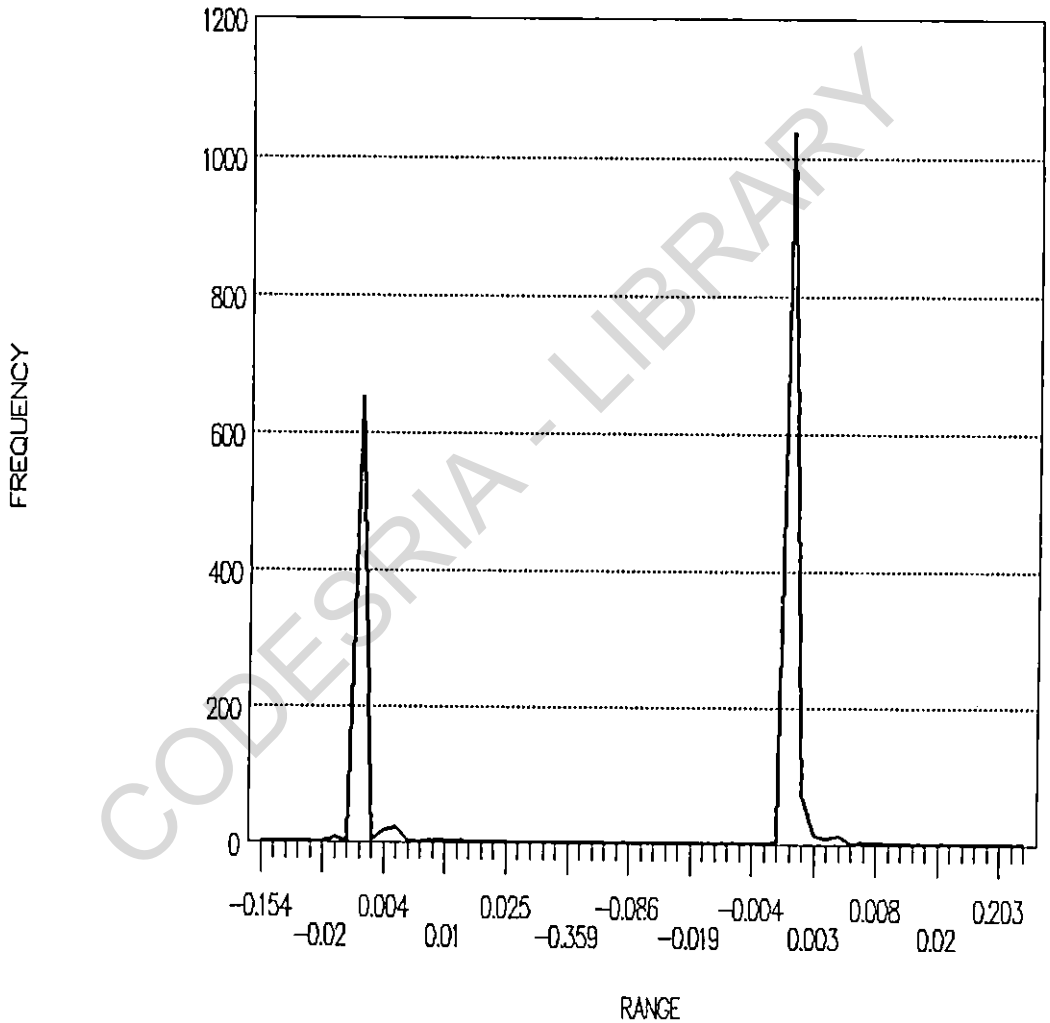


FIG. A-11: WEEKLY STOCK PRICE CHANGES

– GUINESS

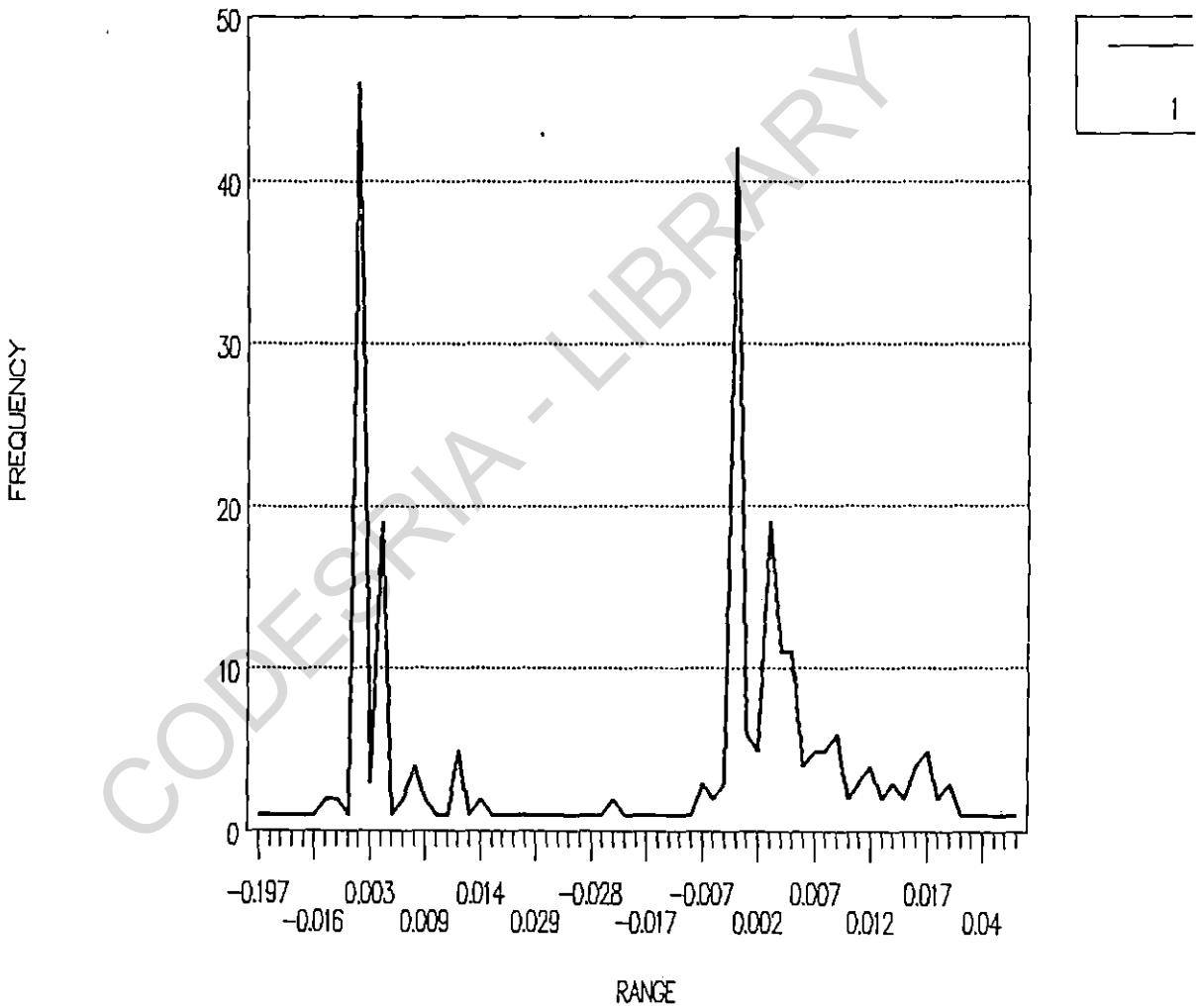


FIG. A.12: WEEKLY STOCK PRICE CHANGES

– NIGERIAN TEXTILE

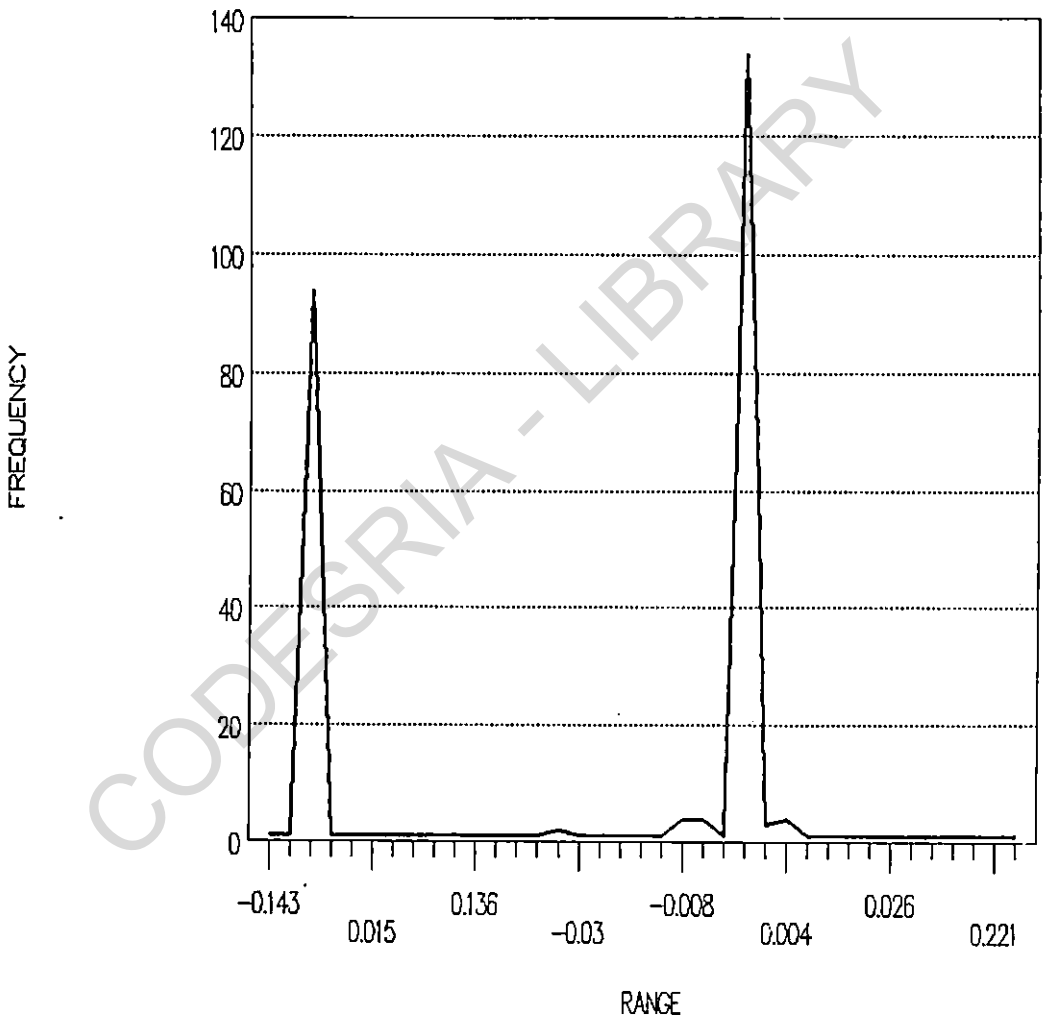


FIG. A-13: WEEKLY STOCK PRICE CHANGES

– UNION BANK

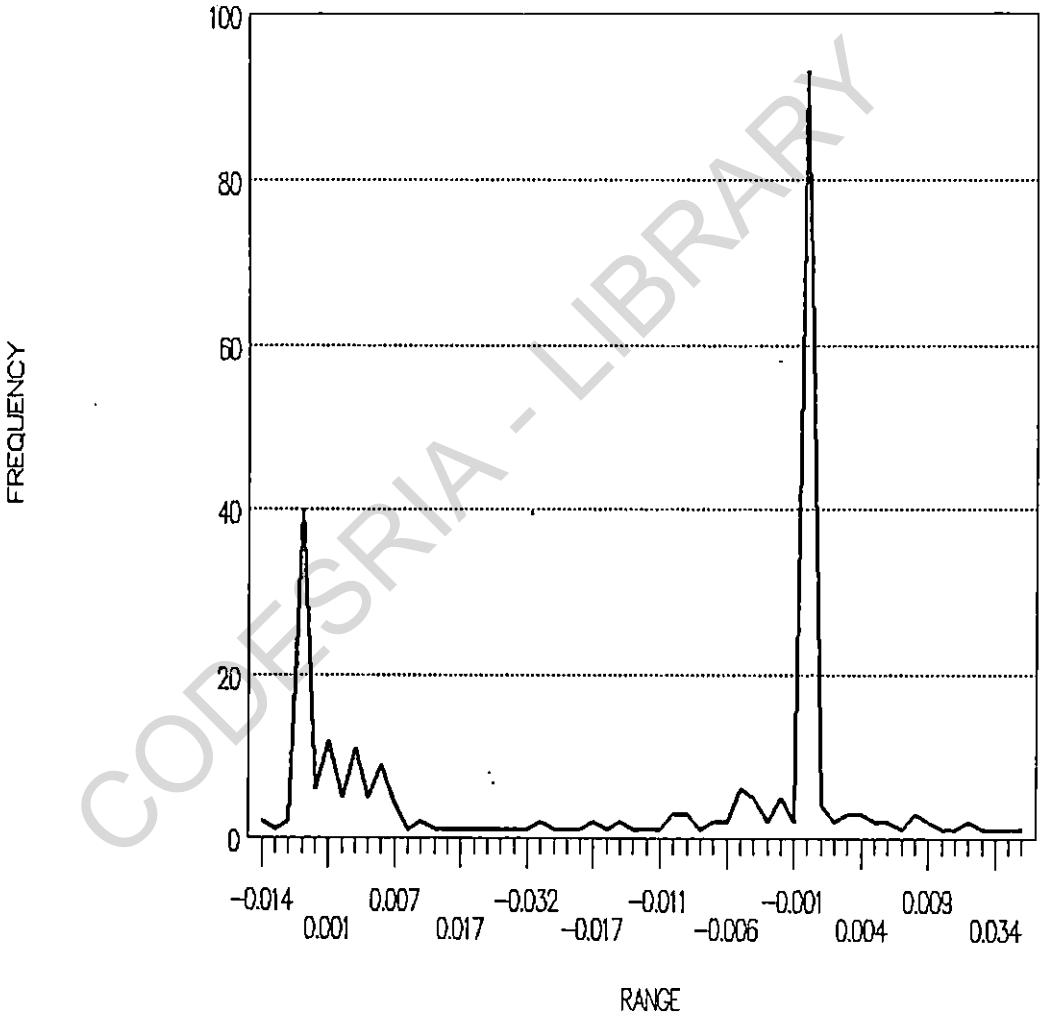
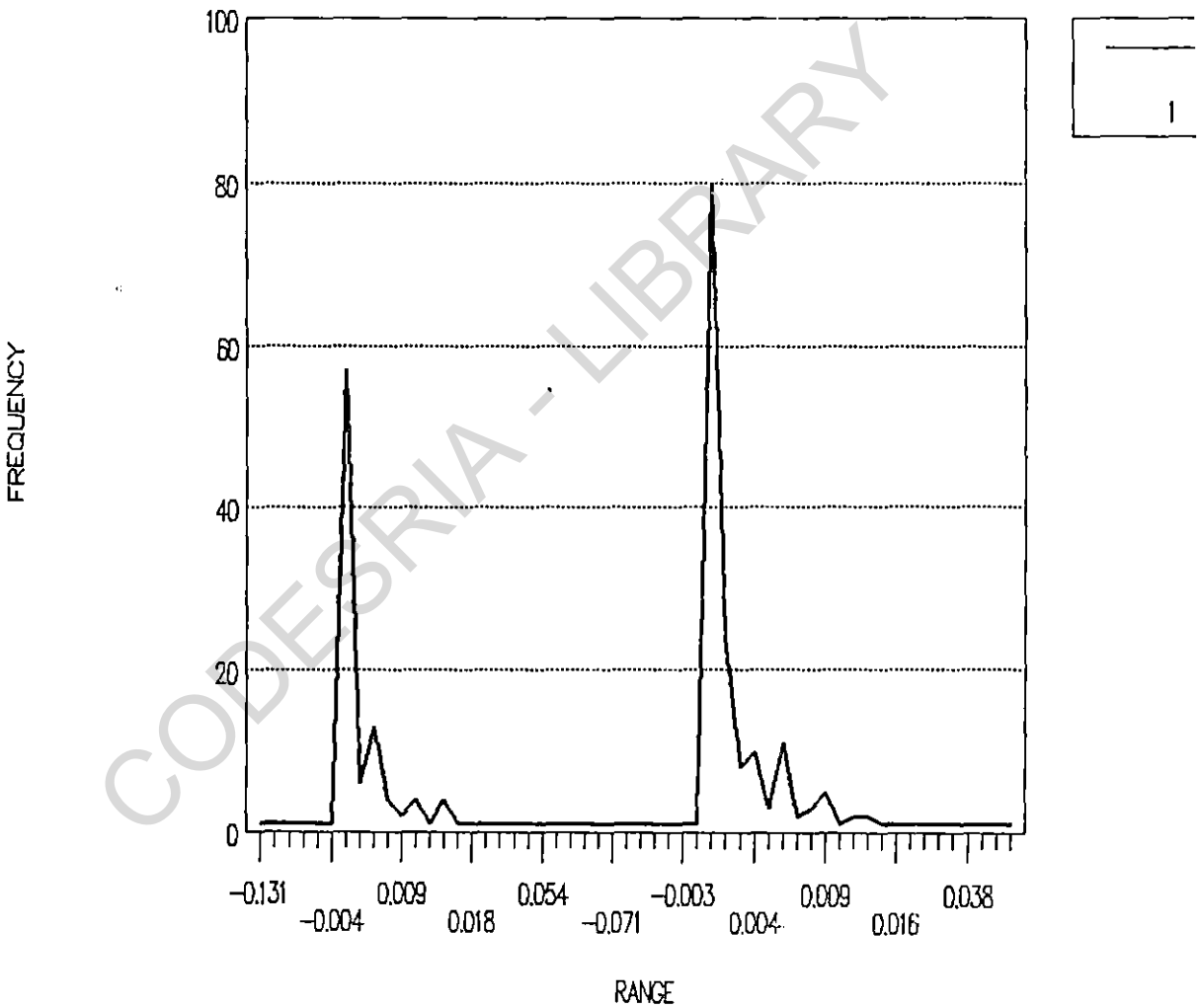


FIG. A-14: WEEKLY STOCK PRICE CHANGES

– FOOD SPECIALITIES



FIG·A·15: WEEKLY STOCK PRICE CHANGES

– JULIUS BERGER

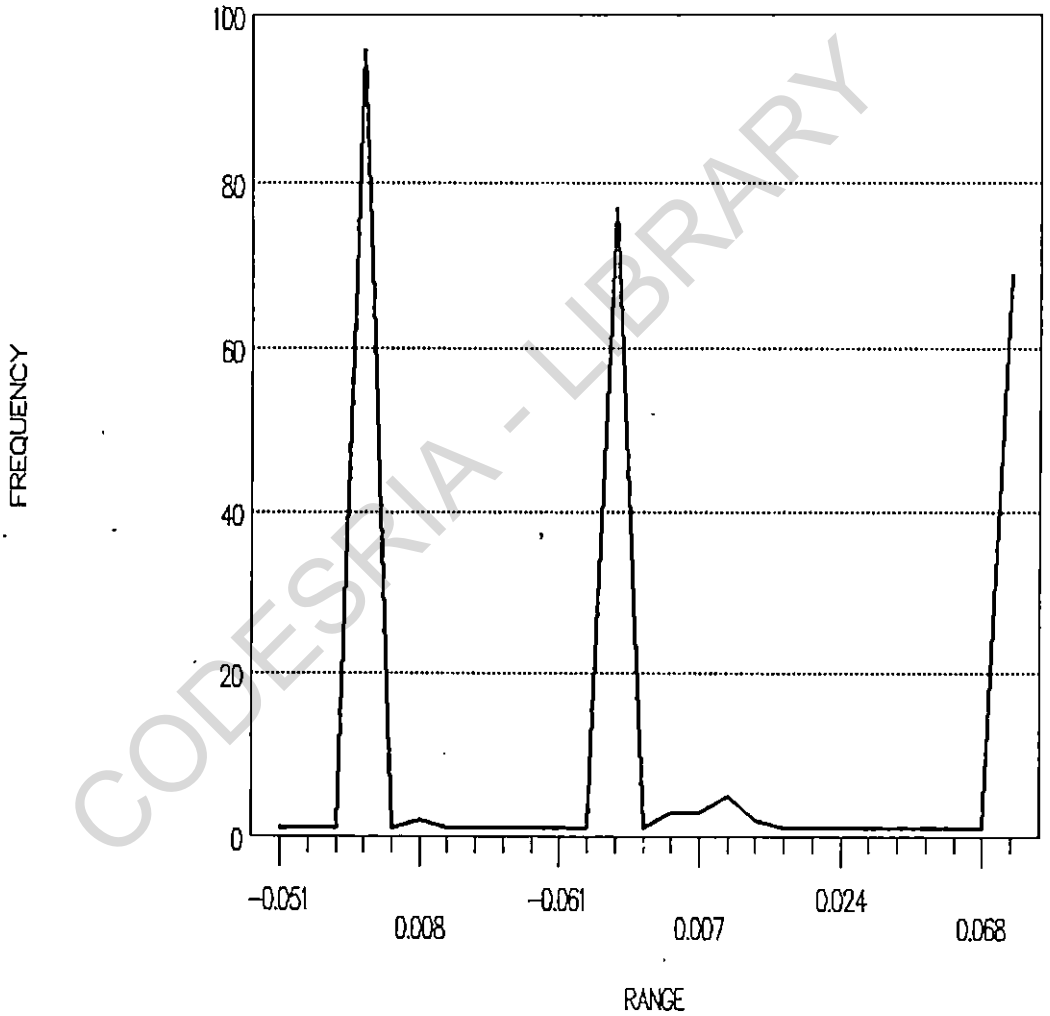


FIG. A-16: WEEKLY STOCK PRICE CHANGES

– DAILY TIMES

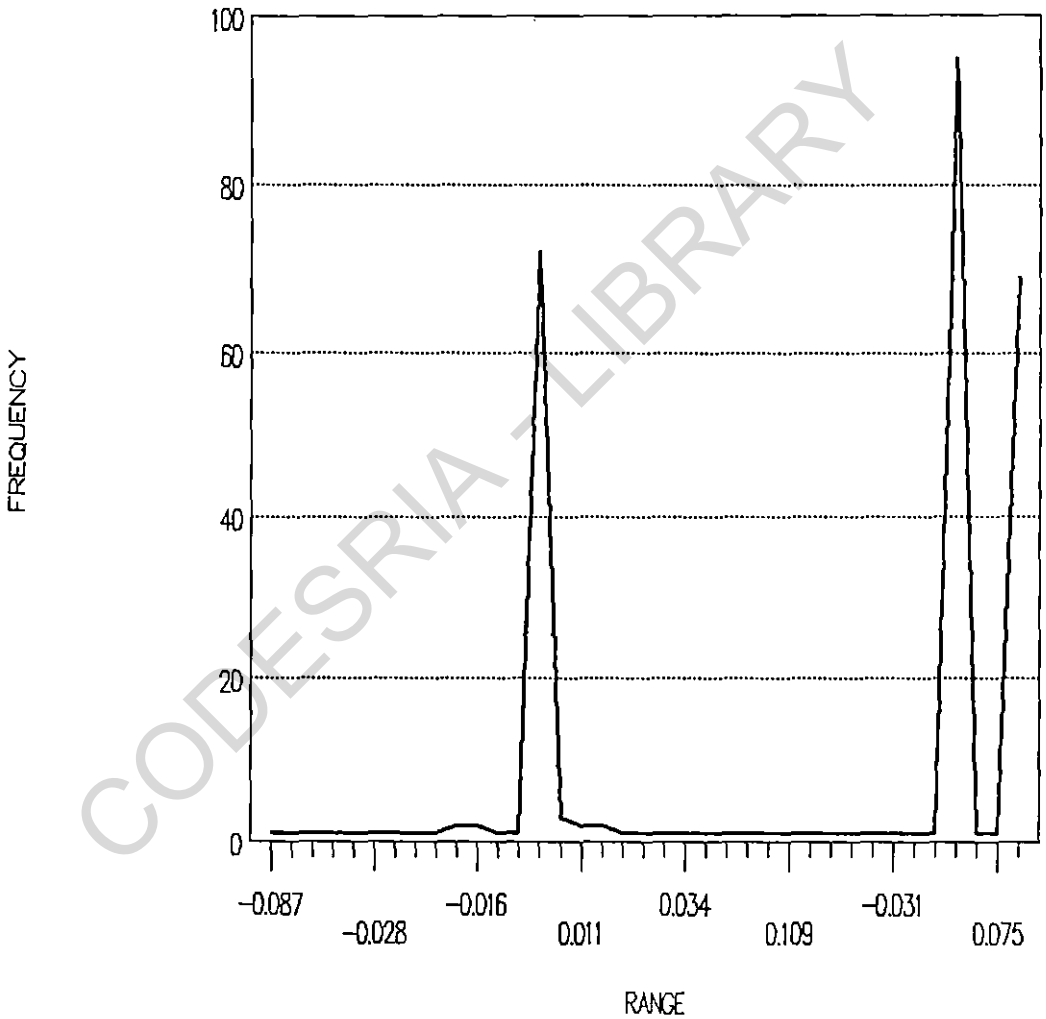


FIG. A-17: WEEKLY STOCK PRICE CHANGES

– N.C.R

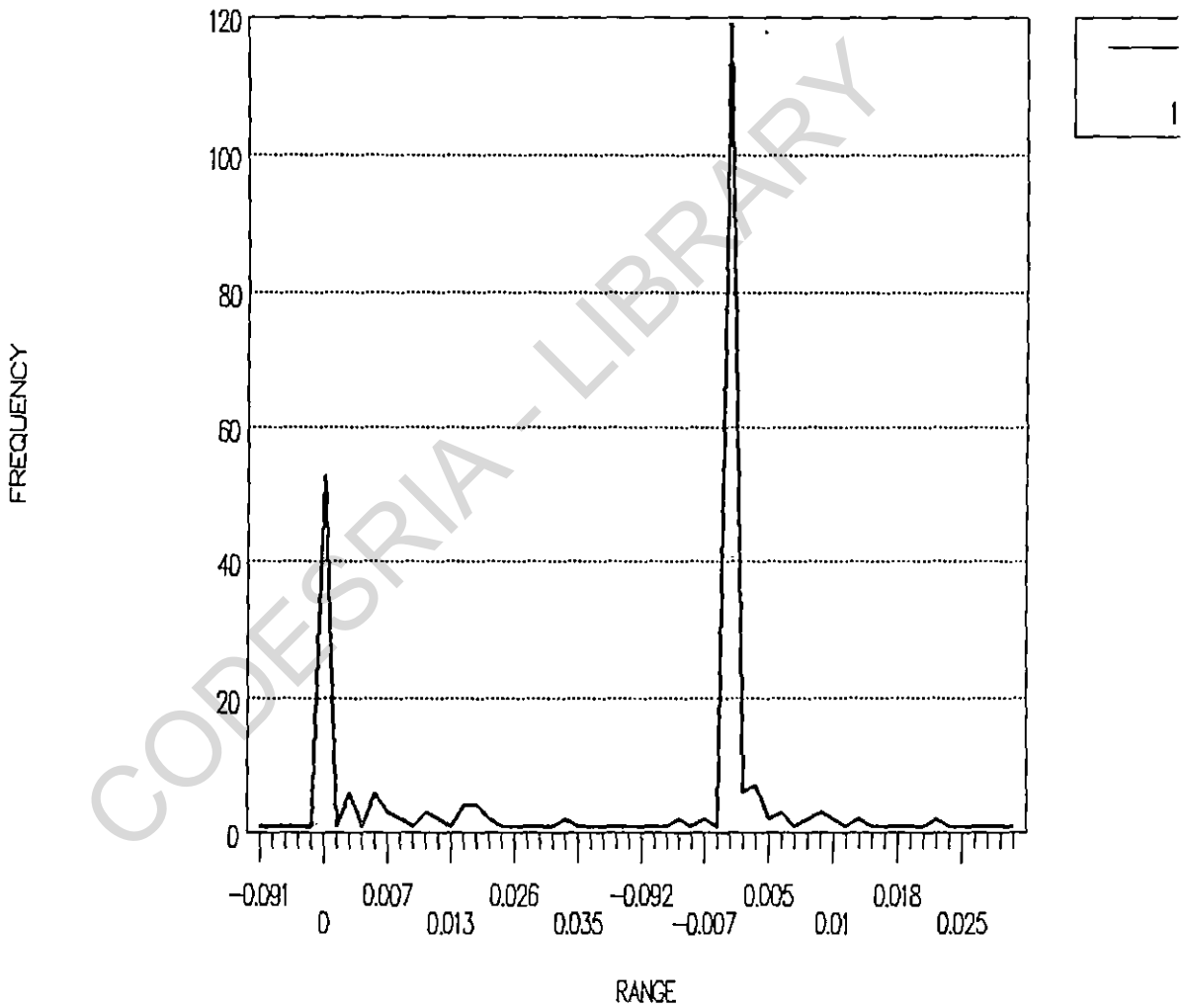
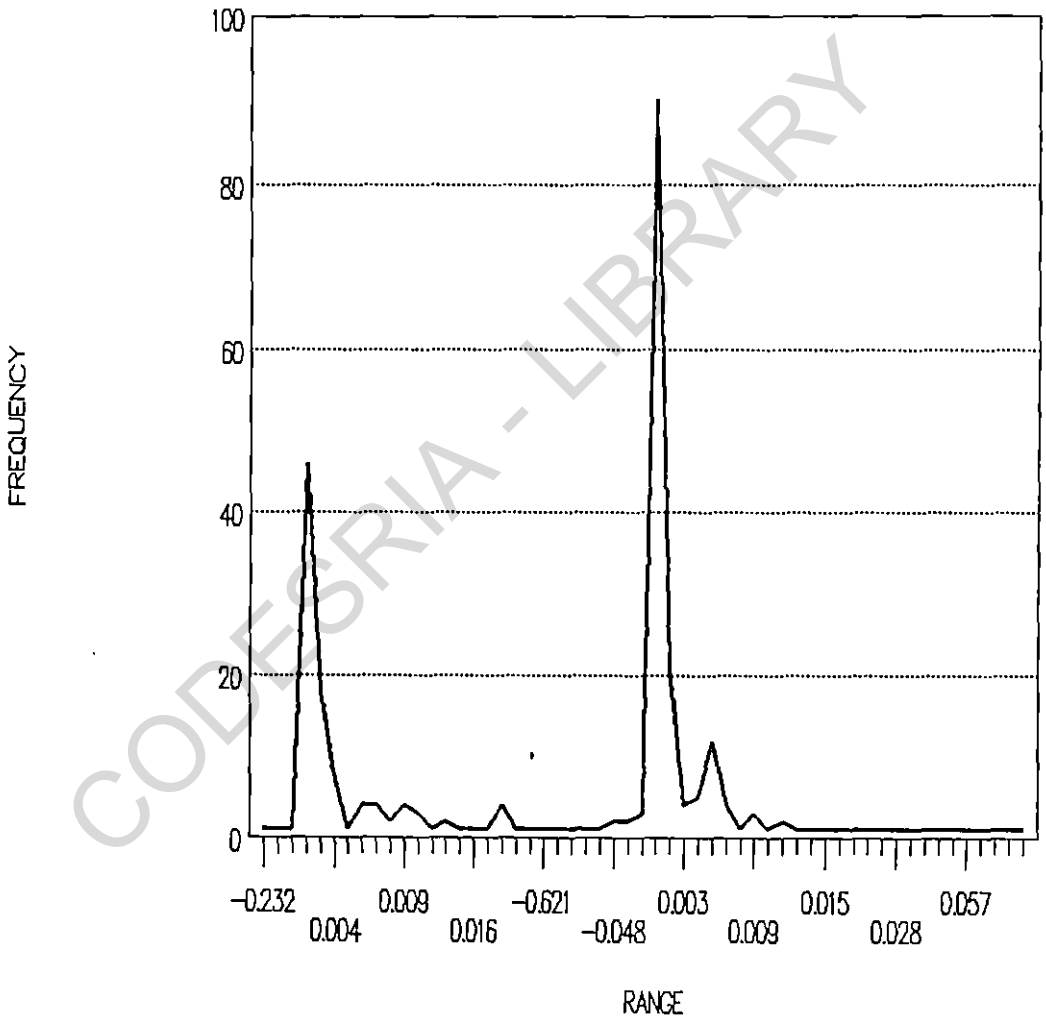


FIG. A.18: WEEKLY STOCK PRICE CHANGES

- TOTAL PETROL



FIG·A·19: WEEKLY STOCK PRICE CHANGES

– U.A.C.N

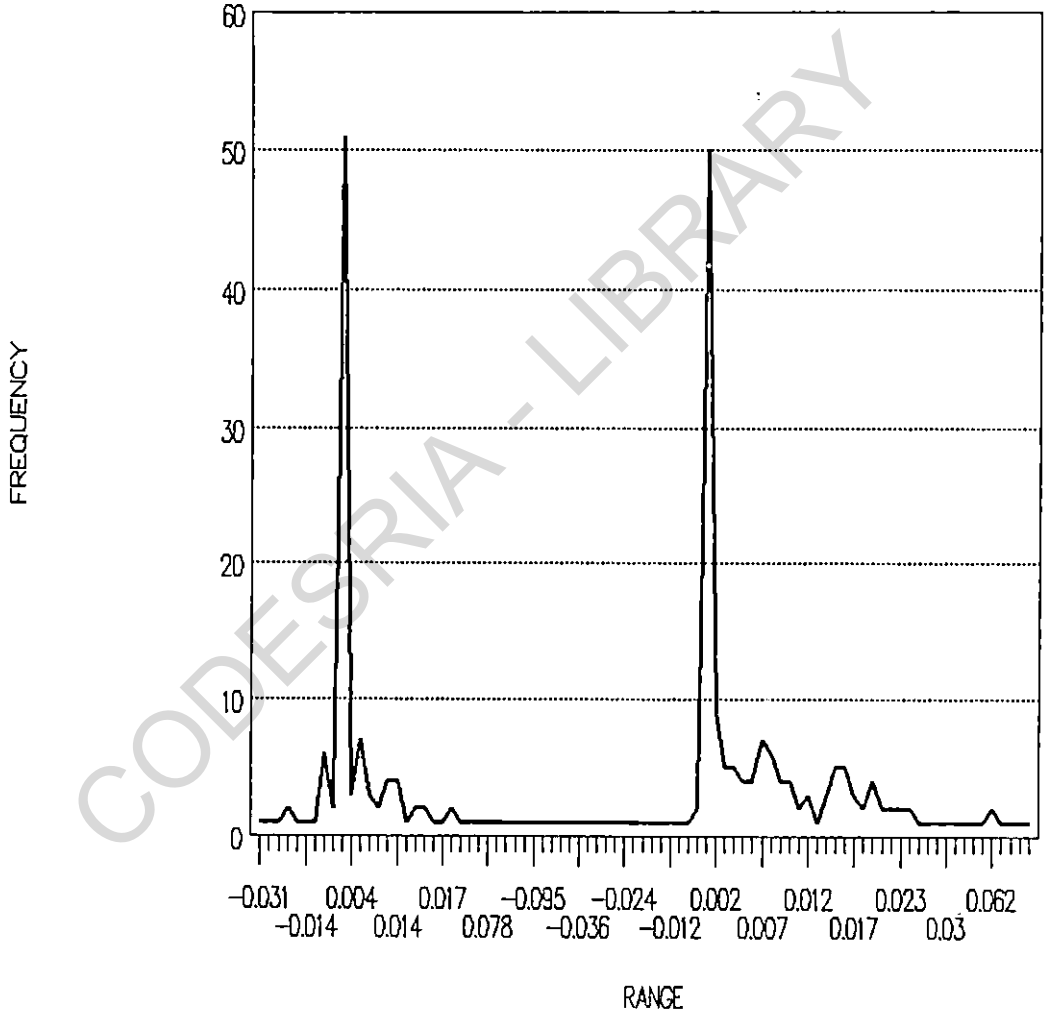


FIG. A·20: WEEKLY STOCK PRICE CHANGES

– JOHN HOLT

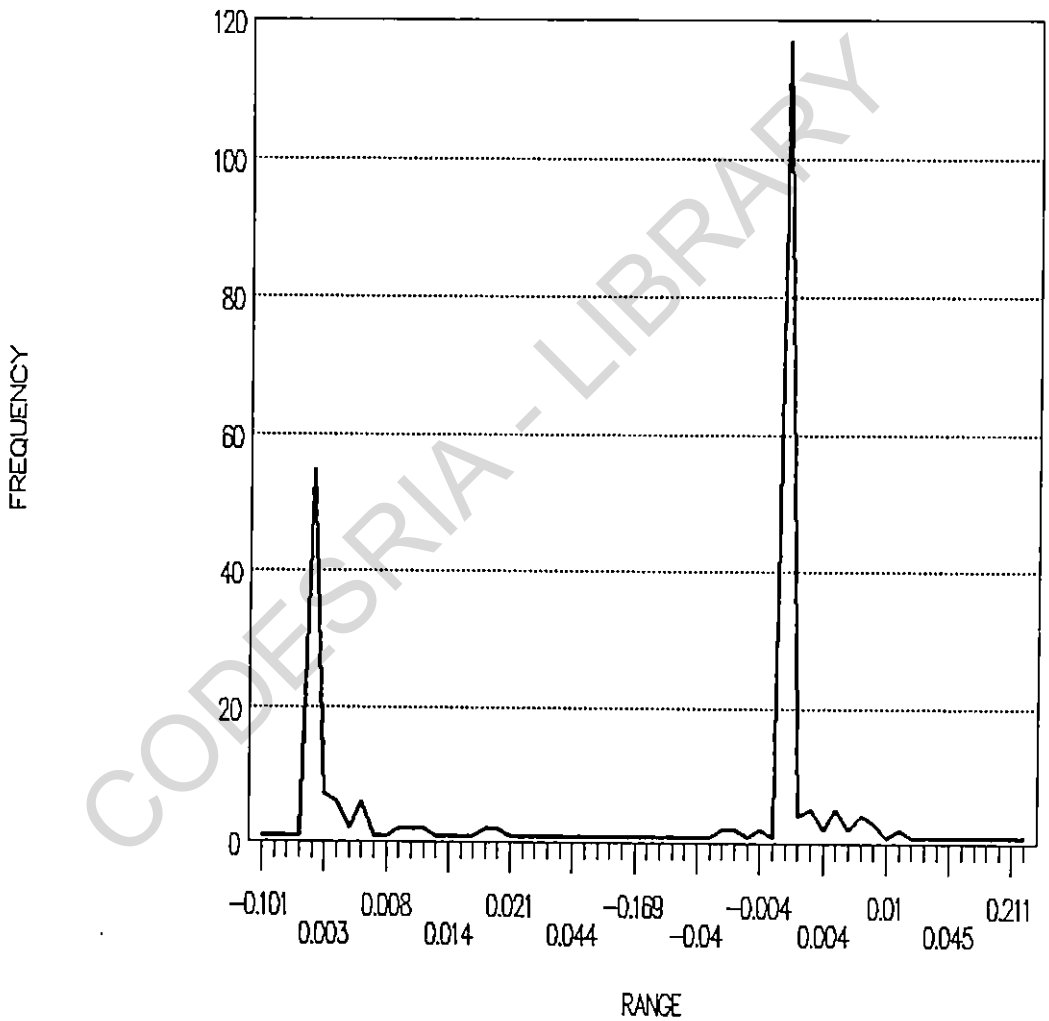


FIG. A.21: MONTHLY STOCK PRICE CHANGES

– UNION BANK

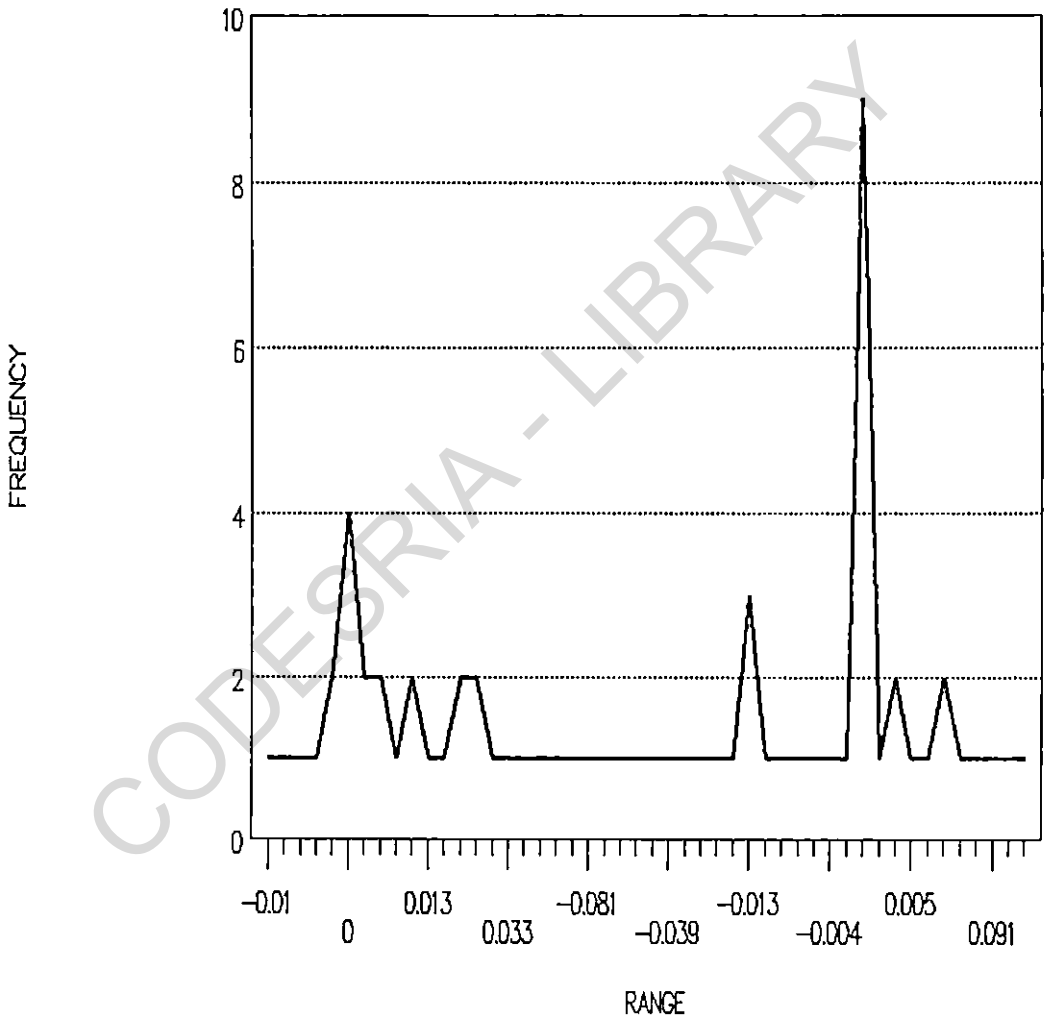


FIG. A. 22: MONTHLY STOCK PRICE CHANGES

– GUINNESS

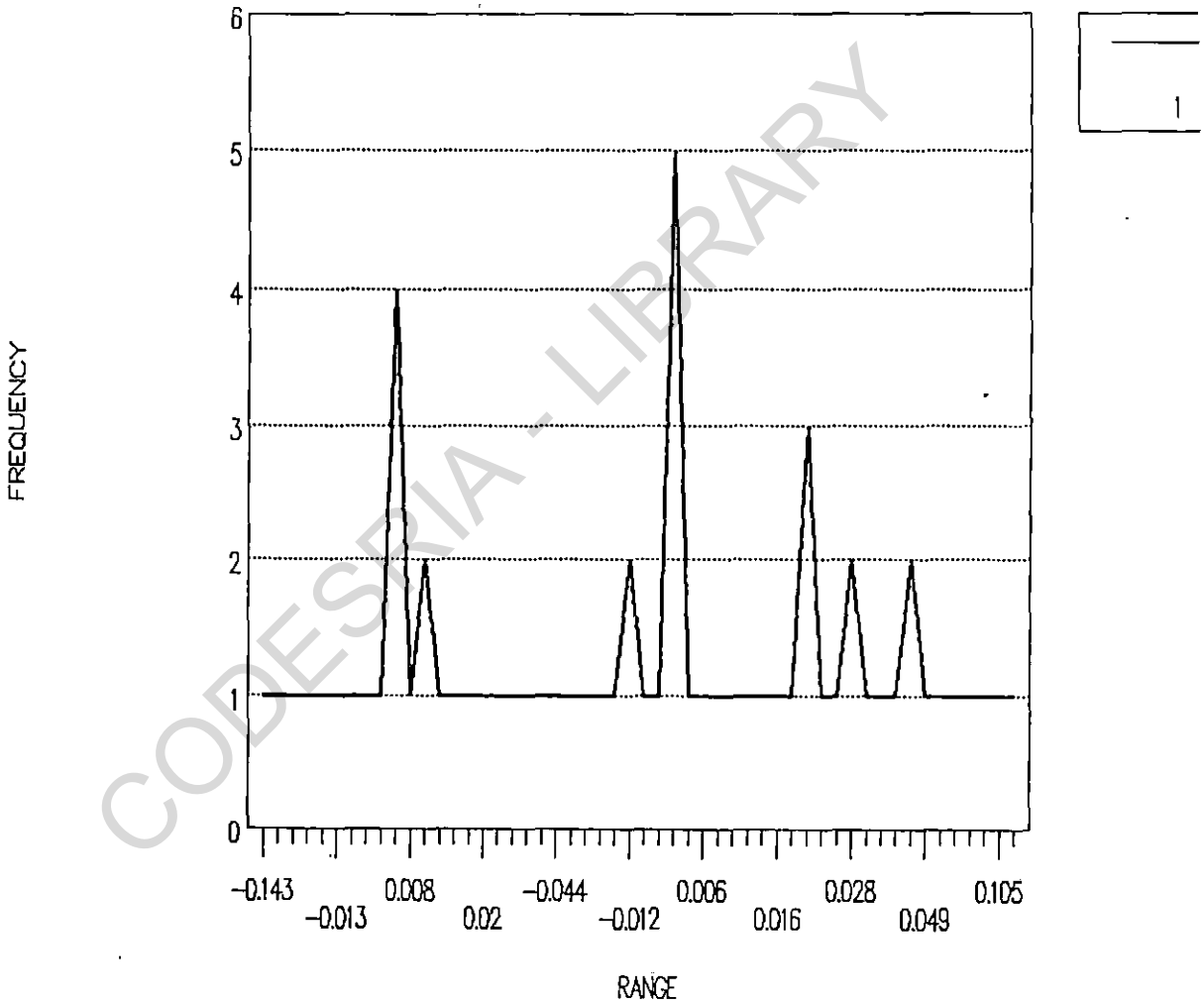


FIG. A.23: MONTHLY STOCK PRICE CHANGES

– JULIUS BERGER

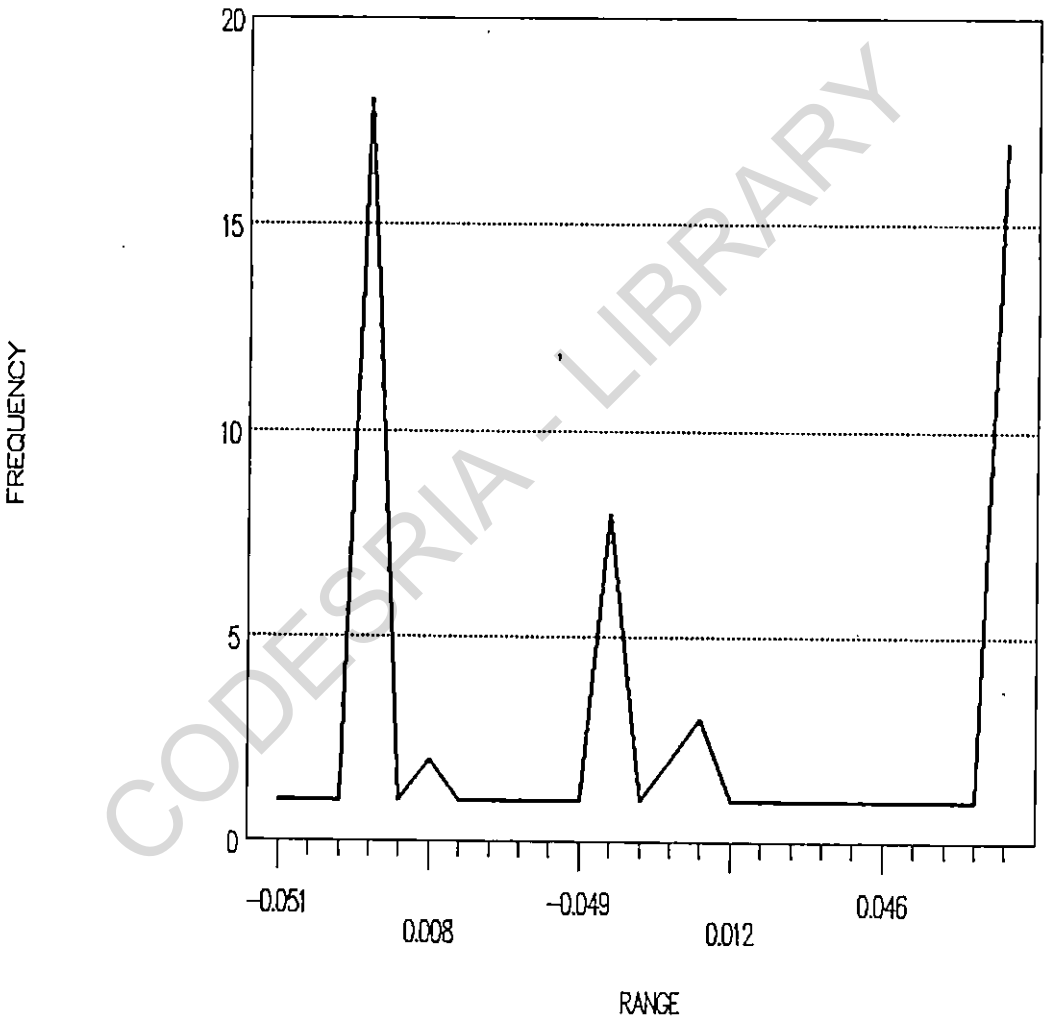


FIG. A · 24: MONTHLY STOCK PRICE CHANGES

– FOOD SPECIALITIES

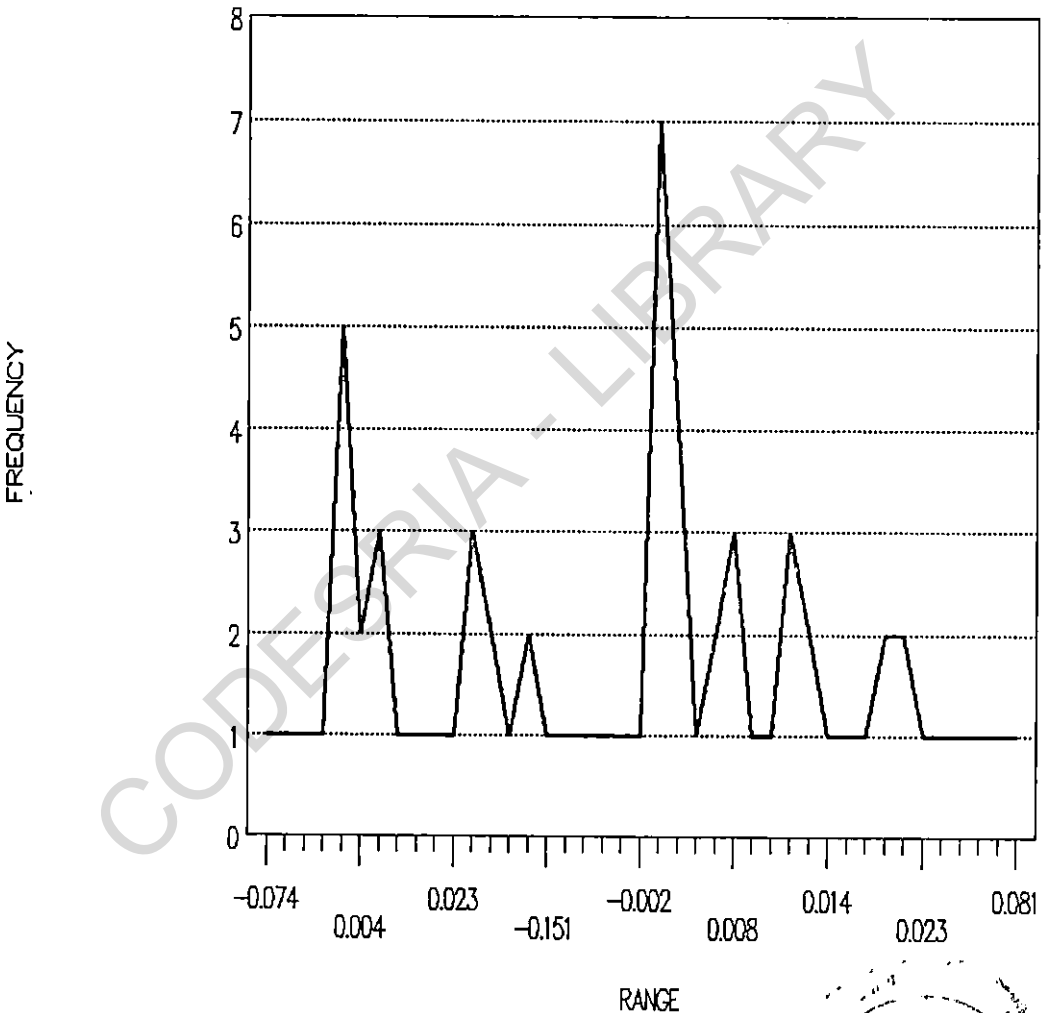


FIG. A. 25: MONTHLY STOCK PRICE CHANGES

- JOHN HOLT

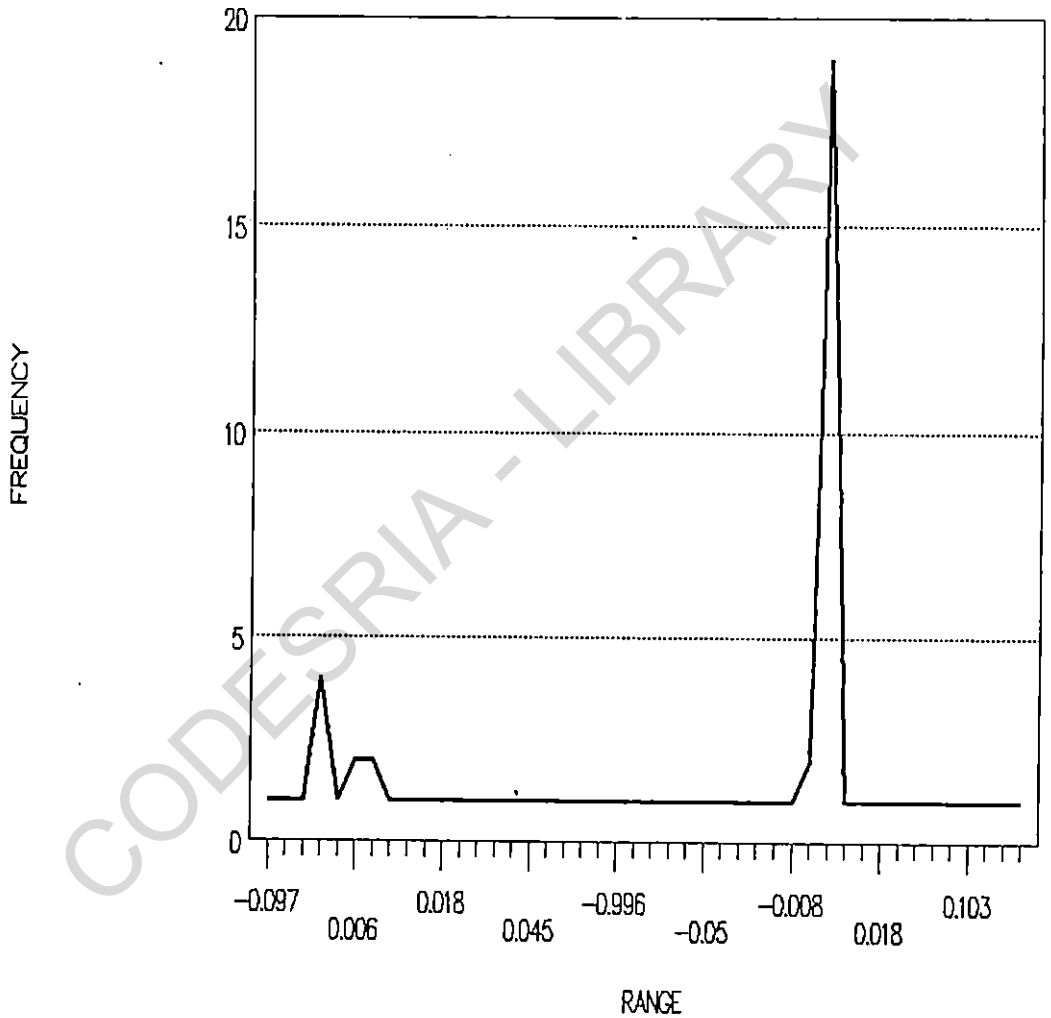


FIG. A-26: MONTHLY STOCK PRICE CHANGES

– U.A.C.N

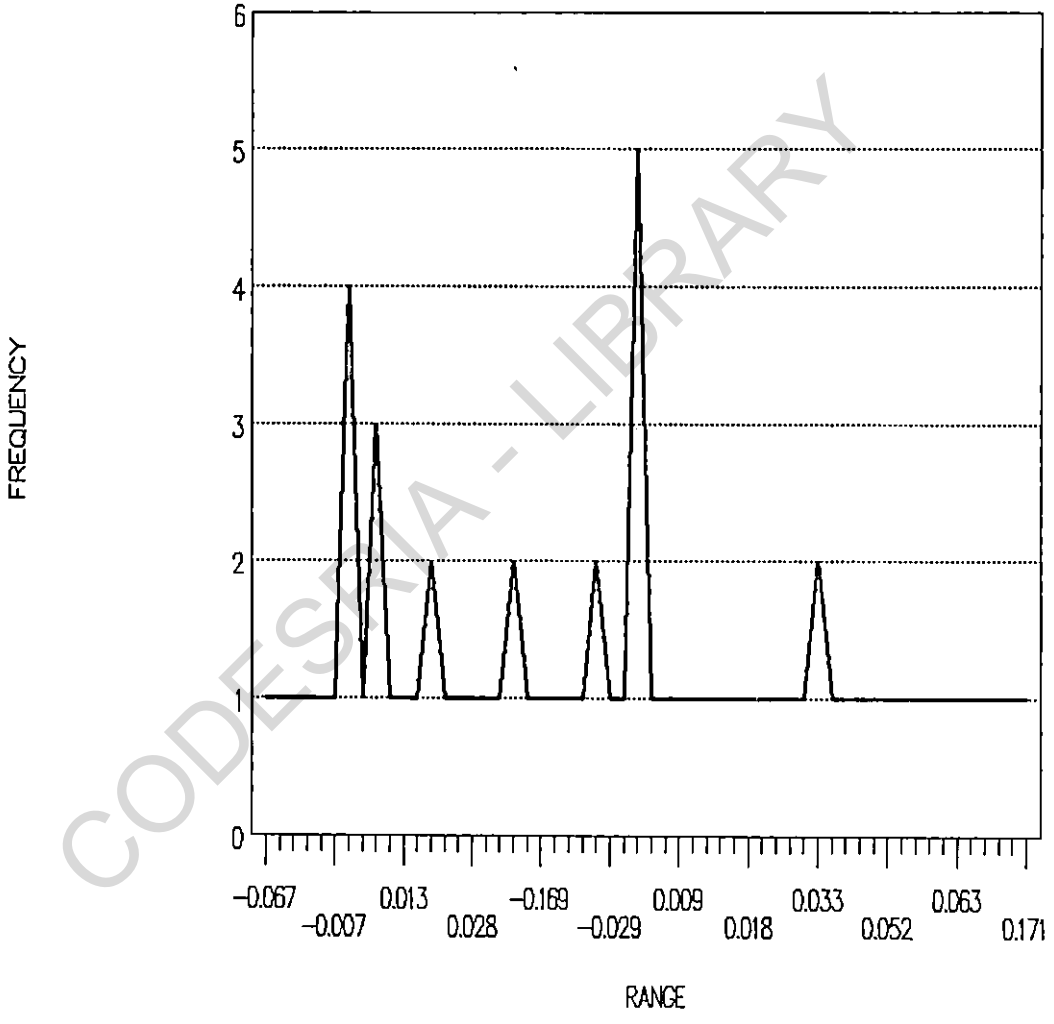


FIG. A. 27: MONTHLY STOCK PRICE CHANGES

– TOTAL PETROL

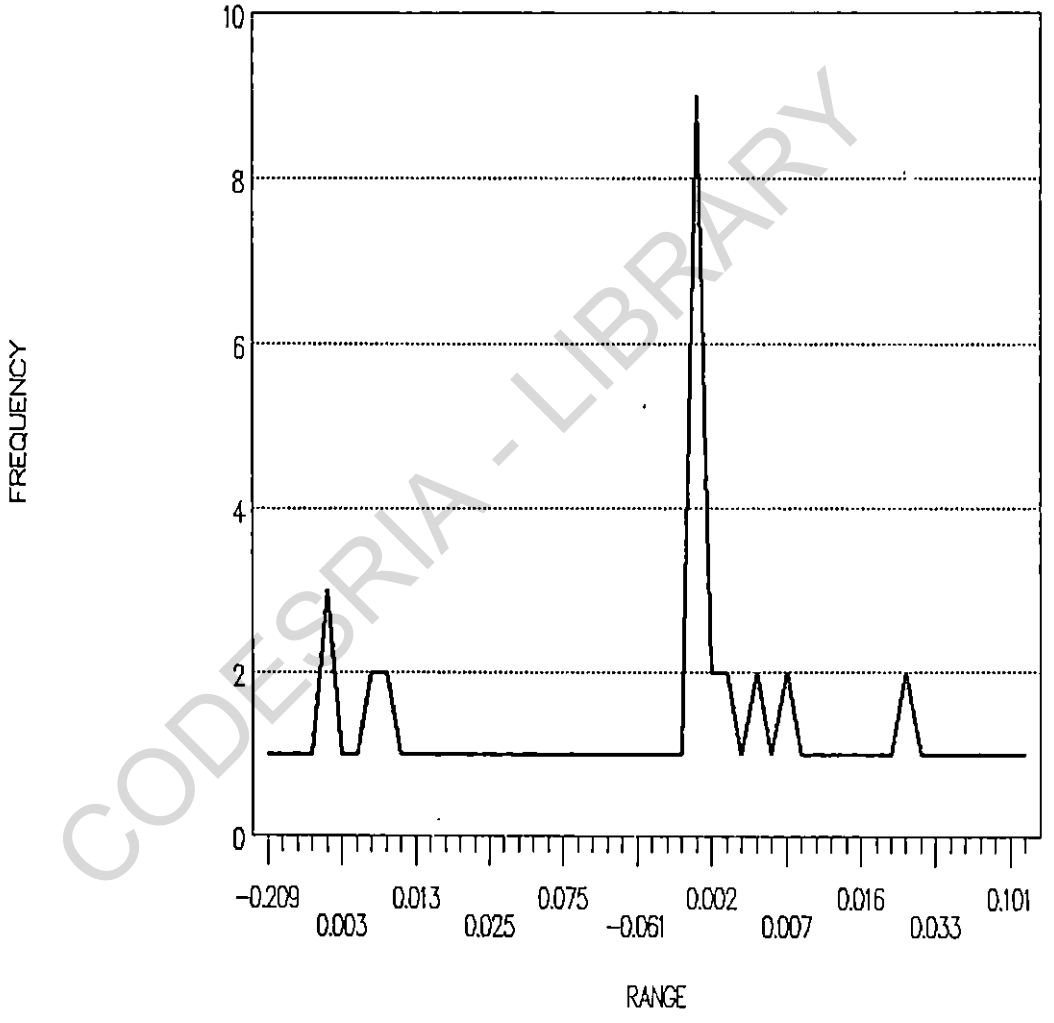


FIG. A. 28: MONTHLY STOCK PRICE CHANGES

– N.C.R

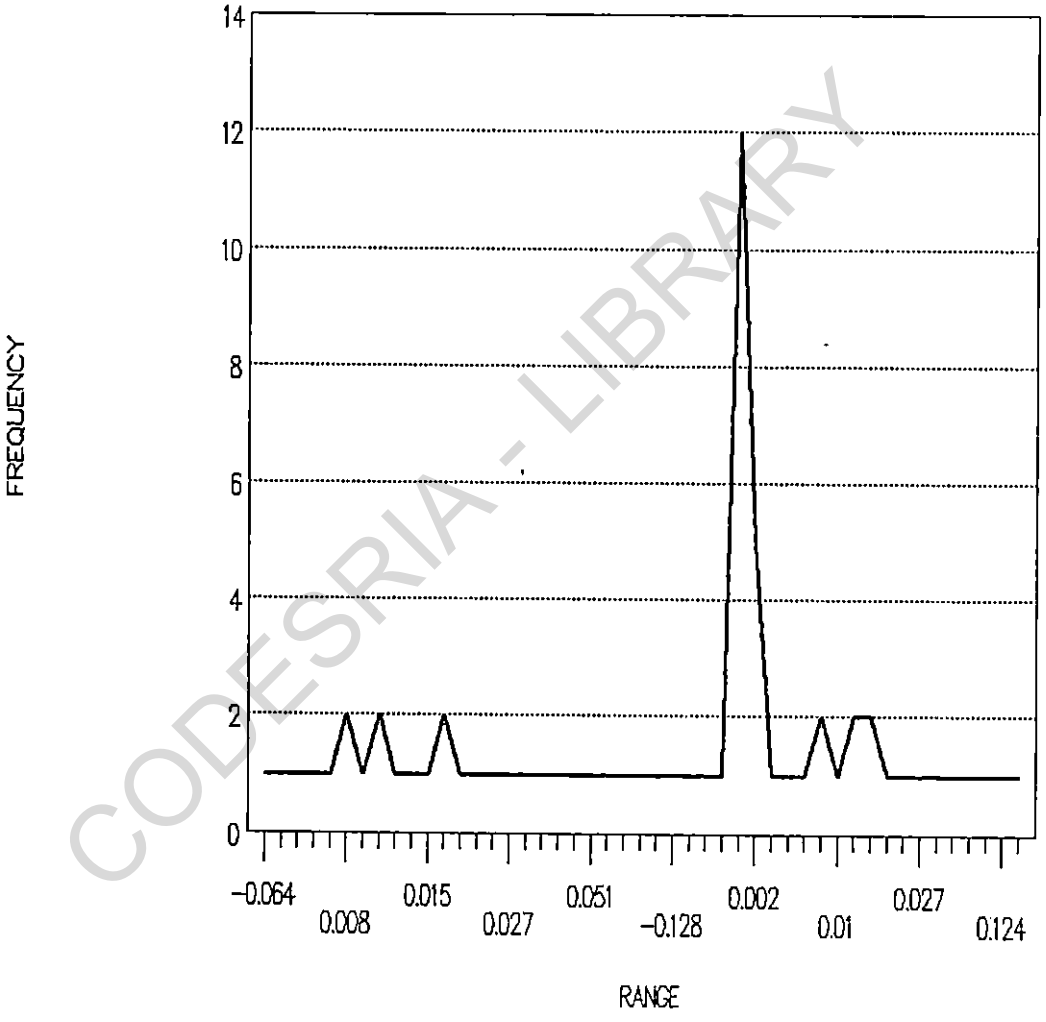


FIG. A.29: MONTHLY STOCK PRICE CHANGES

– DAILY TIMES

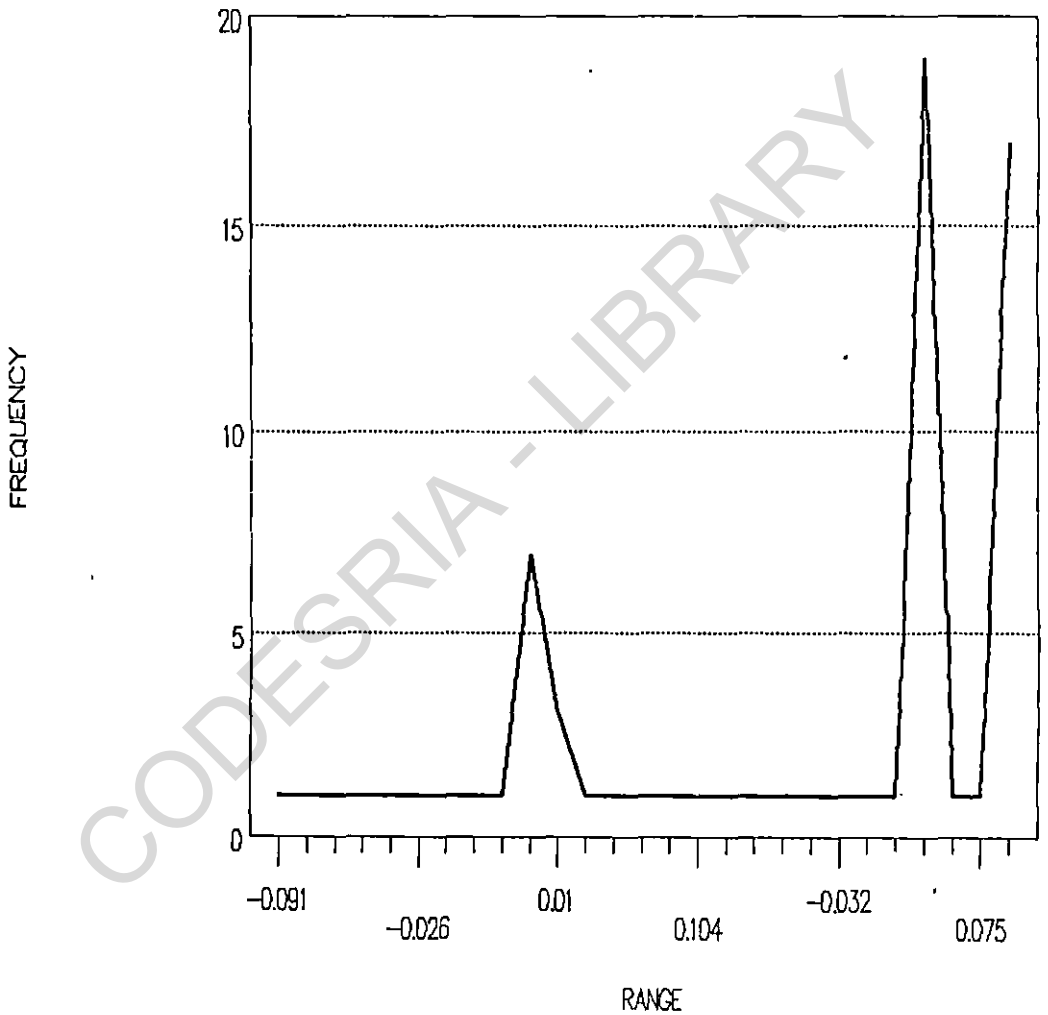


FIG. A.30: MONTHLY STOCK PRICE CHANGES

– NIGERIAN TEXTILES