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Systematic Factors and Returns on Equities in the Nigerian Securities Market

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SYSTEMATIC FACTORS AND RETURNS ON EQUITIES IN THE NIGERIAN SECURITIES MARKET

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DEDICATION

To the Emenugas

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ABSTRACT

SYSTEMATIC FACTORS AND RETURNS ON EQUITIES IN THE NIGERIAN SECURITIES MARKET

In recent years, especially since the introduction of the Structural Adjustment Programme in Nigeria in 1986, emphasis has shifted from reliance on external funds to domestic resources for development.In this regard,the financial markets are playing important roles. The Nigerian securities market has particularly become sensitive to policy measures aimed at promoting its activities; leading to its rapid growth in terms of market capitalisation, the number of stocks listed, and the number of market operators.

The role of financial intermediation which the market plays in the Nigerian economy underscores the need to investigate the relationship between returns in the securities market and the macroeconomic environment. The investigation is aimed at examining the relationship between systematic macroeconomic factors and returns on equities, ascertaining the relevance of systematic risk factors to asset pricing in the equities market, and determining the effectiveness of equities as inflation hedge.The purpose is to

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provide a basis for policy and investment decision.

A one-period model which incorporates capital gains, cash dividends, and scrip and rights issues, was used to generate a stream of monthly returns on equities. Using the Capital Asset Pricing Model (CAPM) beta as a measure of systematic risk, and the standard error of the market model as a measure of non-beta systematic risk, the study tests whether beta is a relevant systematic risk that determines returns on equities. Factor analysis technique was used to investigate the existence of risk premium on any systematic factor within the theoretical framework of the Arbitrage Pricing Theory (APT). Further, returns on equities were regressed on a set of macroeconomic variables which include, expected and unexpected rates of inflation,money supply,exchange rate, and interest rate, in order to identify the macroeconomic factors that are associated with the pricing of equities.

The results of the various analyses show that neither beta nor any other measure of systematic risk is associated with risk premium. Returns on Nigerian equities have no defined relationship with the macroeconomic environment.

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The outcome of the study has a number of implications. Risk of Nigerian equities can only be defined in terms of the idiosyncratic variations in the rates of return on equities. These are the components of risk which can largely be diversified away within an efficient portfolio. Contrary to theoretical expectations, the equities are not inflation hedge. The insignificance of beta and other forms of systematic risk in equities pricing casts doubt on the relevance of CAPM and APT in the Nigerian equity securities market.

The study makes some recommendations for promoting and sustaining investment in the Nigerian securities market. These include deregulation of the pricing mechanism, and establishment of a special fund to serve as a catalyst in equities trading. Given the present insensitivity of stock returns to the macroeconomic environment, in an event of persistent decline in stock returns, direct intervention in the form of suspension of trading and fiscal measures will be more effective than tinkering with macroeconomic factors.

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CERTIFICATION

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CHAPTER ONE

INTRODUCTION

1.1 Statement of the problem

Since the downturn in the world price of petroleum in the early 1980s, the Nigerian economy has been experiencing economic recession. This shows up in high unemployment, excess capacity in industry, low agricultural productivity, high rate of inflation, and inadequacy of capital in both the public and the private sectors.

The traditional approach to solving the problem of capital inadequacy in Nigeria, as one means of solving the mother problem of underdevelopment, has been to borrow external funds, a la the two- gap model (Chenery and Strout, 1966). This has resulted in the substantial external debt burden of the country which, as at the end of 1991, amounted to $33.3 billion (Central Bank of Nigeria, 1991).

In recent years, especially since the introduction of the Structural Adjustment Programme (SAP) in 1986, emphasis has shifted from reliance on external funding to using domestic resources for development. This logically leads to issues pertaining to mobilisation of domestic resources. In this regard, the role of

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financial markets comes to mind. Gurley and Shaw (1967) avidly demonstrated that the development of the financial sector of any economy is very strategic, if not a sine-qua-non for economic development.

Financial markets, in the ultimate, function to increase the range of financial resources in the economy and to create conditions for efficient use of the available resources. Both actions stimulate and accelerate the process of economic growth (Popiel, 1990). Usually banks, insurance firms, finance companies, trust schemes, and securities markets, constitute the key financial institutions in any market economy. The roles played by each of these institutions are quite significant. For example, securities markets provide risk capital and long term financing both of which contribute to the stability of the financial structure of companies and the solvency and liquidity of the entire financial system, if not the economy. These markets, which deal in long term equity and debt instruments, offer the medium for mobilising both domestic and foreign savings from the surplus saving units and channelling the mobilised funds for investment in the deficit saving units. The process guarantees, ideally, efficient allocation and utilisation of resources as it ensures that investments are made where the

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yield per unit of risk is maximum. The markets thus serve as catalysts for economic growth and development.

In Nigeria, the securities market has, of late, witnessed major changes in response to policy measures aimed at promoting its activities. Following the deregulation of the financial system, bank funds, which used to be a cheap source of operating capital to companies, have become costly, causing some companies to abandon their historical reluctance to go public by raising equity funds in the securities market. The privatisation of public companies has encouraged many individuals to buy shares and many companies to go public.

As a result of the above, the Nigerian stock market has been on the growth path. For instance, in very recent years, the total market capitalisation has been increasing. From N4.464 billion in 1980 it rose to N16 billion in 1990, showing an average annual growth rate of 25.84% over the period. From 1990 to 1991, the market capitalisation increased by 43.75%. The total number of securities listed has also been growing. Equities, for example, rose from 91 in 1980 to 142 in 1991 (Nigerian Stock Exchange, Annual Report, 1980-1991 issues).

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In an economy with a securities market, the performance of the market is important for several reasons. The tempo of activities in the market serves as the barometer to gauge the fate of the economy at any particular point in time. Batra (1988), for example, showed that the immediate cause of the Great Depression of the 1930s was the stock market crash in the United States in 1929. Appropriate economic policies to stabilise the stock market in a period of excessive stock speculation, or during stock market crash, to avert or minimise economy-wide catastrophe, as carried out in the United States of America in 1987, derive from the knowledge of macroeconomic factors that determine or influence the trend of stock market indices. It is a "vacuum" that such factors have not been investigated in the face of the growing importance of the securities market in Nigeria.

The stock market is also of great importance to the quoted companies and investors. The ease with which a quoted company can source additional capital, especially in the form of "offer for subscription", depends on the market performance of its stocks. Investors, on the other hand, attach much importance to the liquidity of their investment. For a security to retain this cherished quality of liquidity, which makes it possible for the

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stock-holders to exchange shares for cash without substantial capital loss, the particular security must be active on the stock market trading floor.

The importance of the securities market has led to the science of financial analysis in securities markets, particularly risk-return relationships. This study investigates the nature of the risk elements that are associated with the returns-generating process in the Nigerian equity securities market.

1.2 Objectives of the study

The study aims at investigating the responsiveness of returns on equities in the Nigerian securities market to systematic factors. In specific terms, the study is tailored to:

(i) assess whether systematic macroeconomic factors affect returns on equities;

(ii) determine the relevance of systematic risk factors to asset pricing;

(iii) determine whether investors in the Nigerian securities market are sensitive to macroeconomic risks ; and

(iv) determine whether, and to what extent, equities serve as hedge against inflation.

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1.3 Hypotheses of the study

In line with the above objectives, and emanating from the literature, the study advances the following research hypotheses:

(i) The rate of return on equity is a function of the systematic risk of the equity.

(ii) Returns on equities are sensitive to the market risk and to risks associated with inflation and other macroeconomic variables.

1.4 Need for the study

Factors that determine the performance of a security are normally categorised into systematic or pervasive macroeconomic, and industry-wide or firm-specific factors. Ideally, within a portfolio of securities that is diversified across different industries, the industry-wide and firm-specific factors are expected to cancel out. Systematic factors, however, remain whether in a context of single securities or a well diversified portfolio. What is expected of investors is to have foreknowledge of these factors and to demand compensation in the form of risk premia for their effects.

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Furthermore, macroeconomic policies designed to influence the trend of returns in a securities market, as a means of sustaining the market's role in savings mobilisation, are usually tied to the systematic factors that affect returns on securities. The study intends to identify these factors and determine whether the risk premia associated with them are priced.

It has been observed that technical analysis of stock returns is lacking for Nigerian securities (Soyode, 1989). Specification of models in studies of the effects of firm-specific factors (such as dividend policy, stock splits, mergers, acquisitions, etc.) on stock returns, requires the knowledge of the behaviour of investors towards risk (Basu, 1977; Banz, 1981). By ascertaining the risk-related attitude of Nigerian investors, this study will provide a framework for further capital market studies in Nigeria.

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1.5 Scope of the study

The study is based on equities which, in terms of market value, are the dominant class of securities in the Nigerian capital market. The analysis, which is carried out using monthly data, covers January 1987 to December 1991. A number of reasons guided the choice of this period. First, it represents the period of

deregulation of economic activities, during which market signals, rather than policy control measures have been allowed to guide the behaviour of economic agents and prices. Second, unlike the pre-1986 period, this period has been quite significant for the remarkable increases in the number of quoted companies, stockbrokers, investors and activities in the stock market.

Some positive effects are expected from these developments. Increase in the supply of equities is expected to give rise to improved opportunities for portfolio composition, risk-diversification, and accurate pricing and valuation of assets. The presence of more players is expected to reduce the degree of concentration and increase the degree of competition in the market (Adam, Cavendish and Mistry, 1990). It is therefore within the chosen period that we expect to observe the sensitivity of asset returns to the factors that impact their values.

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CHAPTER TWO

THE NIGERIAN CAPITAL MARKET: AN OVERVIEW

2.1 Introduction

The term capital market refers to a network of specialised financial institutions which bring suppliers and users of long-term capital together.A capital market functions to achieve such broad goals as:

- encouraging the mobilisation of savings, and investment of same in public and private sector projects;
- promoting efficiency in the allocation of resources among competing alternative investments; and
- improving the opportunities for firms to secure long-term funds.

The potential for a capital market to accomplish these goals is qualified and predicated on the market being efficient. Studies on the efficiency of the Nigerian capital market are discussed in section 2.6 below.

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2.2 Institutional framework

The major institutions in the Nigerian capital market include banks, the Nigerian Securities and Exchange Commission, stockbroking firms, and the stock exchange. Below is a succinct review of the roles and contributions of these institutions to the development of the capital market.

2.2.1 Banks

The categories of banks in Nigeria are the central bank, commercial banks, merchant banks, and development banks. Each of these categories is discussed below:

(a) Central Bank of Nigeria (CBN)

The central bank has been the principal institution controlling other institutions in the capital market. Two of the main functions of the bank are (i) organisation and provision of development finance, and (ii) development and control of the financial system.

The bank's role in setting up other financial institutions is quite pioneering. Prior to the establishment of the Nigerian Stock Exchange, the apex bank coordinated and implemented the issues and

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transfers of public and private securities (Alile and Anao, 1986), thus substituting the role of the stock market. The Central bank has also exercised regulatory role over the stock market through the Securities and Exchange Commission (SEC). For some years, the SEC's regulatory organ of the capital market was run by the Central bank.

The development finance functions of the bank relate to the issuance of government securities and establishment of specialised banks. For the Federal Government's development stocks, the CBN is the issuer, underwriter, and manager. Through this exercise, the bank contributes to the funding of the capital market. As underwriter, any of the government stocks not subscribed to by the public is normally bought back by the bank. By this role, the bank guarantees liquidity and price stability in the gilt-edged securities sector (Alile and Anao, 1986).

The yield on government loan stocks is determined by the Central bank. Until the deregulation of the financial system in 1987, the yield rates were administratively fixed by the bank and were such as would guarantee low cost of government borrowing. This policy has been observed to have "produced the undesirable effect of reducing the volume of stock transactions and creating,

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on the overall, a disincentive to save ... since it eliminated any prospect there might have been of capital gains" (Alile and Anao, 1986: 91). Following the new policy thrust of allowing market forces to determine yield rates on financial assets, the Central bank now has a new challenge to bring scientific tools to the management of government loan stocks. This is required to ensure that the timing of the floatation and redemption of debts is carried out at such periods as would guarantee low interest cost to government.

The development banks in Nigeria, namely the Nigerian Industrial Development Bank (NIDB), the Nigerian Bank for Commerce and Industry (NBCI), the Nigerian Agricultural and Cooperative Bank (NACB), and Federal Mortgage Bank of Nigeria (FMBN) owe much of their establishment and management to the Central bank. As applies to other financial institutions, the apex bank also regulates these banks.

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(b) Commercial and merchant banks

Commercial banks in Nigeria have two broad goals. These are to encourage savings among Nigerians and to create channels for extending credit to the economy. Merchant banks play the role of

providing long-term lending and corporate financial services.

The number and branches of the commercial and merchant banks are shown in Table 2.1. The number of these two categories of banks has been growing over the years. The ratio of rural to urban branches of the commercial banks has also been growing since the late 1970s. It rose from 25% in 1979 to 53.8% in 1984 and 71.7% in 1991. The growing emphasis on rural banking portends increased opportunity for fund mobilisation from the rural sector. Merchant banks operate mainly in the urban areas and have limited branch network.

The contributions of bank to capital market development are quite substantial. They mobilise deposits from savers and lend same to investors. The role of the merchant banks here is very vital, since they mainly intermediate in medium and long term transactions.

Commercial banks have assisted individuals in acquiring shares of quoted companies through provision of loans for the purpose. This happened during the indigenisation and privatisation exercises. Acquisition of shares by the public is enhanced by the banks through their services as collection points. It is doubtful if the privatisation exercise could have elicited the mass

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Table 2.1: Number of Banks in Nigeria, 1970 - 1992

Year	Commercial Banks					Merchant Banks		Total No. of Commercial and Merchant Banks
	Number of Banks	Urban Branch	Rural Branch	Branches Abroad	Total Number of Branches	Number of Banks	Number of Branches	
	(1)	(2)	(3)	(4)	(2)+(3)+(4)	(6)	(7)	(8)
1970	14	-	-	-	273	1	-	15
1971	16	-	-	-	318	1	-	17
1972	16	-	-	-	367	1	-	17
1973	16	-	-	-	385	2	-	18
1974	17	-	-	-	403	3	-	20
1975	17	-	-	-	436	5	-	22
1976	18	-	-	-	463	5	-	23
1977	19	474	13	5	492	5	1	24
1978	19	511	98	5	614	5	7	24
1979	20	533	133	6	672	6	7	25
1980	20	565	168	7	740	6	12	26
1981	20	622	240	7	869	6	15	26
1982	22	676	308	7	991	8	19	28
1983	25	694	407	7	1,108	10	24	32
1984	27	810	432	7	1,249	11	25	36
1985	28	839	451	7	1,297	12	26	39
1986	29	879	481	7	1,367	12	27	40
1987	34	947	529	7	1,483	16	33	45
1988	42	1,050	602	7	1,659	24	46	58
1989	47	1,078	771	7	1,856	34	56	76
1990	58	1,079	771	7	1,877	49	74	107
1991	65	1,129	810	7	1,939	54	84	119
1992	65	1,135	815	7	1,950	54	84	119

Note: Classification of Branches into Urban and Rural started in July, 1977

Sources: (i) CBN, Statistical Bulletin, June 1992
(ii) CBN, Annual Report and Statement of Accounts

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participation it did but for the role of the banks, especially the commercial banks which used their wide urban and rural branch network to provide publicity and brokerage services for share sales

These services provided by the banks are sine-qua-non at the developing stage of the capital market. This is because stockbroking firms are few and their activities are concentrated in Lagos and few other major cities.

Some commercial banks serve as registrars to quoted companies while most of the merchant banks are either stockbrokers or have subsidiary stockbroking firms. Some commercial banks also have stockbroking subsidiaries. Conversion of dividend warrants into cash is done by the commercial banks. They treat dividend warrants issued by company registrars in the same way as bank cheque. One crucial service provided by merchant banks in the capital market is their role as issuing houses. Commercial and merchant banks therefore occupy very important and strategic positions in capital market operations in Nigeria.

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(c) Development banks

Four banks render development banking services in Nigeria. They are, the Nigerian Industrial Development Bank (NIDB), the Nigerian Bank for Commerce and Industry (NBCI), the Nigerian Agricultural and Cooperative Bank (NACB) and the Federal Mortgage Bank of Nigeria (FMBN). The specific sectors served by these banks are as reflected in their names.

In the pursuit of their main objective, which is to speed up the process of development in the specified sectors, these banks provide long-term funds and financial advisory services to companies. By so doing, they contribute to the funding and general development of the capital market.

2.2.2 The Securities and Exchange Commission (SEC)

The Securities and Exchange Commission (SEC) is the agency or institution that regulates operations in the Nigerian capital market. It was established by the Securities and Exchange Commission Decree (No. 71) of 1979. The Decree was reformulated by Decree No. 29 of 1988.

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The Securities and Exchange Commission is an offshoot of the ad hoc Capital Issues Committee which was established in 1962. The Committee was later conferred with statutory powers as Capital Issues Commission by the Capital Issues Decree of 1973. The basic objectives of the Commission were to protect investors and ensure the development of the capital market. As specified in section 2 of the Capital Issues Commission Act of 1973, the general functions of the commission were to determine:

"(a) the price at which shares or debentures of a company are to be sold to the public either through offer for sale or by direct issues;

(b) the timing and amount of any subsequent public issues of shares or debentures by the company; and

(c) such other matters incidental or supplementary to the foregoing as the Commission may at its discretion determine".

Thus sales of shares to members of the public were approved and supervised by the Commission. But sales of shares of private companies could be effected without going through the Commission. For instance, during the implementation of the indigenisation policy, only the shares of public companies were traded through

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SEC. This represented 28 out of 430 enterprises or 7% of companies affected by the indigenisation exercise. The rest of enterprises restructured their ownership through private arrangements (Alile and Anao, 1986).

The functions of the Capital Issues Commission were later taken over by the Securities and Exchange Commission (SEC) which was established by the Securities and Exchange Commission Decree No.71 of 1979. Three broad objectives circumscribe the operations of SEC, namely:

(a) to protect the interest of investors and thereby enhance their confidence in the capital market;

(b) to ensure orderly, fair and equitable dealings in securities; and

(c) to promote the growth and development of the Nigerian capital market.

To achieve these objectives, section 6 of the Securities and Exchange Commission Decree No. 29 of 1988 specifies the functions of SEC. The activities of SEC in the Nigerian capital market are geared towards executing these functions which are as follows:

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(a) determining the amount of, the price and time at which securities of a company are to be sold to the public either through offer for sale or subscription;

(b) registering all securities proposed to be offered for sale to or for subscription by the public or to be offered privately with the intention that the securities shall be held ultimately other than by those to whom the offers were made;

(c) maintaining surveillance over the securities market to ensure orderly, fair and equitable dealings in securities;

(d) registering stock exchange or their branches, registrars, investment advisers, securities dealers and their agents and controlling and supervising their activities with a view to maintaining proper standards of conduct and professionalism in the securities business;

(e) protecting the integrity of the securities market against any abuses arising from the practice of insider trading;

(f) acting as regulatory apex organisation for the Nigerian capital market including the Nigerian Stock Exchange and its branches to which it would be at liberty to delegate

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powers;

(g) reviewing, approving and regulating mergers, acquisitions and all forms of business combinations;

(h) creating the necessary atmosphere for the orderly growth and development of the capital market; and

(i) undertaking such other activities as are necessary or expedient for giving full effects to the provisions of the Decree.

2.2.3 Stockbroking firms

Stockbroking firms are authorised agents that liaise between investors and the stock market in transacting in shares. In Nigeria, stockbroking business is undertaken by registered companies. Individuals only act as employees and agents of such companies. They do not, on personal account, trade in securities. Stockbrokers, or dealing members of the Nigerian Stock Exchange, are limited liability firms incorporated for that purpose. Often they are also finance companies. Some of them are subsidiaries of merchant banks, commercial banks or finance companies.

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The number of stockbrokers between 1970 and 1991 in Nigeria is shown in Table 2.2. From only two stockbrokers in 1970, the number increased to 10 in 1980, showing an addition of approximately one firm per year. A comparable but higher average growth rate was maintained from 1980 to 1986 when the number of firms rose from 10 to 23. Since 1987, the number of new firms per year has been unprecedentedly high, ranging from 10 in 1987 to 30 in 1991. The total number of stockbrokers in 1991 stood at 110. The increased stockbroking activities since 1987 when the number of new firms per year increased to 10, as against one in the earlier periods, is obviously a consequence of the liberalisation of the financial sector and increased emphasis on capital market development.

One feature of stockbroking services in Nigeria is the concentration of the operating firms in one city - Lagos. Table 2.3 gives a breakdown of the location of the head offices of the firms as at 1991. It indicates that 82 companies or 71.8% of the companies have their head offices in Lagos. Eleven head offices are in Port Harcourt, and seven in Kaduna. Kano has four, while Benin City and Enugu have two each. Uyo, Onitsha, Minna, Ibadan and Yola have one each. Evidently 91.8% of the head offices are

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Table 2.2: **Number of Stockbrokers in Nigeria; 1970 - 1991**

Year	Number of Stockbrokers	Number of New Members
1970	2	-
1980	10	2
1981	13	3
1982	13	-
1983	16	3
1984	18	2
1985	23	5
1986	23	-
1987	33	10
1988	43	10
1989	61	18
1990	80	19
1991	110	30

Note: There were already two stockbrokers in 1968 and 8 in 1979.

Source: Derived from Nigerian Stock Exchange Factbook, 1992.

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Table 2.3: Location of Head-Offices of Stockbroking Firms, 1991

	City	Number of Firms
1.	Lagos	82
2.	Port Harcourt	11
3.	Kaduna	7
4.	Kano	4
5.	Benin City	2
6.	Enugu	2
7.	Uyo	1
8.	Onitsha	1
9.	Minna	1
10.	Ibadan	1
11.	Yola	1

Source: Nigerian Stock Exchange Factbook, 1992.

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located in Lagos, Port Harcourt, Kaduna and Kano. These are four cities with the oldest stock trading floors. It can be seen that there is a high correlation between the age of a trading floor and the number of head offices of stockbroking firms located in the same city with the trading floor. This implies that the establishment of a trading floor causes and leads the establishment of and influences the locations of stockbroking firms.

Most stockbrokers in Nigeria, like merchant banks, do not usually operate multiple branches, but tend to operate only from the head office.

In general, a number of problems surround stockbroking activities in Nigeria. These were first highlighted by Adeosun, (1979) and recapitulated by Alile and Anao (1986: 99) as follows:

"(a) Undue delay in the share registration process. This is probably due to the prevailing poor infrastructural facilities e.g. postage and communication, information handling technology, power supply, etc.;

(b) Administrative bottlenecks imposed by the authorities of the stock exchange. For example, the requirement to refer transactions back to the exchange for authentication before completion of the transfer process;

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(c) A securities pricing system which is not sufficiently sensitive to changes in the economic circumstances of individual securities. The exchange is largely blamed for this, but this is also, to some extent, due to the inexperience or lack of adequate training on the part of stockbroking personnel;

(d) Poor or complete absence of information services rendered by the stockbrokers to their clients; and

(e) Inhibitions to trading imposed by the dealing system in operation. Some people feel that the call-over system still in operation has long outlived its usefulness".

It is hoped that the on-going process of reforming the capital market will sufficiently address these problems.

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2.3 The Nigerian Stock Exchange

2.3.1 Origin and growth

The origin of the Nigerian Stock Exchange dates back to the establishment of the Lagos Stock Exchange in 1960 as a company limited by guarantee. In 1961 the company was transformed into a formal stock exchange which started as the Lagos Stock Exchange.

The birth of the Lagos Stock Exchange was induced by public sector demand for services of a stock market. Three reasons have been advanced for government's pioneering interest and initiative in setting up the exchange (Ojo, 1976). First, the attainment of political independence in 1960 created the need to mobilise capital for development programmes. Second, there was the need for repatriation of funds invested abroad as a means of strengthening the balance of payments position which had been deteriorating since the late 1950s. Third, government needed the debt instruments of a stock market to finance budget deficits which had persisted since 1958.

Generally, the functions of a stock exchange in an economy are many. They include the following (Popiel, 1990):

(a) mobilisation of long-term savings for financing long-term investment;

(b) promotion of efficient allocation and utilisation of resources in the economy through a competitive pricing mechanism;

(c) broadening the ownership of productive resources in the society; and

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(d) provision of risk capital to entrepreneurs or venture capitalists.

Besides the above, a securities market serves as a link between the financial markets in an economy and those of other countries. It offers the avenue for the investment of foreign capital in the domestic economy. Being a coordinating point for the mobilisation and utilisation of funds in an economy, the index of activities in the market serves as a guide to the general economic trend.

The stated government objectives for establishing the Lagos Stock Exchange situate within the above listed general functions of a stock exchange. The objectives of setting up the Lagos Stock Exchange reinforce the desire to achieve the general functions. They are as follows(Alile and Anao,1986:21 and 22):

- "to provide facilities to the public in Nigeria for the purchase and sale of funds, stocks and shares of any kind and for the investment of money;
- to control the granting of a quotation on the Lagos Stock Exchange in respect of funds, stocks and shares, of any company, government, municipality, local authority or other body corporate;

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- to regulate the dealings of members with their clients;
- to standardise and, from time to time, review and, if necessary or desirable, increase or decrease the fees or other charges to be made by members for services rendered to their clients or modify the method or methods of assessing or calculating such fees or charges;
- to correlate the stock broking activities of members and facilitate the exchange of information for their mutual advantages and for the benefit of their clients and to offer facilities whereby the public can be informed of prices of shares dealt in by members;

- to co-operate with associations of stockbrokers and stock exchanges in other countries and to obtain and make available to members information and facilities likely to be of advantage to them or to their clients;
- to investigate any irregularities or alleged irregularities in the dealings of members with their clients, any differences or disputes between members and their clients; any complaints made against members by other members, or any other parties, provided that such

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differences, disputes or complaints shall relate to or touch on the stockbroking business or activities of such members, and to deal with and decide upon such irregularities, differences, disputes or complaints and to take necessary steps for the enforcement of its decisions and awards;

- to promote, support, or propose legislative or other measures affecting the aforesaid objects".

In 1978, the Lagos Stock Exchange was transformed into the Nigerian Stock Exchange. This was obviously to give a national outlook to the institution. Consequently, in the year,one additional trading floor each was established in Kaduna and Port Harcourt, bringing the total number of trading floors to three. A fourth trading floor was opened in Kano in 1989. A year later, in 1990, two more trading floors were opened in Ibadan and Onitsha. The creation of multiple trading floors is one of the policy measures designed to enhance the development of the Nigerian stock market.

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2.3.2 Organisation and classification

The Nigerian stock market is classified into two. These are, the primary market and the secondary market. The primary market is concerned with new issues. These are securities introduced into the market for the first time. The secondary market deals in securities that have already been quoted on the stock exchange.

Securities traded in both the primary and secondary markets comprise debt and equity instruments. In the debt category are Federal Government development stocks, industrial loan stocks, preference stocks and corporate bonds. Equities, on the other hand, are ordinary shares of companies.

The equities market is further sub-divided into the first-tier and the second-tier markets. The second-tier market was established in April 1985 under less stringent requirements in order to encourage small and medium-sized indigenous companies to get listed. The second-tier market provides softer conditions and requirements than the first-tier for companies seeking stock exchange quotation. It therefore serves as a kind of preparatory ground for small indigenous companies to mature and meet the more demanding conditions for listing in the first-tier market. The major differences between the first-tier and the second-tier

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markets are therefore in terms of the listing requirements. These are highlighted below.

2.3.3 Listing requirements

In its listing requirements, the Nigerian Stock Exchange spells out conditions to be met by any company desiring to be publicly quoted. To be quoted in the main or the first-tier market, a company is required to adhere to the following basic rules (NSE, Factbook, 1992):

(i) The company must be registered as a public limited liability company.

(ii) Submission of financial statements/business record for the past 5 years.

(iii) Not less than 25% of the issued share capital, the said proportion having a minimum nominal value of N150,000, must be made available to the public.

(iv) The number of stockholders must not be less than 500, unless otherwise prescribed by council in individual cases.

(v) The securities must be fully paid for at the time of the allotment or registration.

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(vi) Application for listing must be sponsored by a dealing member of the Nigerian Stock Exchange.

(vii) The date of last audited accounts of the company must not be more than 9 months.

(viii) There is no limit to the amount that can be raised.

(ix) Payment of listing fee. Table 2.4 contains a schedule of listing fees.

The above conditions have been modified for any company seeking listing, instead,in the second-tier securities market.

The listing requirements for the second-tier market are as follows:

(i) The company seeking listing should have financial statements/business record for the past 3 years.

(ii) At least 10%, constituting a minimum of N50,000 of the share capital, must be made available to the public.

(iii) No shareholder can own more than 75% of the issued share capital of the company.

(iv) The amount that can be raised may not exceed N5 million.

(v) A flat annual fee of N2,000,payable to the stock exchange, is required.

(vi) The number of shareholders must be at least 100.

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Table 2.4: Nigerian Stock Exchange: current scale of listing fees

Serial	Class Interval of Market Capitalisation of Share Capital/ Debenture/Stocks		Present Listing Fees
			N
1.	Less than,	1,000,000	3,500.00
2.	From	1,000,000 - 5,000,000	5,000.00
3.		5,000,001 - 10,000,000	6,000.00
4.		10,000,001 - 15,000,000	9,000.00
5.		15,000,001 - 20,000,000	10,000.00
6.		20,000,001 - 25,000,000	12,000.00
7.		25,000,001 - 30,000,000	14,000.00
8.		30,000,001 - 35,000,000	16,000.00
9.		35,000,001 - 40,000,000	18,000.00
10.		40,000,001 - 45,000,000	20,000.00
11.		45,000,001 - 50,000,000	22,000.00
12.		50,000,001 - 55,000,000	24,000.00
13.		55,000,001 - 60,000,000	27,000.00
14.		60,000,001 - 65,000,000	28,000.00
15.		65,000,001 - 70,000,000	29,000.00
16.		70,000,001 - 75,000,000	30,000.00
17.		75,000,001 - 80,000,000	32,000.00
18.		80,000,001 - 85,000,000	33,000.00
19.		85,000,001 - 90,000,000	35,000.00
20.		90,000,001 - 95,000,000	37,000.00
21.		95,000,001 - 100,000,000	40,000.0
22.		100,000,001 - 120,000,000	42,000.00
23.		120,000,001 - 140,000,000	45,000.0
24.		140,000,001 - 160,000,000	46,000.00
25.		160,000,001 - 180,000,000	47,000.00
26.		180,000,001 - 200,000,000	48,000.00
27.	Above	200,000,000	50,000.00
28.	SECOND-TIER SEC. MARKET (SSM)		- 3,000.00 FLAT

EFFECTIVE DATE: 1st January, 1990

Source: The Nigerian Stock Exchange Factbook, 1992, p.31

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2.3.4 Growth of listed securities

There are three classes of securities in the Nigerian stock market. These are, Government stocks, industrial loan stocks and bonds, and equities. Table 2.5 shows the number of stocks listed and the growth rates for each of the three classes of securities. Both industrial loans and bonds, and equities, have maintained steady growth over the period 1980-1992. The growth rate of government stocks was positive from 1980 to 1986 but negative between 1987 and 1991. The decline in the number of government stocks reflects the Federal Government's reduction in financing development projects through development stocks.

Table 2.6 compares the growth rates in the indices of the stock market performance in the pre-and-post-liberalisation periods, i.e. 1982-1986 and 1987-1991. As already pointed out, less of government stocks were issued between 1987 and 1991 compared to the earlier five-year period. Within the liberalisation period, resources were made available to the Federal Government through divestment of its holdings in the privatised companies. This could have contributed to its reduced dependence on development stocks.

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Table 2.5 NUMBER OF LISTED SECURITIES (1980-1992)

Year	Government stock		Industrials and bonds		Equities		Total	
	Number	Growth rate	Number	Growth rate	Number	Growth rate	Number	Growth rate
1980	54		12		91		157	
1981	56	3.70	14	16.67	93	2.20	163	3.82
1982	57	1.79	18	28.57	93	0.00	168	3.07
1983	61	7.02	25	38.89	92	1.08	178	5.95
1984	56	8.20	27	8.00	92	0.00	175	1.69
1985	57	1.79	28	3.70	96	4.35	181	3.43
1986	58	1.75	29	3.57	99	3.13	186	2.76
1987	54	-6.90	31	6.90	100	1.01	185	-0.54
1988	51	-5.56	35	12.90	102	2.00	188	1.62
1989	47	-7.84	40	14.29	111	8.82	198	5.32
1990	43	-8.51	43	7.50	131	18.02	217	9.60
1991	40	-6.98	57	32.56	142	8.40	239	10.14
1992	40	0.00	57	0.00	145	2.11	242	1.26

Source: The Nigerian Stock Exchange Factbook, 1992.

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Table 2.6: Average growth rates of Nigerian securities, 1982-1991 (Percentages)

	1982 - 1986	1987 - 1991
Government Stocks	4.11	-7.16
Industrial Loans and Bonds	16.55	14.83
Equities	1.71	7.65
Total Number of Securities	3.38	5.23
Market Capitalisation	13.18	24.58

Source: Computed from table 2.5

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Between 1987 and 1991, industrial loans and bonds recorded an average growth rate of 14.83% as against 16.55% in the preceding period. But the growth rate of equities rose from 1.71% to 7.65%. The decreased growth rate of industrial loans and bonds resulted from a crowding out effect of equities. The liberalisation of the financial sector resulted in increased cost of debt and possibly induced companies to use more of equity capital. The increased use of equity financing is reflected in the total number of securities listed and the market capitalisation. The growth rate of the total number of securities listed rose from 3.38% to 5.23% while market capitalisation grew by 24.58% as against 13.18% in the pre-liberalisation period. Since the growth rates in Government stocks and industrial loans and bonds declined in the liberalisation period, the increase (almost 100%) in the growth rate of market capitalisation might have been accounted for by equities. Table 2.7 shows the growth rates of the stock market capitalisation. It reveals growth rates since 1987 that could be considered phenomenal.

Besides the increased cost of debt, another factor that contributed to the growth of the stock market is the privatisation of public enterprises. For example, from 1988 when the exercise

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Table 2.7: Market Capitalisation of the Nigerian Stock Exchange, 1980 - 1992 (N billion)

Year	Market Capitalisation	Growth Rate
1980	4.46	
1981	4.84	8.52
1982	4.92	16.53
1983	5.80	17.89
1984	5.50	-5.17
1985	6.40	16.36
1986	7.70	20.31
1987	8.90	15.58
1988	9.70	8.99
1989	12.00	23.71
1990	15.90	32.50
1991	23.10	45.28
1992	31.30	35.23

Sources: (i) The Nigerian Stock Exchange, Factbook, 1992.

(ii) The Securities and Exchange Commission, Report and Accounts for the Year ended 31st December, 1992

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started to 1992, a total of 1.27 billion ordinary shares were divested of pubic holding. This involved 35 companies and the transaction amounted to N1.5 billion (Securities and Exchange Commission,1992).

2.4. Pricing of securities

At the primary market, security prices used to be determined by the Securities and Exchange Commission (SEC) until recently (1993) when the function was transferred to stockbrokers. Now, at both the primary and the secondary market, prices are determined by forces of demand and supply. The method employed by SEC in valuing shares before 1993 is discussed below, at least for record purpose.

SEC used two methods in valuing shares. These are: (i) the net asset value method and (ii) the earnings or maintainable profit basis. For the net asset value method, the value of total assets of a company less its total liabilities which gives the net asset value would be divided by the total number of shares to get the unit price per share. In the method of the maintainable profit, "the average profit of the company capitalised at an expected rate of return in that industry and divided by the number

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of shares, gives the unit price of shares of the company"(sic)(Akamiokhor, 1983:28). This later method was favoured by SEC as against the former because it emphasises the earning capacity of companies which is of primary interest to prospective investors. Besides, the first method emphasises book values of assets which are historical in nature and may be out of line with current market values.

The role of SEC in security valuation has been criticised to the effect that shares are either overvalued or undervalued (see First Bank of Nigeria, 1988, pages 4 and 5 for such criticism). Now that activities in the capital market are being deregulated, with the task of determining the offer prices of securities having been transferred to the market through the stockbrokers, one hopes that the question of appropriate valuation will be resolved by the market through the forces of demand and supply.

In the secondary market, prices are formed by matching the offer and bid prices given by stockbrokers. But what informs stockbrokers' opinion in determining share prices are matters for researchers to unravel. There is, however, a policy guideline which checks the extent of price movement in any single transaction. It is required that no stock should gain or lose more

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than 10 points (10 kobo) in one trading session. It could, however, keep on gaining or losing up to this maximum points in successive trading sessions.In an emerging stock market such as Nigeria's, the policy was fashioned in order to minimise the possible incidence of unhealthy speculation among stockbrokers. But in a thin market such as ours, with infrequent trading, such a policy could reduce the level of gain or loss on a security within any specific period.

2.5 Transactions in the Nigerian securities market

Table 2.8a contains the values of stocks traded in the Nigerian securities market, while Table 2.8b contains the turnover rate of these stocks. Table 2.8b shows an average turnover rate of 9.47% for Government securities, 0.64% for equities and industrial loans and 5.51% for all securities. These figures show that not up to 1% of equities and industrial loans, and not up to 10% of Government stocks, are traded in a year. Such is a very low level of turnover.

Given the low level of transactions, the Nigerian stock market can be described as "thin" since it lacks breadth, depth and resilience (Nemedia, 1982). The thinness of the market is largely

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Table 2.8a: Nigerian Stock Exchange, Values of Turnover, 1980-1991 (N million)

Year	Government Securities	Equities and Industrial Loans	All Securities
1980	512.03	10.82	522.85
1981	326.18	6.12	323.30
1982	208.22	8.19	216.40
1983	384.87	13.00	397.87
1984	234.12	15.70	249.82
1985	287.84	23.26	311.11
1986	475.85	11.99	487.83
1987	282.25	4.05	286.30
1988	215.83	34.49	250.31
1989	582.43	71.13	653.31
1990	172.80	133.54	306.34
1991	92.68	141.86	234.54

Source: The Nigerian Stock Exchange, Annual Report and Accounts, 1991 and 1992 issues

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Table 2.8b: Nigerian Stock Exchange, Turnover Rate, 1980-1991 (percentages)

Year	Government Securities	Equities and Industrial loans	All Securities
1980	18.20	0.51	11.50
1981	10.70	0.32	6.70
1982	6.80	0.85	5.30
1983	10.90	0.58	6.90
1984	13.72	0.60	7.59
1985	9.72	0.73	5.50
1986	17.43	0.53	7.23
1987	7.26	0.99	4.19
1988	2.31	0.59	1.37
1989	10.93	0.69	4.06
1990	4.55	0.84	1.62
1991	1.30	0.47	0.59
Average	9.47	0.64	5.51

Source: The Securities and Exchange Commission, Report and Accounts for the Year ended 31st December, 1991.

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attributable to the "buy and hold" attitude of Nigerian investors (Ike, 1984; Gill, 1982; Phillips, 1985;and Inanga, 1990).

Unfortunately, the promotion of activities in the stock market since 1987 has not improved its turnover rate. Table 2.9 compares the transactions in the market over the two periods, 1982-1986 and 1987-1991. The periods' average turnover rates decreased from 11.69% to 5.27% for Government stocks but rose marginally from 0.66% to 0.72% for equities and industrial loans. Overall, the turnover rate of all securities fell from 6.50% in 1982-1986 to 2.37% in the 1987-1991 period. This shows a poor performance in the turnover of all the securities during the period of liberalisation. The decreased rate of turnover could be due to the declining interest in Government securities over the period. The turnover rate of equities and industrial loans could not change appreciably over the two periods.

Hopefully, the turnover rate in the stock market may improve with further development of the market in future. Otherwise the "buy and hold" attitude may have to be accepted as a permanent feature of the Nigerian stock market particularly for equities to which it mostly applies.

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Table 2.9: Nigerian Stock Exchange, Turnover Rate, 1982-1986 and 1987-1991 (Percentages)

Type	1982 -1986	1987 -1991
Government Stocks	11.69	5.27
Equities and Industrial Loans	0.66	0.72
All Securities	6.50	2.37

Source: Computed from table 8b

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2.6 Efficiency of the Nigerian capital market

A capital market is efficient if prices "fully reflect" all available information (Fama, 1970). Three forms of market efficiency have been identified. These are, the weak form, the semi-strong form and the strong form market efficiency (see sections 3.1.4 for explanation of the concept of market efficiency). Few tests of capital market efficiency have been carried out using data from the Nigerian capital market. Ayadi (1984) used the Wald-Wolfowitz runs test to examine the weak-form efficiency of the Nigerian securities market. He concluded that "share price behaviour or movement in Nigeria follows a random walk" (p. 6). This finding reinforces the conclusion reached by Samuels and Yacout (1981) that successive stock prices in Nigeria are orthogonal. But Inanga and Asekome (1992) have questioned the validity of the methodology employed in the two studies. They argue that the findings of Ayadi (1984) could have been biased because the author excluded zero runs in the test. This exclusion constitutes a serious weakness to the study considering the finding of Inanga (1990) that many stocks in the market record zero price changes over any trading period as a result of the buy- and- hold attitude of investors. Samuels and Yacout (1981) are criticised

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for using two-week lag-structure, which is considered long, and small sample size, in the test of serial correlation of stock prices.

In their test of the efficiency of the market, Inanga and Asekome (1992) applied both the Box and Pierce (1970) Q-test and the Number of runs test to analyse serial correlation of stock prices. The study concluded that the market is "weakly efficient" in the weak form level. It therefore affirmed the view of Granger and Morgenstern (1963) that the random walk hypothesis is "an average kind of law" which may not necessarily hold for all securities at all times.

There is yet no definite finding on the semi-strong and strong forms of efficiency of the Nigerian securities market. An attempt at the semi-strong test by Emenuga (1989) using money supply information found that the structural efficiency of the stock market could not be determined using monetary data since there is no empirical relationship between money supply and stock prices. Thus tests of the semi-strong and strong forms of efficiency of the Nigerian securities market still remain outstanding research agenda.

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CHAPTER THREE

LITERATURE REVIEW

Modelling returns on equities

3.1 The Beta factor

The work of Sharpe (1964) heralded a unified body of theory dealing with conditions of risk. It shows that returns to an investor can be separated into the "price of time" and the "price of risk". The price of time is the interest rate which an investor earns by postponing consumption and investing what could have otherwise been consumed. The price of risk is the additional return which the investor expects to receive by taking investment decision whose outcome is uncertain. In other words, it is the reward for taking risk or the risk premium.

In the ensuing model, investors' expectations are defined by two parameters, namely, expected return, and risk. Thus an investor's utility function (U) is of the form:

$$U = f(E_R, d_R) \quad \ldots\ldots\ldots\ldots\ldots \quad (3.1)$$

where

E_R is the expected return, and d_R, the risk. Given the assumption that more returns are preferred to less, the first derivative of U with respect to E_R will be positive. For a risk-

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averse investor, the first derivative of U with respect to d_R will be negative. Taking these two characteristics of the utility function, the task facing an investor is to find an efficient trade-off point between risk and return.

An investment strategy (or portfolio) which is efficient is required to satisfy three conditions (Sharpe, 1964). First, there will be no other alternative strategy which generates the same expected return but having a lower level of risk. Second, there will be no other option with the same risk level which has higher expected return. Third, no other strategy guarantees both higher expected return and lower risk. These three conditions constitute the basic propositions of portfolio theory. Simply put, an efficient investment strategy, or an efficient portfolio, is one that offers the lowest level of risk for a given rate of expected return, or the highest rate of expected return for a given level of risk(see Appendix 1 for graphical illustration).

Sharpe (1964), Treynor (1965), Lintner (1965), and Mossin (1966), relied on Markowitz's (1952) portfolio diversification theory to derive a model for pricing capital assets. Markowitz had earlier demonstrated that undiversified holding of assets is typically inefficient because the investor still bears firm-

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specific risk which could be eliminated through diversification.

The risk of holding an individual asset differs from the risk attributable to that particular asset when the investor holds an efficient portfolio of assets. To a single asset holder, his total risk is the risk of that single asset. Here the total risk is made up of the variations in the rates of return on the single asset. To the holder of a diversified portfolio of assets, the risk of an asset (additional security) is gauged by the extent to which the addition of the new security changes the risk profile of the already held portfolio.

Generally, the risk of the additional asset to a portfolio is measured by the covariance of the return on the new security with the return on the efficient portfolio.If the additional security is j, its risk element is therefore given by:

$$B_j = \frac{\text{Cov } [E(R_j),\ E(R_m)]}{\text{Var } [E(R_m)]} \quad \ldots\ldots\ldots\ldots \quad (3.2)$$

where;

B_j = the risk of the jth security;

$E(R_m)$ = the expected return on the efficient market portfolio; and

$E(R_j)$ = the expected return on the jth security.

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The risk of the jth security is a measure of the systematic relationship between the expected return on security j and the expected return on the market portfolio. B_j is therefore called the systematic risk of security j. Systematic risk is otherwise called pervasive risk because its effect spreads to the whole market. By definition, the systematic risk, or the Beta (B) of a security, is "the volatility of a security's return attributable to changes in the level of market return" (French, 1989: 125). The systematic risk arises out of economy-wide factors such as fluctuations in exchange rate, interest rates, and inflation, which could affect business performance generally.

Since systematic risk exists in the context of an efficient portfolio, it stands to reason that the systematic risk of a security is smaller than the total risk of that security. Total risk includes the risk of inefficiency of undiversified holding. The difference between the total risk of a security and its systematic risk is the security's unsystematic risk. It is also called idiosyncratic risk. While the unsystematic risk can be offset by diversification, the systematic risk cannot(see Appendix 2 for graphical demonstration). Since an investor has no control over the systematic risk, he will require a higher rate of return

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for bearing the risk if he is risk averse. Therefore the higher the systematic risk, the higher the expected rate of return (risk premium) which investors require on the security. On this premise rests the Capital Asset Pricing Model (CAPM).

Within the framework of some restrictive assumptions (Section 3.1.2), CAPM states that the expected rate of return on an asset has two components. One of the components is the risk-free rate of return or the return that would accrue to the asset holder if there were no market risk. The other component is a compensation for the risk of the asset. CAPM is illustrated graphically in Appendix 3.

Symbolically, CAPM is stated as:

$$E(R_i) = R_f + [E(R_m) - R_f] B_i \quad \text{.....(3.3)}$$

where,

$E(R_i)$ = the expected rate of return on the ith asset or portfolio of assets;

R_f = the rate of return on an asset that is considered risk-free;

$E(R_m)$ = the expected rate of return on the market portfolio of assets;

B_i (Beta) = the risk of the ith asset or portfolio of assets, i.e. the sensitivity of the ith asset or group of

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assets to market movements; and

$[E(R_m)-R_f]$ = the excess rate of return on the ith asset or portfolio of assets.

The model posits that Beta (B), as defined in equation 3.2, is the source of cross-sectional variations in the rates of return on a portfolio of equities.

3.1.1 The assumptions of the Capital Asset Pricing Model (CAPM)

It is necessary to mention that CAPM was developed as a normative rather than positive model. In imagining a model that should capture the complexities of the capital market, the following assumptions were invoked:

(i) Investors are risk-averse, prefer more returns to less, and seek to maximise their wealth subject to risk constraints (the concept of risk aversion is explained below).

(ii) The prices of capital assets are determined on considerations of risk and return. No other parameter is of relevance to the judgement.

(iii) There is homogeneity of expectations of risk and return among market participants.

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(iv) The capital market is perfect, i.e. efficient (Fama, 1970), and information is unrestrictedly available.

(v) The expectations of investors are characterised by a one-period time horizon.

(vi) There exists a risk-free asset, and investors can lend and borrow unlimited amounts of money at the risk-free rate of return.

(vii) The business world is one without taxes and there are no transactions costs attendant to a change of an investor's portfolio composition.

(viii) All capital assets are marketable, divisible, permissible of fractional holding and are fixed in quantity.

(ix) The capital market is in equilibrium state.

The essence of some of these assumptions may have to be stressed. The assumption of homogenous expectations guarantees consensus among investors as the basis for deriving a single asset pricing model for the whole market. The assumption also rules out unanticipated changes in the variables (interest rates, inflation, exchange rates, etc.) which may cause divergent expectations due to non-homogenous perception of the impact of variations in these variables.

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The availability of market information to all, and possibly at no cost, is a requirement for market efficiency. With efficient market, investors are price-takers and the valuation and transactions of one investor do not alter the market trend. The one-period time horizon assumption is made to rule out the effects of changes over time in the variables that influence market expectations. The requirement of the existence of a single borrowing and lending risk-free rate forms the basis for a linear CAPM .

If there is no tax, as it is assumed, the tax clientele effect will not arise and, with the absence of transactions costs, all investors would face equal treatment. Given that the quantity of total assets is fixed, and that all assets are marketable and divisible, liquidity is expunged from factors involved in risk analysis. This makes it possible for investment exercises to be reflected as continuous curves (French, 1989). The import of the capital market being in equilibrium is that, ab initio, all assets are efficiently priced with respect to their risks.

Two important concepts in the above assumptions are explained below. These are, **risk aversion** and **efficient capital market**.

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3.1.2 The concept of risk aversion

The definitions of various attitudes towards risk are provided in MarKowitz (1959). Given that U is the utility; W,the level of wealth; and E, the expected value operator, we have the following risk attitudes:

Risk aversion if: $U[E(W)] > E[U(W)]$ ..... (3.4)

Risk neutrality if: $U[E(W)] = E[U(W)]$ ..... (3.5)

Risk loving if: $U[E(W)] < E[U(W)]$ ..... (3.6)

Risk aversion thus implies that the utility of expected wealth is greater than the expected utility of wealth. In other words, more utility is received from the actuarial value (expected outcome) of the gamble (investment) obtained with certainty than from taking the gamble itself (Copeland and Weston, 1983). Risk aversion can be illustrated with the case of an individual who faces two prospects; x and y. Prospect x implies receiving N10 for sure, i.e. without taking gamble. Prospect y entails a 90% probability of receiving nothing and a 10% probability of receiving N100.00. An individual who prefers the gamble is a risk lover; the person who is indifferent is risk neutral; and one who prefers the actuarial value with certainty is a risk averter.

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3.1.3 The concept of efficient capital market

In an efficient market, prices provide accurate signals for resource allocation. A capital market is said to be efficient if asset prices "fully reflect" all available information (Fama, 1970).

The efficient capital market hypothesis is presented in the expected return or "fair game" model. Fama (1970) has formalised this model. In such a market, the following equation holds:

$$E(P_j, t+1/\phi t) = [1 + E(r_j, t+1/\phi t)] P_j t \quad \ldots\ldots\ldots \quad (3.7)$$

where

E = expected value operator

$P_j t$ = the price of asset j at time t;

$P_j, t+1$ = the price of asset j at time t+1;

$r_j, t+1$ = one-period (t+1) percentage return which equals $(P_j, t+1 - P_j t)/P_j t$; and

ϕt = a symbol for the information which is assumed to be "fully reflected" in the asset price at time t.

The equilibrium expected return becomes that which is based on all previously available information; given as:

$$E(r_j, t+1/\phi t) \quad \ldots\ldots\ldots \quad (3.8)$$

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Equation (3.8), which is the equilibrium expected return, assumes the condition of instantaneous price adjustment to the available information.

The implication of the conditional expectation notation of equation (3.7) is that the information in ϕt is fully used up in the determination of the equilibrium expected return. In this sense, we say that ϕt is "fully reflected" in the formation of the price $P_j t$.

The empirical implication of the expected return market equilibrium formed using fully, the information set, ϕt, is that any trading rule based on the information set, ϕt, will not give expected profit or return in excess of the equilibrium profit or return.

Formally stated, it is that:

$$X_j,\ t+1 = P_j,\ t+1 - E(P_j,\ t+1/\phi t) \quad \ldots\ldots\ldots (3.9)$$

$$\text{When } E(X_j,\ t+1/\phi t) = 0 \quad \ldots\ldots\ldots (3.10)$$

Where X_j $t+1$ = the excess market value of asset j at time t+1. It is the difference between the observed price and the expected value of the price, which was projected at time t, based on the information ϕt.

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Equation (3.10), by definition, says that the sequence of X_jt is a "fair game" with respect to the information sequence ϕt. In this sense, it is said that the price sequence is a "fair game" or a "martingale" variable - there are as many chances of gaining as there are of losing.

3.2 The Arbitrage factors

The Arbitrage Pricing Theory (APT), formulated by Ross (1976) offers a comprehensive framework for a disaggregated analysis of the effects of systematic factors on equity stock returns . Ross' original model has received approval and extensions by Huberman (1982), Chen and Ingersoll (1983), Chamberlain and Rothschild (1983), Ingersoll (1984), Connor (1984), and a host of others. APT rests on few basic assumptions. These are as follows:

(i) The capital market is perfectly competitive and frictionless, in which there are no arbitrage opportunities. In other words, the capital market is in competitive equilibrium.

(ii) Investors are assumed, as in CAPM, to prefer more wealth to less, to be risk averse and to possess concave utility functions.

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(iii) The number of securities in the stock market (or of assets in the capital market) is infinite or sufficiently large to allow the operation of the law of large numbers.

(iv) The number of factors that determine asset returns is known or can be estimated. This particular assumption is helpful for the empirical estimation of the model.

(v) There are homogeneous expectations among investors that the stochastic properties of returns on capital assets are of a kth linear factor form.

The assumption of the stochastic process that generates asset returns forms the cornerstone in the derivation of the model. The model, it is assumed, is a k-factor process of the form:

$$R_i = E(R_i) + b_i1\delta_1, + \text{----} + b_{ik}\,\delta_k + e_i \quad \text{.....} \quad (3.11)$$

for i = 1, 2, -------, N

where

R_i = the rate of return on the ith asset;

$E(R_i)$ = the expected rate of return on the ith asset;

b_{ik} = the sensitivity of the rate of return on the ith asset to the common factor δ_k;

δ_k = a zero-mean Kth factor common to returns on all assets;

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e_i = a zero-mean error term for the ith asset; and

N = number of assets.

The K factors whose effects are common to the returns on the N assets are the systematic factors affecting returns on the assets. The noise terms (e_i), which captures the factors whose effects are idiosyncratic to the ith asset is the unsystematic or the diversifiable risk of the asset. It should possess the usual ordinary least squares properties of the error term. For all $i \neq j$, e_i and e_j will be independent. A strong dependence in the e_i's will imply that there are more than K common factors affecting returns on the N - assets.

In the model, for a set of N assets, N should be greater than the K number of factors so as to render the model estimable. In a context of diversification, the error term (e_i) in equation 3.11 will be zero. In that case, the return on the ith asset will be a linear combination of the return on a riskless asset (or a zero-beta asset) and the returns on the K factors. Since the riskless asset factor, $E(R_i)$ in equation 3.11, and the K factors, are common to all assets and all portfolios of assets, any given set of portfolio will be a perfect substitute for all other portfolios (Roll and Ross, 1980). Also given the dictum of the law of one

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price for perfect substitutes, different portfolios of assets will have the same rate of return.

To appreciate the basic idea of APT, we consider an individual who holds a portfolio of N assets but wishes to alter the composition of his portfolio. The difference between his former and the new portfolios will be investment proportion X_i, where X_i is the naira amount acquired, or disposed of the ith asset (the ith asset being a fraction of the total wealth of the individual). Acquisition (purchase) of the ith asset entails positive X_i whereas disposal (sale) of the asset entails negative X_i. In sum, there will be a zero change in the wealth of the individual, since any new purchase of an asset can only be possible by sale of other assets. Thus the X_i proportions will sum up to zero, i.e.:

$$\sum_{i=1}^{N} X_i = 0 \qquad \ldots\ldots\ldots\ldots \qquad (3.12)$$

Any portfolio so formed by altering the composition of old portfolios, without requiring new wealth is called an <u>arbitrage portfolio</u>.

For the N assets in an arbitrage portfolio, the additional return gained by forming the new arbitrage portfolio is specified as:

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$$R_{AP} = \sum_{i=1}^{N} X_i R_i = \sum_i X_i E(R_i) + \sum_i X_i b_{i1} \delta_1 + \ldots + \sum_i X_i b_{ik} \delta_k + \sum_i X_i e_i \quad \ldots\ldots\ldots (3.13)$$

where, R_{AP} is the return on the arbitrage portfolio, while R_i and other variables are as previously defined.

To construct a well diversified riskless arbitrage portfolio of assets, we eliminate the systematic and the unsystematic risk components. Three conditions are necessary to achieve this (Copeland and Weston, 1983), namely:

(i) the percentage changes in investment proportions, X_i, should be very small, i.e. X_i approximates to 1/N;

(ii) the diversification of asset holding should be across a large number of assets, i.e. N should be made to be a large number; and

(iii) the choice of the changes in assets, X_i, should be such that for each common factor, K, the weighted sum of the components of the systematic risk should be zero. That is,

$$\sum_{i=1}^{N} X_i b_{ik} = 0, \text{ for each factor} \quad \ldots\ldots (3.14)$$

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Given the law of large numbers, a weighted average of the error terms (e_i's) which are independent, tends to zero, in the limit, where N is large. And where the error term is zero, the diversifiable risk is eliminated in equation 3.13, and the return on the arbitrage portfolio now becomes:

$$R_{AP} = \sum_{i}^{N} X_i E(R_i) + \sum_{i} X_i b_{i1} \delta_1 + \text{---+} \sum_{i} X_i b_{ik} \delta_k \quad \ldots \quad (3.15)$$

Since by the third condition above, the sum of the systematic risk elements is zero for each factor in the arbitrage portfolio, the return on the arbitrage portfolio of equation 3.15 will be unaffected by the common market factors. In other words, we now have an arbitrage portfolio with zero beta in each factor. Therefore,

$$R_{AP} = \sum_{i} X_i \, E(R_i) \qquad \ldots\ldots\ldots \quad (3.16)$$

The implication of equation 3.16 is that the return on the arbitrage portfolio, which has no systematic and unsystematic risks, is a certainty, being the expected return.

Ordinarily, the return on the arbitrage portfolio which has no risk and which does not require any new wealth should be zero. Where the return on the arbitrage portfolio is not zero, it means that there exists a possibility of reaping returns without capital

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and at no risk. This, of course, is not possible in an equilibrium capital market. If individual arbitrageurs are in equilibrium, implying that they are content with the composition of their portfolios, there will be no portfolio adjustment ($X_i = 0$) and the return on the arbitrage portfolio will be zero. A portfolio that requires no new wealth and which attracts no risk will have no return. Therefore,

$$R_{AP} = \sum_{i}^{N} X_i E(R_i) = 0 \qquad \ldots\ldots\ldots (3.17)$$

where

$$X_i = 0$$

The result of equation 3.17 is an algebraic consequence of equation 3.12 and 3.14. Stated in algebraic terms, any vector that is orthogonal to the constant vector, i.e.

$$(\Sigma X_i) \cdot 1 = 0 \qquad \ldots\ldots\ldots (3.12) \text{ (repeated)}$$
$$i$$

and also orthogonal to the coefficient vectors, i.e.,

$$\sum_{i} X_i b_{ik} = 0 \text{ for each K,} \qquad \ldots\ldots\ldots (3.14) \text{ (repeated)}$$

must also be orthogonal to the vector of expected returns, i.e.

$$\sum_{i} X_i E(R_i) = 0 \qquad \ldots\ldots\ldots (3.17) \text{ (repeated)}$$

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Algebraically, the consequence of the above statement is that the vector of expected returns should rather be a linear combination of the constant vector and the vector of coefficients (Copeland and Weston, 1983). Thus, in the algebraic sense, there should be a K + 1 set of coefficients, namely Y_0, Y_1, Y_2, ----, Y_k explaining the expected returns viz:

$$E(R_i) = Y_0 + Y_1b_{i1} + Y_2b_{i2} +----+ Y_kb_{ik} \ldots \quad (3.18)$$

where

b_{ik} is a measure of the sensitivity of the return on the ith security to the kth factor.

We now interpret Y_0 and Y_k. For a riskless (or zero beta) asset with the rate of return R_f, the sensitivity of this asset to the kth factor will be b_{0k} and, $b_{ok} = 0$.

Therefore $R_f = Y_0$

Then equation 3.18 can be rewritten as

$$E(R_i) = R_f + Y_1b_{i1} + Y_2b_{i2} +---+ Y_kb_{ik} \ldots\ldots \quad (3.19)$$

In "excess returns" form, equation 3.19 becomes:

$$E(R_i) - R_f = Y_1b_{i1} + Y_2b_{i2} +----+ Y_kb_{ik} \ldots\ldots \quad (3.20)$$

In the arbitrage pricing relationship of equation 3.18 or 3.20, we seek interpretation for the coefficients of the factor loading (b_{ik}) which are Y_i. In the equations, Y stands for the risk premium.

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From equation 3.18 above, APT shows that returns on capital assets are determined by the riskless rate of return and a set of k factors.

3.3 CAPM and APT factors

The major difference between APT and the CAPM is on the number of non-diversifiable factors. CAPM regards the market beta as the only non-diversifiable risk in the market. APT, on the other hand, states that for every equilibrium state of the securities market, there will exist no arbitrage opportunity. Rather, all equilibrium states "will be characterised by a linear relationship between each asset's expected return and its return's response amplitudes, or loadings, on the common factors" (Roll and Ross, 1980: 1074).

APT and CAPM may thus be seen not to be in conflict. APT only expands the linear returns generating factors beyond the market factor to include as many factors as are operative, of which beta could be one. However, unlike CAPM, APT does not impose such peculiar requirement as the condition that the market portfolio should be mean-variance efficient. Nor does the role of a benchmark parameter, assigned to the market returns index in CAPM,

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still retain its relevance in APT. The APT model, unlike CAPM, is not restricted to a single period time horizon.

Therefore the complementary analysis using both CAPM and APT framework which this study adopts, helps to determine the relevance of beta, a CAPM factor, as well as APT factors.

In the next section we review studies on the role of both beta and APT factors in determining returns on equities.

3.4 Review of empirical tests

3.4.1 Beta and asset returns

The most authentic test of the relationship between beta and asset returns is provided by Black, Jensen and Scholes (1972). The test employed cross-sectional and time series regression analyses of returns on diversified portfolios of common stocks quoted on the New York Stock Exchange (NYSE) between 1931 and 1965. The study established that systematic risk, measured by beta determines returns on equities. The relationship between risk and return was also found to be linear and investors, risk averse. Douglas (1969), using a sample of over 600 individual securities, had earlier observed the same relationship between risk and return.

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Miller and Scholes (1972) picked issues with Douglas over the use of single stock returns instead of portfolios and attributed Douglas' finding to measurement error. Yet even with their use of portfolios of common stocks, the duo came to the same conclusion as Douglas. Also in a portfolio context, Fama and MacBeth (1973) found evidence in support of the linearity of the beta model and further evidenced a positive trade-off between risk and return. Gibbons (1982), among others, had the same result.

In his critique, Roll (1977) contends that any test which does not use the true market portfolio does not portend to test a CAPM-based pricing relationship. He further argues that the results of empirical tests of asset pricing relationships could be highly sensitive to the proxy used for the market portfolio.

To make up for the deficiencies observed by Roll, Stambaugh (1982) used market indices which included equities, real estate and bonds, in a sensitivity analysis. However, he did not observe any significant sensitivity of the model parameters to the choice and composition of the market portfolio.

The outcome of most empirical tests of the market model can be summarised as follows:

(i) There is a positive relationship between risk and return.

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(ii) The beta coefficient explains returns on capital assets, but sometimes the explanatory power is weak.

As a result of the less than perfect (sometimes weak) explanatory power of the beta coefficient, attempts have been made at modifying the model. Litzenberger and Ramaswany (1979), for example, relaxed the assumption of no taxes and allowed for tax-clientele effects. Brennan (1971) has, however, shown that even with different tax rates on capital gains and dividend income, the securities market line still retains its linearity and significance.

Black (1972) demonstrated that the break down of the borrowing and lending process at a risk-free rate suffices to fault the model. He argued that in the absence of a riskless asset and the consequent absence of riskless borrowing and lending, the intercept of the model becomes a measure of the rate of return on a minimum-variance, zero-beta portfolio.

Mayers (1972, 1973) made provision for non-marketable assets which include human capital. He demonstrated that in taking investment decisions, investors consider the covariation of the returns on risky marketable assets with the returns on their non-marketable assets. With this knowledge, they (investors) modify

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their expected risk premia, and attach relatively smaller risk premia to the marketable assets whose returns are least correlated with their non-marketable assets. Therefore, different investors will hold portfolios of risky marketable assets which differ greatly in composition. In spite of the recognition of non-marketable assets, Mayers concluded that the equilibrium market relationship between risk and expected return on individual assets remains as in the original Sharpe - Lintner - Mossin model, when the existence of a riskless asset is assumed.

Merton (1973) has provided for the translation of the single period CAPM into an inter-temporal model. This model takes into account changes in the investment opportunity set which characterise asset returns. Merton therefore concluded that a special "assumption of a constant investment opportunity set is a sufficient condition for investors to behave as if they were single-period maximizers and for the equilibrium return-risk relationship specified by the Capital Asset Pricing Model to obtain" (P. 878). He, however, regarded this assumption as unrealistic in practical terms in view of one observable element of the investment opportunity set - interest rate - which, according to him, changes stochastically. Without that assumption,

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investors' expectations of returns will be set, in equilibrium, by compensations for bearing the market risk, and also the risk of shifts in the investment opportunity set. Within this framework, for a security that has zero systematic risk, its expected rate of return will not be equal to the riskless rate of return in the sense of the classical CAPM. Rather it will be the riskless rate plus a premium for the preference to hedge against variations in future investment opportunities.

Rather than formal tests of Merton's inter-temporal CAPM, subsequent developments in the literature were in the direction of the Consumption Capital Asset Pricing Model (CCAPM). In the setting of an inter-temporal economy, Rubinstein (1976) and Breeden and Litzenberger (1978) showed that asset returns are related to the consumption preferences of investors. However, it was Breeden (1979) that presented a formal statement of the Consumption-oriented CAPM. He demonstrated that the multi-beta CAPM implied in Merton's (1973) inter-temporal analysis is equivalent to a single-beta CCAPM.

CCAPM models asset prices as a function of changes in aggregate consumption between any two periods. In this case, consumption expenditure replaces market return as a determinant of

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assets' systematic risk or beta.

A number of empirical tests such as Hansen and Singleton (1983), Gibbons and Ferson (1985) and Litzenberger and Ronn (1986) have shown that the CCAPM is a relevant model for measuring asset returns which exhibits properties similar to the CAPM. In any case, CCAPM does not portend to be a replacement for CAPM. A detailed empirical study by Breeden, Gibbons and Litzenberger (1989) concluded that the performance of the traditional CAPM and CCAPM are about the same.

Altogether, some scholars have questioned the completeness of beta as a measure of risk, thus doubting the validity of CAPM as a complete model for evaluating returns on risky assets. Basu (1977) examined the performance of equity stocks in relation to their price/earnings ratios. He found that variations in stock returns are, to a significant level, explained by the price/earnings ratios of firms. A relationship between firm size and equity stock returns has been observed by Banz (1981) and Reinganum (1981). Firms of smaller sizes were observed to have higher abnormal rates of return than firms of larger sizes. Litzenberger and Ramaswamy (1979) observed that firms with high dividend yields have higher rates of return than others.

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It is to be noted that despite the shortcomings of CAPM-based beta model, it remains the most widely used model of asset pricing. While recognising the basic general weaknesses of the model, and the likely peculiar problems of applying it in the Nigerian capital market, Inanga (1987), still agreed with Brealey and Myers(1988) that while the search for better theories continues, CAPM will, at least, remain a useful rule of thumb for evaluating risk-adjusted returns on capital assets, and a good framework for representation of basic concepts pertaining to the behaviour of returns on capital assets. Our interest in CAPM in this study is to the extent the model helps us to ascertain the relevance of beta (a systematic risk derivable from CAPM) in asset pricing in Nigeria.

3.4.2 Arbitrage factors and asset returns

Years before the advent of the Arbitrage Pricing Theory (APT) Farrar (1962), King (1966) and Meyers (1973) had given hint to the likelihood that more than one factor could be operative in asset returns. Studies by Langetieg (1978), and Vinso and Lee (1980), have also suggested that asset returns are a function of multiple factors.

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Tinic and West (1984), questioned the assumed completeness of Beta as a measure of risk. Along this line of reasoning, Chang and Pinegar (1988), in comparing returns on common stocks and treasury bills, found evidence that denied the existence of a pervasive risk-return relationship. The finding showed that the return on common stocks could be explained by factors other than beta.

Formal empirical tests of APT factors are few. Roll and Ross (1980) undertook the first comprehensive of such tests. Using daily and monthly data for the United States of America, they found that at least three factors span cross-sectional returns on securities. In an elaborate analysis of the relationship between stock returns and the rate of inflation, Pearce and Roley (1988) identified unanticipated inflation as a variable that affects returns on stocks whose influence is not captured by beta. Using Likelihood ratio procedure, Brown and Weinstein (1983) counted the number of factors that affect returns on securities to be between three and five.

Other empirical works by Trzcinka (1986), Luedecke (1984) and Linn and Chang (1985) which assumed an approximate factor structure in which residual returns could exhibit weak correlation across securities, found that one major factor (eigenvalue) dominates

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returns on securities, though there are others of little importance. Roll (1988) carried out empirical investigation to determine the effect of a multiple factor specification on the adjusted coefficient of determination (R^2). Comparing CAPM and APT models, the study observed that the adjusted R^2 was displaced upwards in a multiple factor cross-sectional distribution of returns compared to when a single pervasive factor (beta) was used. However, Roll emphasised that the result was not sufficient to conclude that a multiple factor model was better than a single factor specification. To draw such conclusion, he said, one would have to demonstrate, in addition, that:

(i) the additional factors are pervasive and non-diversifiable; and

(ii) the additional factors are associated with risk premia.

On the question of whether the multiple factors are priced, Roll and Ross (1980) had evidence that three factors are priced by investors. Gultekin and Gultekin (1987), in their test of APT, found that APT factors are only priced in January months. But Burmeister and McElroy (1988), who also observed the "January factor" in security returns, argued that the inclusion or exclusion of a January factor has no appreciable effect on the basic results

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of a multiple factor model. These studies used factor analysis technique in which the variables that underlie the identified factors are indeterminate.

In contrast to the usual method of using factor analysis approach to determine the factors affecting asset returns, some scholars have used measured macroeconomic factors to explain stock returns. Sweeney and Warga (1986) found that changes in interest rate are associated with risk premia. They interpreted the observation to be a reflection of changes in the rate of inflation, given the finding of Fama (1975) that changes in the rate of inflation are fully reflected in interest rates.

In an elaborate search for the macroeconomic variables that have effect on stock returns, Chen, Roll and Ross (1986) identified interest rate, expected and the unexpected rates of inflation, and the spread between high and low-grade bonds as the relevant variables. These variables were found to be significantly priced. But, surprisingly, neither the market portfolio nor aggregate consumption was associated with separate risk premium.

The theoretical basis for the pricing of the variables identified by the study needs to be pointed out. Using the dividend model, stock returns are expressed as the discounted value

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of expected stream of cash (dividend) flows (Miller and Modigliani, 1961). The systematic variables that affect discount factors and cash flows to companies will therefore influence returns. It is in this sense that interest rates and the rates of inflation, money supply, as well as exchange rates are expected to affect stock returns (Chen, Roll and Ross, 1986).

Attempt has been made by Soyode (1993) to test the "association" between stock prices in Nigeria and such macroeconomic variables as exchange rate, inflation, and interest rates. He observed these variables to be statistically associated with the aggregate stock price. It is, however, unknown whether these macroeconomic variables are cointegrated with stock prices and are, consequently related to stock returns.

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CHAPTER FOUR

METHODOLOGY

4.1 One-period returns generating model

The analyses in the study require the estimation of returns on Nigerian equities and relating the estimates to a set of macroeconomic variables. We estimate stock returns because there are currently no such readily available data set.

The return on a security (R) is measured by the change in the price of the security (P) from period t-1 to period t plus any dividend (d) paid between t-1 and t time periods, all relative to the price of the security at time t-1. Thus:

$$R_{it} = \frac{P_{it} - P_{it-1} + d_{it}}{P_{it-1}} \qquad \ldots\ldots (4.1)$$

In calculating returns on securities, we adjusted for scrip issues. Scrip issues are shares issued to equity shareholders in proportion to existing holdings. The end period price of the ith equity, P_{it}, is multiplied by $(1 + \alpha)$ to derive the value of a share after adjusting for scrip issues, where α is the ratio of the scrip issues to the existing shares. The above formula presents scrip issues as components of capital gains rather than cash dividends. This is because the gains from scrip issues accrue to shareholders

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as shares and not as cash.

Fifty equity stocks spread across all the twenty-two industrial sectors of the Nigerian stock market were selected for analysis. These are the only stocks that satisfied the criteria for inclusion.

To be included, a stock was required to : (a) be continuously listed throughout the period covered by the study (Reinganum, 1981); and (b) be traded (i.e. to have non-zero rates of return) in thirty out of the sixty months of the study. The selection of stocks with variable rates of return ensures that we are dealing with stocks that are capable of capturing the changes in the environment in their returns-generating process.

The fifty stocks constitute 50% of the total number of stocks listed as at the last trading day of 1986, the beginning period for the analysis. The chosen stocks are well distributed across all the industrial sectors of the Nigerian stock market.

We generated the average return on the stock market (R_m) for each month of the study period, 1987 (1) to 1991 (12). Both equally-weighted and value-weighted portfolio rates of return are computed and used for analysis. For the value-weighted portfolio, the index of value is market capitalisation. Equally-weighted

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portfolio assumes that an investor invests equal amount in each stock. Vaue-weighted portfolio assumes that an investor invests in each stock an amount proportional to the market value of that stock.The return on the market, (Rm), for each month is therefore the average return on the fifty securities. Monthly returns on each of the fifty stocks and the market portfolio are generated for the period of the study, 1987(1) to 1991(12).

4.2 The Beta model

In testing for beta as a measure of systematic risk, it should be noted that the basic CAPM model is usually stated in ex ante form. However, it has been shown (Jensen, 1969) that the ex ante CAPM can be translated into ex post estimable equation. In fact, the assumption of homogeneous expectations implies that ex ante expectations of returns distribution will correspond to ex post realised returns (Fama and MacBeth, 1973).

The testable form of the model is of the form:

$$R_i = X_{ot} + X_{1t}B_i + X_{2t}B_i^2 + X_{3t}S_i + e_{it} \quad \ldots\ldots \quad (4.2)$$

Where

R_{it} = the rate of return on the ith equity at time t;

B_i = the beta (systematic risk) of the ith equity;

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B_i^2 = a measure of the linearity of the beta model;

S_i = a measure of the effects of non-beta (B_i) systematic risk;

X_i.s = the coefficients;

e_i = the residual error term; and

t = 1 ---- 60

The in-built hypotheses in equation 4.2 are as follows:

(i) Beta is the only, and a complete measure of a security's systematic risk;

(ii) The relationship between return on a security and the risk of that security is linear; and

(iii) In a capital market, where investors are risk averse, the higher the risk, the higher the expected return.

The expected results of equation 4.2 are as follows:

(i) $X_{it} > 0$, showing positive return-risk trade-off (risk aversion).

(ii) $X_{3t} = 0$, showing that there are no systematic effects of non-beta risk.

(iii) $X_{2t} = 0$, showing that the return-risk relationship is linear.

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To estimate equation 4.2, we first derive the empirical value for beta (B_i). Beta is a measure of the sensitivity of the rate of return on a security to the general market rate of return. By definition the beta of a security is:

$$B_{it} = \frac{\text{Cov } (R_{it}, R_{mt})}{\text{Var } (R_{mt})} \quad \ldots\ldots\ldots 4.3$$

where R_m is the rate of return on the market portfolio of equities. The sign of the estimated beta for any given period could be positive or negative. A positive beta means that the rate of return on the security moves in the same direction with the general level of return in the market. A negative beta shows that the rate of return on the security moves in opposite direction to the general market trend.

The measure of non-beta risk of the ith security in equation 4.2, denoted by S_i, is the standard deviation of the least-squares residuals S_{it} from an estimate of the market model:

$$R_{it} = X_0 + B_i R_{mt} + S_{it} \quad \ldots\ldots\ldots 4.4$$

where the variables are as previously defined. The estimated residual of the market model, (S_{it}), measures the systematic risk of a security that is not part of Beta. This is because since equation 4.3 is by definition an identity, it follows that in

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equation 4.4, Cov (S_i, R_m) = 0.

4.3 Arbitrage factor model

An assumption required to make an APT specification empirically testable is that the anticipation of individuals with regard to the values of coefficients and the expected returns are homogeneous. With the additional assumption of rational anticipations, ex ante equations will also describe ex post returns (Roll and Ross, 1980).

If there are common factors affecting stock returns, and if the economic variables represented by the factors are known, then in a test of the effects of these factors on stock pricing, stock returns will be regressed on the known factors. But since the existence of the common factors for Nigerian equities is yet unknown, we adopt a factor analysis approach in the search for the common factors and their pricing effects.

First we estimate the factor coefficients for the common factors. Second, we use the estimated factor coefficients as explanatory variables to test whether the common factors are priced(Roll and Ross,1980).

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We thus hypothesise that:

H_0 = there are non-zero constants (Y_0, Y_1, ..., Y_k) in the model:

$$R_i = Y_0 + Y_1 b_{i1} + Y_2 b_{i2} + \ldots + Y_k b_{ik} \quad \ldots\ldots\ldots\ldots \quad 4.5$$

where;

R_i = the return on the ith security;

Y_0 = the risk-free rate of return;

Y_1, Y_2, Y_k = the sensitivities of stock returns to common factor coefficients; and

$b_{i1}, b_{i2} \ldots b_{ik}$ = the estimated factor loadings on the common factors.

Factor analysis techniques provide the method for estimating the b coefficients in equation 4.5. Our procedure for the analysis takes the following steps (Chatfield and Collins, 1980 and Kendall, 1980):

(i) compute the variance - covariance matrix from the data on stock returns;

(ii) perform a maximum likelihood factor analysis on the covariance matrix to estimate the number of factors (K) and the factor loading, b_{ik};

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(iii) use the estimated factor loadings, b_{ik}, to explain cross-sectional variation of the mean rates of return on equities.

The loadings on the common factors are expected to explain cross-sectional variation of stock returns. This will imply that the economic variables represented by the common factors are associated with risk premia in stock pricing.

Further, to provide a basis for translating the findings of the study into policy, we investigate the economic factors that affect returns on common stocks which are represented by the common factors.

The pre-selected variables are exchange rate, interest rate (average lending rate), rate of inflation, expected rates of inflation, unexpected rate of inflation, change in the rate of inflation and money supply (M_1 and M_2). The inclusion of these variable derives from the literature on other stock markets (Chen, Roll and Ross, 1986; de la Calle, 1991). The inclusion of exchange rate, interest rate (lending rate) and inflation is further supported by the observed relationship between these variables and stock prices in Nigeria (Soyode, 1993).

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The relationship between stock returns and the macroeconomic variables is specified as follows:

$$R_{mt} = b_0 + b_1 ER_t + b_2 I_t + b_3 M_t + b_4 U_t^e + b_5 U_t^{ue} + b_6 DU_t + n_{it} \quad \ldots\ldots\ldots \quad 4.6$$

where

ER = exchange rate measured by the naira-dollar rate;

I = interest rate (average lending rate);

U^{ue} = unexpected rate of inflation;

U^e = expected rate if inflation;

DU = change in the rate of inflation;

M = money supply;

R_{mt} = mean rate of return on the securities at time t; and

n = the error term.

t = time subscript

The variables are expected to affect returns on equities. There is yet to be a theoretical consensus on their signs (Chen, Roll and Ross, 1986).

The rate of inflation is decomposed into its anticipated and unanticipated components using the Autoregressive Model of Box and Jenkins (1970). Schwert (1981) has demonstrated that the result of such a technique, which estimates the expected rate of inflation

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using the past rates, produces unbiased and efficient measures of the anticipated and the unanticipated rates of inflation.

We consider the rate of inflation in period t to depend on n of the past rates of inflation in an autoregressive order:

$$AR(n): U_t = 0_0 + 0_1U_{t-1} + 0_2U_{t-2} +, \ldots\ldots + 0_nU_{t-n} + e_t \quad \ldots\ldots\ldots\ldots 4.7$$

where

U_t = the rate of inflation in period t;

$e_t = U_t^{ue}$ = the disturbance term or the unanticipated rate of inflation in period t;

The anticipated rate of inflation U_t^e is therefore:

$$U_t^e = U_t - U_t^{ue} \quad \ldots\ldots\ldots\ldots 4.8$$

The change in the rate of inflation (DU_t) will be measured by: DU_t

$$DU_t = U_t - U_{t-1} \quad \ldots\ldots\ldots\ldots 4.9$$

4.4 Estimation techniques

In the test of the relationship between beta and stock returns, Fama and MacBeth (1973) used time series analysis to compute betas. The estimated returns on stocks in one period were then regressed cross-sectionally on the estimated betas in the preceding period, in a portfolio setting. This approach of

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estimating returns and betas from two different periods was adopted by Fama and MacBeth (1973) to correct possible bias introduced by the use of portfolio betas instead of single security betas. Portfolio betas are average values which do not reflect the exact characteristics of the individual stocks.

In the present work, we examine the relationship between beta and stock returns by estimating a contemporaneous regression of stock returns on betas. We apply single securities instead of portfolios because we do not have a very large data set that warrants formation of portfolios. It has, however, been demonstrated that the use of single securities instead of portfolios does not bias the results of such analysis (Miller and Scholes, 1972). The use of single securities provides the basis for contemporaneous estimation as against the lagged form used by Fama and MacBeth (1973).

Equation 4.2 is first estimated with all the fifty securities, and then for two groups. One group is made up of high beta (beta greater than one), and the other low beta (beta less than one) securities. This is to isolate any influence of beta size. All the estimates are made in step-wise regression.

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Factor analysis techniques in the SPSS software was used for the estimation of equation 4.5. Maximum likelihood method was used to extract factors on stock returns. For the extraction involving all the fifty securities, the factor extraction process was terminated (aborted) in the tenth iteration, with the indication that local minimum factors do not exist for factor analysis. This suggests that correlation coefficients among the stock returns are too weak to justify the possibility of returns on the fifty stocks being significantly explained by any single variable.

To pursue the factor analysis process to a conclusion, we chose two smaller sample sizes. Each group consists of thirty randomly selected stocks. Both groups share ten stocks in common. Factor analysis was performed on each group of stocks. The use of subsamples of stocks arises because a weak relationship not observable in a large sample might be revealed in a small sample. The details of the factor analysis process are discussed along with the results in the next chapter.

For the regression of stock returns on macroeconomic factors (equation 4.6), both the linear and log-linear forms of the variables are used.

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4.5 Sources of data

Data on stock prices, cash dividends, rights and scrip issues, were collected from the daily official lists of the Nigerian Stock Exchange and annual reports of quoted companies. Data on the macroeconomic variables were collected from monthly and annual reports of the Central Bank of Nigeria. For each table presented, the source of the data set is indicated in that table.

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CHAPTER FIVE

PRESENTATION AND ANALYSIS OF RESULTS

5.1 One- period returns generating model

The one-period returns generating model of equation 4.1 was used to compute monthly rates of return on the fifty securities analysed. These are shown in Appendix 5. The figures show that, on average, each stock records zero returns for at least a quarter of the sixty periods. Analysis of the Daily official list data of the stock exchange indicates that, in most cases, zero returns result from non-tradability of the stocks. The monthly returns on the stocks also feature positive and negative values. Examination of the returns for each stock shows variations of volatile magnitudes from one month to another.

A clearer picture of the characteristics of the returns is revealed by their mean values. These are presented in Table 5.1. Of the 50 securities, only five (5) had negative mean rates of return. Others had positive values. The fifty securities had average monthly rate of return of 2.48% when equally-weighted and 3.17% when value-weighted. These rates imply 30% annual rate of return for the equally-weighted and 38.04% for the value-weighted portfolios (see section 6.1(ii) for further discussion on this). The higher rate of return on the value-weighted portfolio suggests that stock performance is positively related to market value of

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Table 5.1: Mean Monthly Rates of Return on Nigerian Securities, 1987(1) to 1991(12)

Security	Mean Rate of Return (R_i)
1	3.20
2	1.35
3	-1.25
4	0.76
5	-0.12
6	0.07
7	-0.19
8	2.61
9	4.70
10	4.09
11	2.76
12	0.82
13	2.00
14	2.55
15	3.51
16	2.26
17	3.70
18	1.83
19	1.85
20	0.54
21	1.06
22	-0.29
23	4.81
24	1.44
25	3.86

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Table 5.1 contd.

Security	Mean Rate of Return
26	4.30
27	4.26
28	1.88
29	3.57
30	3.60
31	1.88
32	7.43
33	1.38
34	3.87
35	0.68
36	3.78
37	4.66
38	4.28
39	2.55
40	2.41
41	-0.66
42	3.02
43	2.86
44	3.17
45	3.42
46	2.69
47	1.91
48	2.84
49	4.30
50	2.12

Source: Estimates

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individual stocks.

Table 5.2 contains the monthly rates of return on the portfolio of fifty securities. The figures demonstrate strong monthly variations in the rates of return. Negative rates of return featured in four out of the sixty periods. It can be observed that variations in the portfolio rates of return are lower than that in the individual stocks. This is a pointer to the possibility of risk reduction through portfolio formation in the Nigerian stock market. Whether such risks are systematic or idiosyncratic will be highlighted in the results discussed in the subsequent sections.

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5.2 Beta estimates

The Beta for the fifty securities, computed from equation 4.3 are presented in Table 5.3. One characteristic of the betas is that they are mostly positive. Only two securities have negative beta. Positive beta for a stock means that returns on the stock vary in the same direction with the market trend.Negative beta shows that returns on the stock vary in opposite direction with the market. The preponderance of stocks with positive beta indicates that most stocks in the market vary in sympathy with others.

Table 5.2: Monthly Rates of Return on the Market Portfolio of Fifty Securities, 1987(1) to 1991(12)

Time Period	Rate of Return	
	Equally Weighted	Value Weighted
1	2.38	2.65
2	-.32	-.33
3	2.81	3.10
4	-1.73	-2.11
5	-.11	-.18
6	23.69	28.41
7	.27	.28
8	.04	.03
9	-.09	.10
10	.18	.25
11	.77	.89
12	.13	.16
13	1.28	1.41
14	1.28	1.13
15	1.13	2.18
16	2.29	2.56
17	1.23	1.29
18	2.91	4.10
19	4.02	5.27
20	4.47	6.21
21	4.13	3.84
22	1.02	.09
23	1.24	2.23
24	1.61	1.42
25	3.68	5.68
26	1.50	2.22
27	3.55	4.12
28	.47	.61
29	.36	.45
30	.78	.81

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Table 5.2 contd.

Time Period	Rate of Return	
	Equally Weighted	Value Weighted
31	.80	.91
32	4.17	4.31
33	9.82	11.22
34	8.93	7.82
35	5.28	6.11
36	4.82	4.93
37	4.03	4.21
38	1.30	2.15
39	3.48	4.17
40	2.65	2.81
41	3.24	3.26
42	2.42	2.48
43	1.43	1.62
44	2.98	3.14
45	3.00	2.91
46	.62	1.24
47	3.87	3.78
48	.57	-.21
49	1.38	1.45
50	3.12	3.18
51	3.06	3.51
52	1.64	1.67
53	1.36	1.47
54	1.50	2.26
55	4.69	5.71
56	2.28	2.91
57	2.48	3.52
58	1.68	1.69
59	.67	1.71
60	2.30	2.44

Source: Estimates

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Table 5.3: Beta of 50 Nigerian Securities

Securities	Beta	
	Equally Weighted Portfolio	Value Weighted Portfolio
1	1.0969	2.0295
2	.2341	.4012
3	2.0496	1.8254
4	.3690	.1342
5	3.4956	4.0265
6	1.6604	1.3562
7	.4639	1.001
8	.4171	.6217
9	.4987	.3445
10	2.7035	1.7891
11	.8939	1.2421
12	.1284	.1344
13	.7775	.9841
14	1.0035	1.5621
15	2.1544	1.8412
16	-.0125	-.0064
17	.5641	.8622
18	.5370	.6415
19	1.0804	1.2408
20	.4370	.4251
21	1.7457	1.7821
22	-.1330	-.2100
23	1.0417	1.2412
24	.2952	.4562
25	.6863	1.2188
26	.9115	.5248
27	1.0141	.7335
28	.4579	.3754
29	.7388	1.4211
30	.7324	1.0100

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Table 5.3 contd.

Security	Beta	
	Equally Weighted Portfolio	Value Weighted Portfolio
31	.7031	.2103
32	1.1847	.9845
33	2.9826	1.5384
34	1.1408	2.1032
35	.6109	.5621
36	.6071	.8211
37	3.9856	2.9445
38	.2330	.3541
39	.2335	.4218
40	.7224	.6348
41	1.2563	1.6214
42	.5383	.6481
43	1.0421	1.0812
44	.0239	.4211
45	.7660	.8415
46	.9900	1.2314
47	.3726	.4713
48	1.8317	1.5517
49	2.1651	2.8211
50	.5671	.6231

Source: Estimates

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A greater number of stocks have beta values that are less than unity (1) (the beta value for the market portfolio). The beta values were used to estimate equation 4.2.

5.3 The market model

The results of the market model of equation 4.4, estimated for the fifty securities are presented in Appendix 6. Returns on 35 securities are significantly related to the market trend. For all these thirty five securities, the relationship with the market is positive. The residuals of these estimates (S_i) were used to estimate equation 4.2.

5.4 Beta factor model

The estimates of equation 4.2 are contained in Table 5.4. The results consistently show that for both equally-weighted and value-weighted portfolios, the explanatory variables, namely Beta(B_i), the measure of non-linearity(B_i^2), and non-beta systematic risks(S_i) are not significant in explaining stock returns. In most cases X_0, the intercept, is significant. These results have a number of implications.

The non-significance of beta (B_i), implies that Beta is not a determinant of the rates of return on equities in Nigeria. Ordinarily, the insignificance of B_i^2 could imply that the

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Table 5.4: Summary Results for the Regression

$$R_{it} = X_{ot} + X_{it} B_i + X_{2t} B_i^2 + X_{3t} S_i + e_{it}$$

For Equally Weighted Portfolio

Specification and Variables	X_o	X_1	X_2	X_3	D.W	$\bar{R}^2$
1 (a) $\bar{R}_I$ (I = 1 to 50 all stocks included)	1.9300 * (2.3630)	0.1110 (.4000)			1.6489	.0033
(b) "	2.0493 * (3.8250)	0.7772 (.9130)	-0.1962 (-.8280)		1.5599	-0.0442
(c) "	1.8603 * (2.3030)	0.7538 (.8740)	-.1993 (-.8330)	.0302 (.3150)	1.5379	.0442
2 (a) $\bar{R}_i$ (31 stocks included for all beta less than 1)	1.4281 * (3.1220)	1.8971 (1.3470)			1.3896	.1306
(b) "	1.4537 * (2.6290)	1.7064 (.7190)	.2152 (.0860)		1.3915	.0998
(c) "	.9692 (1.0700)	1.7712 (.7380)	.1977 (.0780	.0706 (.6790)	1.4690	.0828
3 (a) $\bar{R}_i$ (19 stocks included for all beta greater than 1)	3.2705 * (2.7680)	-.3308 (-.5670)			1.9017	.0185
(b) "	6.7304 * (2.2100)	-4.0701 (-1.3150)	.8190 (1.2300)		1.7903	-.0088
(c) "	6.5863 (1.9530)	-4.0834 (-1.2770)	.8175 (1.1890)	.0208 (.1180)	1.7630	-.0751

* Significant at 5% level.

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Table 5.4 Contd: Value Weighted Portfolio

Specification and Variables	X_o	X_1	X_2	X_3	D.W	$\bar{R}^2$
1 (a) $\bar{R}_i$ (i = 1 to 50 all stocks included)	2.3887* (6.4430)	0.0929 (.3320)			1.6494	.0023
(b) "	2.1152* (3.7780)	.6456 (.7260)	-0.1609 (-0.6550)		1.5784	-0.0308
(c) "	1.9300* (2.3630)	0.6146 (0.6800)	-0.1621 (-0.6530)	0.0303 (0.3140)	1.5569	-0.0509
2 (a) $\bar{R}_i$ (27 stocks included for all beta less than 1)	1.4493 (2.9080)	1.8200 (1.0670)			1.3537	.1284
(b) "	1.8393* (2.5150)	-.4124 (-.1300)	2.3022 (0.7340)		1.4031	0.0838
(c) "	1.4117 (1.4350)	-0.5923 (-0.1840)	2.5191 (0.7900)	0.0692 (0.6580)	1.4685	0.0648
3 (a) $\bar{R}_i$ (23 stocks included for all beta greater than 1)	3.2705* (2.7680)	-0.3308 (-.5670)			1.9017	.0185
(b) "	6.7304* (2.2100)	-4.0701 (-1.3150)	0.8191 (1.2300)		1.7903	-0.0088
(c) "	6.5863 (1.9530)	-4.0834 (-1.2770)	.8175 (1.1890)	.0208 (.1180)	1.7630	-.0751

Source: Estimates

* Significant at 5% level

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relationship between beta and rates of return is not non-linear. But it cannot be concluded that it is linear because the existence of a relationship between beta and stock returns is denied by the insignificance of beta. We cannot also interpret the significance of the intercept as investors' recognition of the risk-free rate of return since the slope of the line is not proved to be relevant in pricing equities. The significance of the intercept could indicate that factors affecting the slope are omitted. Sufficient for our interest in this study,however, is that such omitted factors are not systematic. Non-significance of S_i, the measure of non-beta systematic risk, suggests that, like beta, no other pervasive factor is associated with risk premium.

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5.5 The Arbitrage factors

The results of the factor analysis are presented for the two groups of stocks. The stocks included for each group, their means, and standard deviation are listed in Table 5.5. The values of returns on stocks used are as in Appendix 5.

Factor analysis proceeds by trying to determine the number of factors that explain the variables. In the extreme, there are as many factors as there are variables, since each variable is exactly explained by itself. When we include all factors, all the variance of each variable is accounted for and the existence of a unique

Table 5.5: Mean and standard deviation of stocks for the factor analysis

Group 1

Stock	Mean	Std. Dev
R2	1.34633	4.88882
R3	- 1.24800	11.01297
R5	-.12383	20.36190
R7	-.19067	6.33494
R8	2.60900 -	7.08501
R10	4.09167	12.18852
R12	.81533	2.10609
R13	2.00167	4.75380
R15	3.50850	9.65487
R17	3.69600	5.86136
R18	1.83367	7.28094
R20	.54350	8.22659
R22	-.28517	9.17441
R23	4.80883	10.95161
R27	4.25950	7.12824
R28	1.87617	4.90403
R30	3.60300	5.25933
R32	7.42867	14.33821
R33	1.37700	13.83469
R35	.68300	6.96319
R37	4.65700	15.81260
R38	4.27950	6.07359
R40	2.41417	5.74420
R42	3.01517	9.47583
R43	2.86133	7.38569
R45	3.41633	12.16742
R47	1.91117	5.89155
R48	2.83817	12.52782
R50	2.11783	4.86270

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Table 5.5 Contd.

Group 2

R1	3.19850	12.53820
R2	1.34633	4.88882
R4	.76400	3.69803
R7	-.19067	6.33494
R9	4.70367	6.68889
R10	4.09167	12.18852
R11	2.75967	9.01390
R12	.81533	2.10609
R14	2.54583	3.70816
R17	3.69600	5.86136
R19	1.84517	5.37672
R20	.54350	8.22659
R21	1.03685	8.73384
R22	-.28517	9.17441
R24	1.43517	7.04474
R27	4.25950	7.12824
R29	3.56600	6.57510
R30	3.60300	5.25933
R31	1.87550	5.76459
R32	7.42867	14.33821
R34	3.87333	7.08547
R37	4.65700	15.81260
R39	2.55267	12.80709
R40	2.41417	5.74420
R41	-.66483	9.13602
R42	3.01517	9.47583
R44	3.17933	5.26558
R47	1.91117	5.89155
R49	4.29950	10.08704
R50	2.11783	4.86270

Source: Estimates

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factor in a model becomes unnecessary (Norusis, 1985). In the factor analysis process, we first seek to determine the number of factors needed to represent the data. Tables 5.6 and 5.7 provide the basic statistics for the decision. The columns labelled Eigenvalue contain the total variance of the variables explained by the corresponding factors. These columns are followed by another on the percentage of total variance accounted for by each factor. The cumulative of this percentage is also shown.

On the choice of the appropriate number of factors, one option (the default in SPSSX software) provides for the inclusion of all factors with eigenvalues greater than one. Each variable has a variance of one and factors with variance less than one are considered not better than a single variable. But it has been shown that this criterion is not always reliable (Tucker, Koopman and Linn, 1969).

Scree plot (Cattel, 1966) is often used to identify the number of factors. The "scree" begins at the zth factor, where z is the true number of factors. The scree plots for the two groups of stocks are shown in Figures 5.1 and 5.2. For the two figures, the scree starts at the fourth factor. This indicates that a four factor model could adequately describe the data. However, since empirical tests of APT have identified up to five systematic factors (Roll and Ross, 1980 and Brown and Weinstein 1983), we

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Table 5.6: Eigenvalues and variance of thirty securities (Group 1)

Factor	Eigenvalue	Pct of Var	Cum Pct
1	6.61395	22.0	22.0
2.	2.72085	9.1	31.1
3	2.23313	7.4	38.6
4	1.94182	6.5	45.0
5	1.83685	6.1	51.2
6	1.59726	5.3	56.5
7	1.40880	4.7	61.2
8	1.23025	4.1	65.3
9	1.09399	3.6	68.9
10	.98447	3.3	72.2
11	.91490	3.0	75.3
12	.88749	3.0	78.2
13	.81318	2.7	80.9
14	.74851	2.5	83.4
15	.71899	2.4	85.8
16	.66146	2.2	88.0
17	.57599	1.9	89.9
18	.46272	1.5	91.5
19	.41752	1.4	92.9
21	.33718	1.1	95.3
22	.26640	.9	96.1
23	.25795	.9	97.0
24	.22601	.8	97.8
25	.20692	.7	98.5
26	.15392	.5	99.0
27	.10843	.4	99.3
28	.09375	.3	99.6
29	.06827	.2	99.9
30	.03982	.1	100.0

Source: Estimates

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Table 5.7: Eigenvalues and variance of thirty securities (Group 2)

Factor	Eigenvalue	Pct of Var	Cum Pct
1	6.25168	20.8	20.8
2	2.87551	9.6	30.4
3	2.11731	7.1	37.5
4	1.89606	6.3	43.8
5	1.82369	6.1	49.9
6	1.70766	5.7	55.6
7	1.53520	5.1	60.7
8	1.32764	4.4	63.1
9	1.16922	3.9	69.0
10	1.05953	3.5	72.5
11	.90985	3.0	75.6
12	.87363	2.9	78.5
13	.82656	2.8	81.2
14	.72409	2.4	83.7
15	.61705	2.1	85.7
16	.56482	1.9	87.6
17	.49597	1.7	89.3
18	.47596	1.6	90.8
19	.45101	1.5	92.3
20	.38103	1.3	93.6
21	.37153	1.2	94.9
23	.27452	.9	96.9
24	.21017	.7	97.6
25	.19837	.7	98.2
26	.19400	.6	98.9
27	.12607	.4	99.3
28	.08763	.3	99.6
29	.07460	.2	99.8
30	.05013	.2	100.0

Source: Estimates

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Figure 5.1: Scree plot of eigenvalues (Group 1)

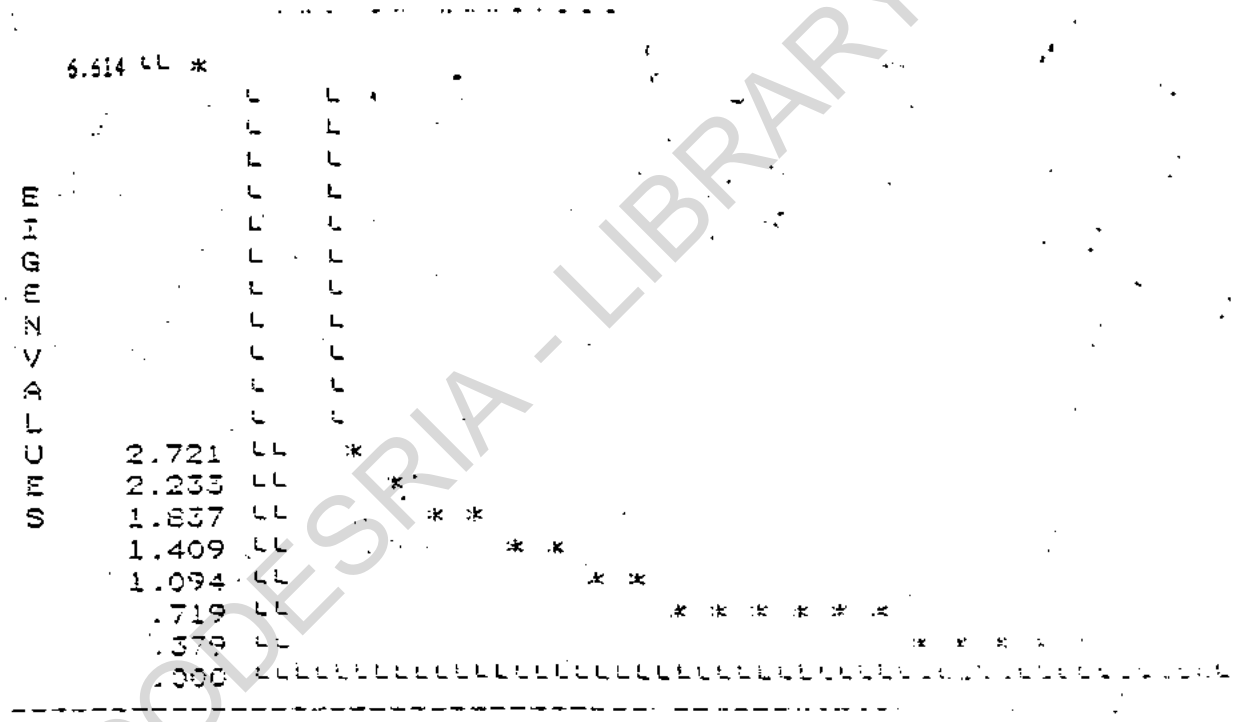

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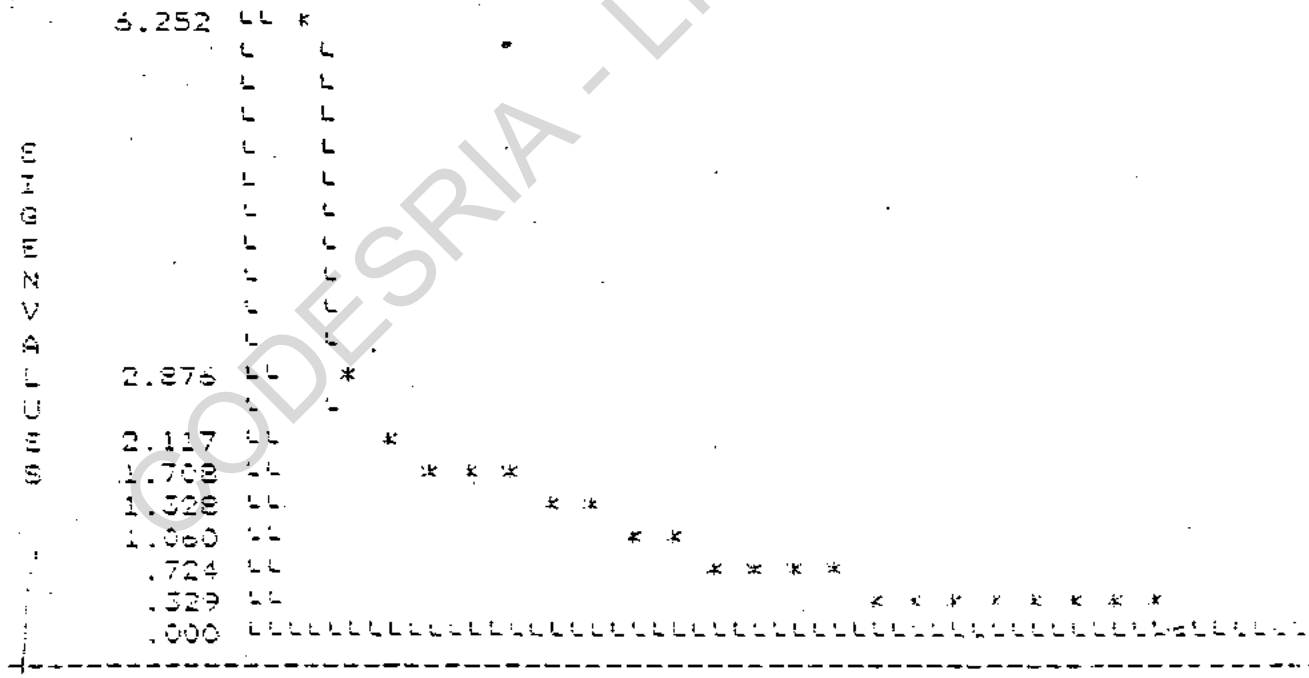
Figure 5.2: Scree plot of eigenvalues (Group 2)



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specified five factors for the analysis.

The Maximum likelihood method was used to extract the factors. Table 5.8 shows the eigenvalues when a five-factor model is used. The cumulative percentage of total variance accounted for by the five factors is almost the same for the two groups. It is 42% for group 1 and 41% for group 2. Table 5.9 shows the communalities of the variables after extracting the five factors. Communalities are the proportion of variance explained by the common factors. They are as low as .02562 for some variables and as high as .99900 for others in the two groups. Most of them are, however, below 0.5. The communalities that are up to 0.5 are ten for group 1 and nine for group 2 while those less than 0.5 are 20 for group 1 and 21 for group 2. Generally, the figures suggest that the common factors are not really common to all the variables. On average, the variance not explained by the common factors, otherwise called the uniqueness of the variable is greater than the communalities.

Tables 5.10 and 5.11 contain the coefficients which express returns on the stocks in terms of the factors for group 1 and 2 respectively. These coefficients are the factor loadings, which indicate the weight of each factor in explaining the dependent variables (returns). The factor coefficients in the tables have been rotated using varimax method. The strength of the varimax method is its minimisation of the number of variables that have

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Table 5.8: Eigenvalue and variance of thirty securities in a five-factor model

Factor	Eigenvalue	Pct of Var	Cum Pct
Group 1			
1	3.07070	10.2	10.2
2.	1.77125	5.9	16.1
3.	4.85355	16.2	32.3
4	1.55968	5.2	37.5
5	1.26820	4.3	41.8
Group 2			
1	1.97116	6.6	6.6
2	5.27594	17.6	24.2
3	2.31874	7.7	31.9
4	1.47692	4.9	36.8
5	1.22355	4.1	40.9

Source: Estimates

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Table 5.9: Communalities of the variables (Nigerian securities) in the factor analysis

Group 1		Group 2	
Final Statistics		Final Statistics	
Variable	Communality	Variable	Communality
R2	.30296	R1	.07131
R3	.65774	R2	.29710
R5	.41630	R4	.99900
R7	.43388	R7	.64694
R8	.51212	R9	.41709
R10	.86653	R10	.90453
R12	.16437	R11	.34884
R13	.54644	R12	.11974
R15	.66270	R14	.42949
R17	.99900	R17	.60234
R18	.13333	R19	.74680
R22	.16512	R20	.09078
R23	.52998	R22	.14758
R25	.31833	R24	.20064
R27	.43953	R27	.48879
R28	.20991	R29	.24377
R30	.99900	R30	.29127
R32	.35349	R31	.16686
R33	.75454	R32	.29730
R35	.23404	R34	.69366
R37	.77468	R37	.81285
R38	.07247	R39	.26454
R40	.23347	R40	.31772
R42	.15309	R41	.48207
R43	.47409	R42	.02562
R45	.09871	R44	.08083
R47	.06268	R47	.14684
R48	.28164	R49	.85010
R50	.47242	R50	.52371

Source: Estimates

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Table 5.10: Rotated Factor Coefficients on thirty securities (Group 1)

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
R2	-.04866	-.00680	.52138	.05702	-.15864
R3	.80465	.04708	.05619	.01767	-.06772
R5	.63355	.02028	-.03843	.10460	.04565
R7	-.05991	.14033	.60273	.13303	.17222
R8	-.10098	.60971	.34361	.00753	.10978
R10	.90688	.09266	-.02297	.08609	.16605
R12	.00099	.21534	.10355	-.07787	.31583
R13	.72139	-.07060	-.04330	.05183	-.12838
R15	.74035	.06768	.17762	.14059	.24225
R17	.04916	.98019	.08357	.16260	-.04887
R18	.26001	-.01931	.25477	-.02098	-.00078
R20	.10338	-.23811	.30628	.19721	.10367
R22	.01203	-.33149	.02975	.20299	-.11400
R23	.10937	-.05073	.18572	.02288	.69313
R25	.20937	.36636	.20424	.04396	-.31097
R27	.36589	.35548	-.14685	.13604	.37311
R28	.36365	-.02370	-.13570	.18927	.15121
R30	.28441	.14125	-.01169	.94760	.00926
R32	.17425	.02415	-.01169	.02060	.55650
R33	.84265	-.02337	.10191	.13877	.11957
R35	.27314	-.06597	.36750	-.14138	-.00662
R37	.83903	.14358	.14054	.12599	.12031
R38	-.05450	.02967	.16436	.19811	.04852
R40	.36222	.25566	-.00059	.18819	.03036
R42	.10866	-.08144	-.01861	.36182	-.05824
R43	.24163	.44534	.00349	.45974	.07746
R45	.02411	.11500	.29029	.00494	-.02485
R47	.24581	-.01031	.03207	-.03332	.00320
R48	.51188	.01898	.11285	.05158	.06218
R50	.26185	.10757	.55026	-.23744	.18200

Source: Estimates

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Table 5.11: Rotated Factor Coefficients on thirty securities (Group 2)

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
R1	.19480	.17490	.04750	-.01505	.01714
R2	.02029	.03741	.52937	-.03872	-.11641
R4	.09832	-.03497	.29595	.93606	.15290
R7	.17943	.18541	.47323	-.58985	-.09216
R9	-.01315	.07933	.60692	.02355	.20425
R10	.84625	.27904	-.23744	.14831	.17661
R11	.11242	.30590	.49049	.01854	-.04137
R12	-.03145	.31492	.02689	-.13730	-.00159
R14	.45240	.36526	.28031	-.11305	-.00723
R17	-.09575	.61563	.21090	-.04009	.40998
R19	.32488	.73137	.13126	.29813	.01540
R20	.22160	-.05730	.08485	-.10048	-.14324
R21	.71096	.19275	.06554	.11856	.02823
R22	.07862	-.17480	-.18377	-.03931	-.27082
R24	-.10887	.27875	.26951	-.10276	-.16701
R27	.20728	.60691	-.15345	.09457	.21210
R29	.15054	.42522	.01291	-.18156	.08663
R30	.25338	.47043	-.06641	.00971	-.03541
R31	.37980	.09977	.02633	-.01473	.10838
R32	.19755	.02890	-.12904	.04730	.48892
R34	.07151	.74867	.19818	-.03855	.29542
R37	.74572	.48540	.04315	.13836	-.01139
R39	-.00956	.09170	.17898	-.34939	.31927
R40	.27234	.28370	.03192	.11784	.38491
R41	.66676	-.12646	-.01352	.11594	.38491
R42	.09625	.06359	-.00365	.10663	-.03662
R44	-.02501	.10063	-.23987	-.10283	-.04433
R47	.23278	-.07185	.04821	.27737	.09074
R49	.50982	.55862	.34955	.28534	-.26655
R50	.40823	-.06720	.43173	-22959	.33681

Source: Estimates

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high loadings on a factor. It therefore selects the variables that are truly related to a factor. The rotation (non-oblique) makes the factors orthogonal.

In Tables 5.10 and 5.11, there is no single factor that is strongly correlated with all the variables. In fact, the number of variables with up to 0.5 coefficients for group 1 (Table 5.10) are F_1 (8), F_2 (2) F_3 (3), F_4 (1) and F_5 (0), where F_1 to F_5 denote the factors and the figures in brackets the number of correlated variables. For group 2, they are: F_1 (5), F_2 (5), F_3 (2), F_4 (2) and F_5 (0). These again suggest that the factors are not common to the variables.

Factor scores in factor analysis are used to represent the values of the factors in other analyses involving the use of the factors (Norusis 1985). These were computed for the two groups and are shown in Tables 5.12 and 5.13. Generally, the factor scores have very small values.

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5.6 Risk premia on estimated systematic factors

The results of the regression of mean rates of return on equities on the estimated factor scores for the two groups of stocks are presented in Table 5.14. For both groups, the coefficients of the five common factors are insignificant. This implies that no arbitrage factor is priced by investors.

Table 5.12: Factor Score Coefficient Matrix for thirty securities (Group 1)

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
R2	-.00780	-.02404	.21723	.00957	-.08580
R3	.14608	-.00933	.01228	-.04094	-.15626
R5	.05992	.00219	-.03612	-.01848	-.01806
R7	-.03968	-.02190	.28495	.01828	.06694
R8	-.03390	-.00896	.15933	.01254	.07540
R10	.34849	.02351	-.20046	-.11163	.10488
R12	-.01603	.00477	.01506	.00303	.11109
R13	.10693	-.00469	-.03708	-.03039	-.14091
R15	.08691	-.00254	.09089	-.02541	.10945
R17	-.04474	1.04195	-.08256	-.14086	-.15450
R18	.01401	-.00815	.07745	-.00186	-.02494
R20	-.00770	-.00968	.11308	.00532	.01745
R22	.00193	-.00544	.02732	.00139	-.04696
R23	-.05343	.01406	.07874	.01062	.40660
R25	.03100	-.01406	.07874	-.00486	-.14424
R27	.01115	.02088	-.11672	-.00966	.18774
R28	.01825	.00720	-.05685	-.00744	.04295
R30	-.08335	-.18206	.01982	1.10547	-.03396
R32	-.01706	.01990	-.07847	-.00124	.24555
R33	.17024	-.00624	.05740	-.04900	-.00997
R35	.01776	-.01337	.12819	-.00164	-.03413
R37	.18210	-.00792	.08998	-.05216	-.00115
R38	-.01225	-.00381	.05041	.00498	.01628
R40	.02174	.00174	-.01484	-.00681	.00281
R42	.00335	-.00166	.00179	.00000	-.02362
R43	.00522	.00487	-.02136	-.00218	.04468
R45	-.00243	-.00851	.08667	.00322	-.01645
R48	.03561	-.00318	.03029	-.00975	-.00783
R50	.00746	-.08054	.26112	.00296	.04960

Source: Estimates

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Table 5.13: Factor Score Coefficient Matrix for thirty securities (Group 2)

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
R1	.00887	.00800	.00707	-.00314	.00130
R2	.02039	-.02529	.12773	-.03712	-.03701
R4	-.06810	-.22746	.37811	.89530	.29093
R7	.08048	-.06133	.31188	-.11073	.00044
R9	.01127	-.02753	.16838	-.06989	.08996
R10	.53421	-.07728	-.40007	.02001	.28343
R11	.00445	.02016	.10978	-.03064	-.02161
R12	-.02282	.04323	-.00151	.00396	.00764
R14	.04884	.00610	.08739	-.03146	-.00771
R17	-.11639	.17753	.02997	-.03191	.24847
R19	-.07675	.30001	-.06773	.05497	-.08268
R20	.03264	-.02860	.03002	-.00805	-.03639
R21	.12155	-.04801	.03203	-.02223	-.01409
R22	.02012	-.02051	-.02435	.01771	-.07361
R24	-.02281	.03944	.04545	-.00241	-.04932
R27	-.05335	.13914	-.09822	.02904	.07617
R29	-.01378	.05127	-.00100	-.00156	.02961
R30	-.01169	.06767	-.03530	.01895	-.02558
R31	.03497	-.01757	.01333	-.01329	.02837
R32	.01204	-.01290	-.02633	-.02140	.16206
R34	-.12610	.25819	.02555	-.02153	.21719
R37	.19751	.08860	-.01213	.00529	-.11423
R39	.00206	-.01160	.06492	-.04301	.12293
R40	.00366	.02303	-.00675	-.01822	.12647
R41	.13012	-.11029	.02554	-.03000	.02618
R42	.00313	.00555	-.00733	.00465	-.01463
R44	-.01362	.02437	-.04289	.01729	-.00984
R47	.02542	-.02367	.00149	-.00567	.01207
R49	.11407	.24061	.20529	.03286	-.59866

Source: Estimates

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Table 5.14: Estimates of Risk Premia on Systematic Factors

	Constant	F1	F2	F3	F4	F5	Adjusted R^2
Group 1	2.1171* (6.2020)	-.01184 (-.0680)	.3102 (1.8990)	-.2384 (-1.4090)	.2026 (1.1840)	3.9241 (1.2510)	.1548
Group 2	1.7798* (3.3970)	-.0526 (-.0440)	.0484 (.2830)	-.8735 (-.6770)	.3056 (.2620)	.0593 (.3470)	0.2379

* Significant at 5% level

Source:Estimates

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5.7 Asset returns and measured systematic factors

The values of the macroeconomic variables used in the analysis are listed in Appendix 7. Table 5.15 contains the correlation matrix of these variables. Two measures of money supply, M_1 and M_2 are perfectly correlated. We therefore used only M_2 (which incorporates the values of M_1) in the estimation. M_1 is currency in circulation plus demand deposits at commercial banks. M_2 is M_1 plus time deposits at commercial banks. The results in Table 5.16 show that the six variables namely, money supply, exchange rate, interest rate, change in the rate of inflation, the expected rate of inflation, and the unexpected rate of inflation, are highly insignificantly related to stock returns. The figures in Table 5.16 are the estimates of the linear form of the variables.The log-linear form estimates are not reported as they present the same conclusion. These results reinforce those of section 5.6 above which show that systematic factors are not associated with risk premia in the Nigerian stock market.

The results, though unusual, could be explained by the infrequent trading in the stock market, and the policy restriction on price movement (see section 2.4). The two factors undermine the adjustment of prices to changes in the business environment.

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Table 5.15: Correlation matrix of the Measured Systematic Factors (Appendix 5)

	RMT	INFL	INF_PRED	INF_U	ER	M1	M2	IAV	INFCHNG
RMT	1.000	-.126	-.155	-.015	.052	.037	.018	.070	-.050
INFL	-.126	1.000	.673	.676	-.116	-.141	-.099	-.363	.707
INF_PRED	-.155	.673	1.000	-.090	-.164	-.158	-.127	-.353	.162
INF_U	-.015	.676	-.090	1.000	.007	-.033	-.007	-.187	.791
ER	.052	-.116	-.164	.007	1.000	.272	.295	.552	-.043
M1	.037	-.141	-.158	-.033	.272	1.000	.988	.516	-.049
M2	.018	-.099	-.127	-.007	.295	.988	1.000	.522	-.040
IPR	.036	-.329	-.329	-.115	.552	.561	.568	.956	-.125
IAV	.070	-.363	-.353	-.187	.552	.516	.522	1.000	-.151
INFCHNG	-.050	.707	.162	.791	-.043	-.049	-.040	-.151	1.000

Source: Estimates

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Table 5.16: Regression of Stock Returns on Macroeconomic Factors

Constant	Money Supply M2	Exchange Rate ER	Average Lending Rate IAV	Change in the rate of inflation INFCHG	Unexpected rate of Inflation INFU	Expected rate of inflation INFE	Adjusted R^2
3.2981	-1.4250	.0814	.2854	-.0563	.0489	-.1720	-.1126
(1.1130)	(-.6520)	(.3190)	(.7060)	(.0920)	(.0920)	(-.8660)	

Source: Estimates

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CHAPTER SIX

SUMMARY OF FINDINGS, POLICY IMPLICATIONS AND RECOMMENDATIONS

6.1 Summary of findings

The major findings of the study are as follows:

(i) The holding period monthly rates of return on Nigerian equities vary widely and take both positive and negative values. However, annual rates of return are usually positive.

(ii) Based on one-month holding period rates, the average annual rates of return on Nigerian equities over the five-year period of the study is 30%. This is higher than the rates of return on other financial assets, i.e. bank deposits and money market instruments over the same period (Inanga and Emenuga, 1993). This shows that investments in equities are more profitable than investments in other financial assets.

(iii) Rates of return on a diversified portfolio of equities fluctuate far less than those of single securities.

(iv) Nigerian equities generally have positive betas.

(v) Within the context of the Capital Asset Pricing Model, beta, which measures the total systematic risk of securities is not a significant determinant of the rates

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of return on Nigerian equities. Also, non-beta systematic risk factors do not determine returns on equities.

(vi) Through the factor analysis process in an APT context, evidence shows that there is no single pervasive factor that is associated with risk premium in stock pricing.

(vii) In line with the observed absence of a relationship between systematic risk and stock returns, measured macroeconomic variables are also unrelated to stock returns. The macroeconomic variables examined are money supply, exchange rate, interest rate, change in the rate of inflation, and expected and unexpected rates of inflation.

6.2 Implications of the findings

(i) The high volatility of the rates of return on individual equities exposes investors who concentrate their holdings on one or few stocks to high risk level. For a diversified portfolio investor, the Nigerian securities market offers a great potential for risk reduction.

(ii) We have observed a securities market environment where stock returns are not affected by market-wide (including macroeconomic) factors. Therefore, risk in the market

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only consists of assets' unique risks, i.e. fluctuations in their rates of return.

(iii) Since returns on equities are neither related to inflation rates, nor associated with inflation-risk premium, equities are not inflation hedge. High inflation rates could have negative effect on investment in the securities market.

(iv) In a financial market environment, where beta and non-beta systematic risks do not determine differential returns on securities, the Capital Asset Pricing Model (CAPM) and the Arbitrage Pricing Theory (APT) frameworks may not be relevant in model specifications involving asset returns and their determinants.

(v) The absence of the effects of macroeconomic variables on equities pricing indicates that changes in macroeconomic variables may not cause volatility in the stock market. Nor could control of such variables be useful in moderating the market's volatility.

6.3 Recommendations

(i) Since risk (fluctuation of returns) is highly reduced in a portfolio setting, it is advisable for investors to hold a diversified portfolio of equities rather than

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invest in one security or in a set of securities whose returns are correlated. A diversified portfolio that consists of only equities provides large scope for risk reduction.

(ii) It is desirable for returns on equities to be inflation hedge. For Nigerian equities to have this property, we recommend full deregulation of the entire price formation process in the securities market. The peg on price movement in the market should be removed. Prices of stocks should be allowed to vary as much as competitive market determines.

(iii) Nigerian equities will tend to be undervalued so long as returns are not associated with risk premia on macroeconomic factors which affect discount factors or cash flows. The effect of this will be to discourage investment in the equities market. Government policy should therefore aim at making returns on equities sensitive to the macroeconomic environment. This can be done through several policy incentives including that recommended in section 6.3(ii) above. Also Government could create a fund for investment in equities. The fund should be highly capitalised and managed by qualified personnel. Its principal goals will be to

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trade on securities and to act as the market leader in determining the appropriate price of each security based on the influence of both systematic and unique factors on the securities.

(iv) Until the goal of making returns on equities sensitive to macroeconomic conditions is realised, policy measures to safeguard investments in the stock market in the event of a run on the market, or imminent market crash, will have to be direct intervention. Suspension of trading could be one of such measures. Manipulation of macroeconomic variables as practised in the developed capital markets will be of insignificant effect.

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6.4 Limitations of the study and scope for further work

The study covered a period of five years. Though the use of monthly data provided enough data points for statistical inference, it was desirable to extend the study to more than just five years. We could not do that because the liberalisation of the financial markets which provided the relevant background for the study is quite recent. Further, although fifty securities are large enough for analysis within the APT framework, such analysis is usually done with larger number of securities. We were limited to only fifty because, not more than that number met the data requirements

for the analysis.

As is usual with analysis involving Capital Asset Pricing Model, our definition of market portfolio is narrow since it includes only equities.

The outcome of the study has shown that systematic factors do not account for the differential rates of return on equities. This indicates that industry-wide and firm-specific factors might account for the variations in stock returns. Further research is required to explore the nature of the unique factors and their effects on stock returns.

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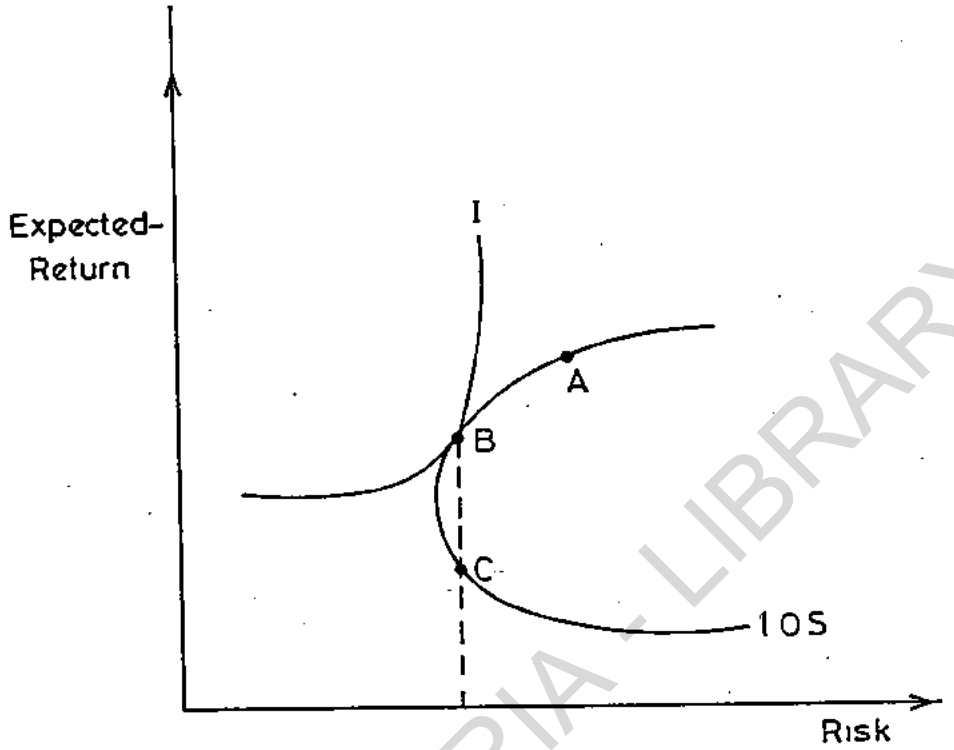

APPENDIX 1: EFFICIENT PORTFOLIO

In the figure above, IOS represents investment opportunity set and I, the indifference curve of investor I. Set B represents the efficient set for the investor, being the point of tangency of his indifference curve and the investment opportunity set. Point C offers lower expected return for the same level of risk as Point A. Point A offers higher expected return than B but has a higher risk level. It also lies outside the investor's indifference curve. Point B is therefore the set of mean-variance choice from the investment opportunity set where for a given level of risk, no other investment opportunity offers a higher return.

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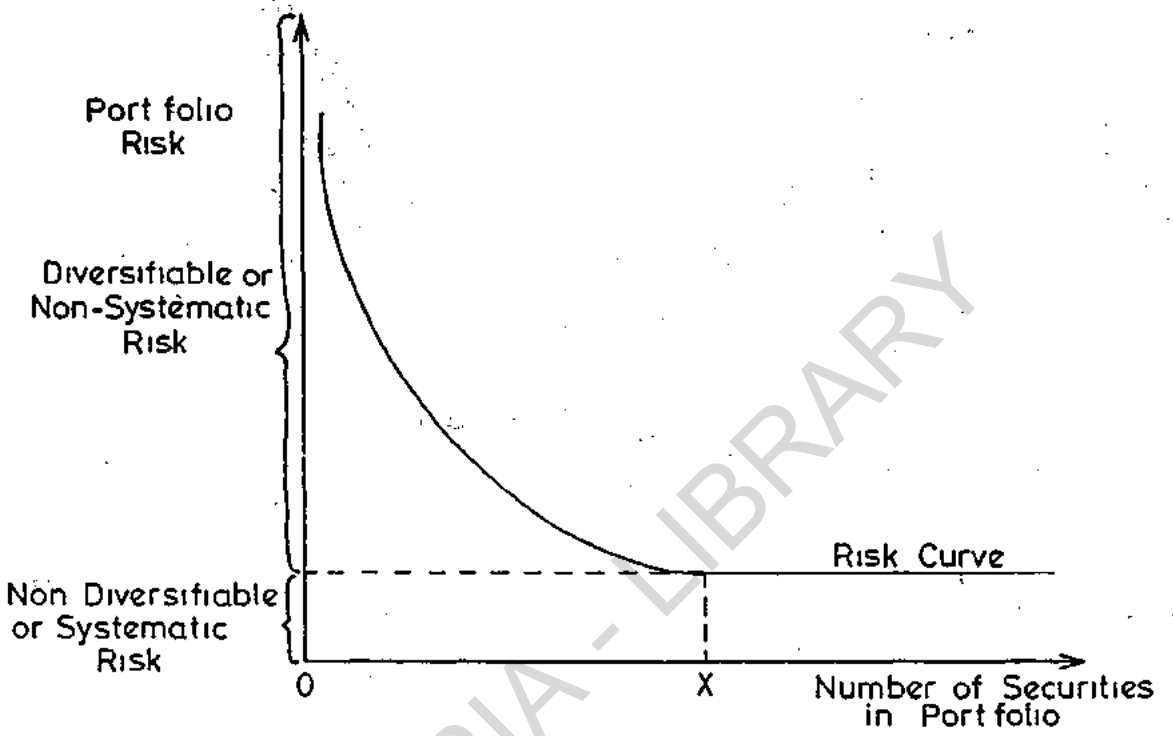

APPENDIX 2: PORTFOLIO RISK CURVE

As the number of securities in portfolio increases, the diversifiable or non-systematic risk reduces. At a point (X), all the non-systematic risk get diversified away and the portfolio is left with only systematic risk.

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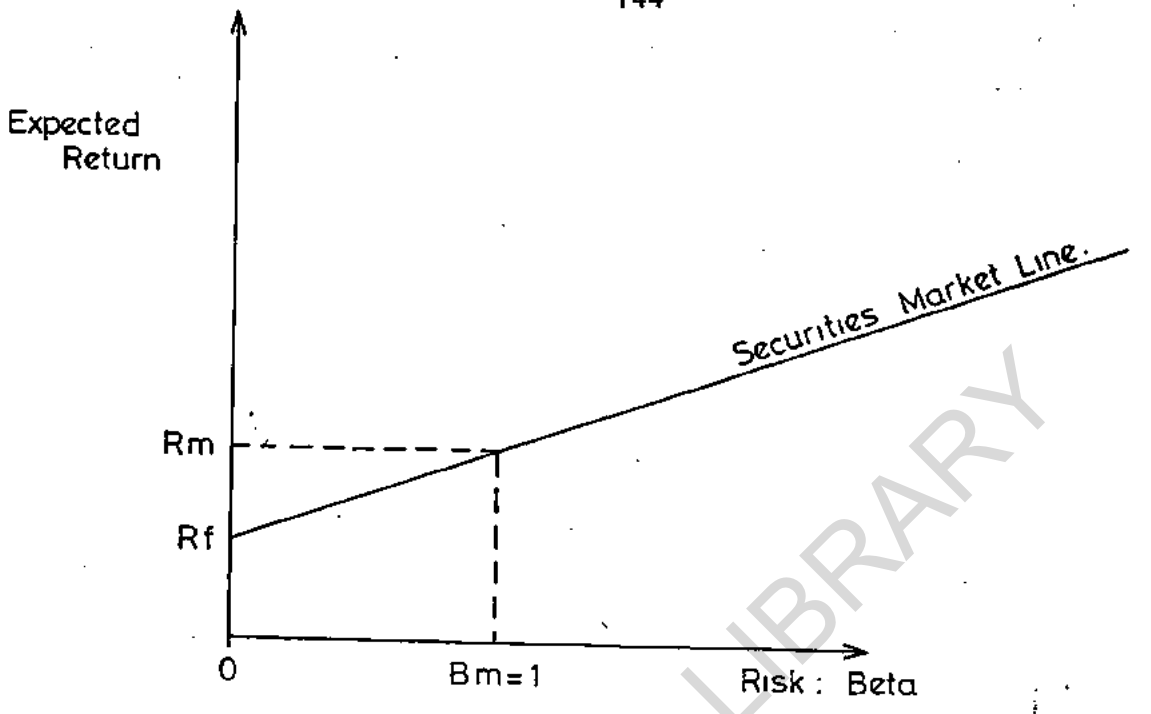

APPENDIX: 3 ILLUSTRATION OF THE CAPITAL ASSET PRICING MODEL [C A P M].

. In the diagram, Rf represents the rate of return on a riskless asset. Rm is the rate of return on the market portfolio while Bm is the risk of the market portfolio. The securities market line, which has a slope of (Rm - Rf) and an intercept of Rf, shows the relationship between risk and expected return. The higher the risk (beta), the higher the expected return.

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APPENDIX 4

The Capital Asset Pricing Model (CAPM)

We demonstrate the derivation of Capital Asset Pricing Model (CAPM). The model is based on the assumptions listed in section 3.1.1

Take a typical investor who invests most of his capital in a portfolio of assets which is representative of the market portfolio. The remainder of his fund is invested in the ith security. The mean rate of return (W) to the investor will be a weighted average of the return on the ith security and the return on the market portfolio.

Thus,

$$W = \alpha R_i + (1-\alpha) R_m \quad \ldots\ldots \quad (1)$$

where

α = an infinitesimal fraction of the investor's asset invested in the security

R_i = the mean rate of return on the ith security

R_m = the mean rate of return on the market portfolio

The variance of the mean rate of return on the investor's asset Var(W) is represented by V where,

$$V = \alpha^2 \text{ Var } (R_i) + (1-\alpha)^2 \text{ Var } (R_m) + 2 (1-\alpha) \text{ Cov } (R_i, R_m) \quad \ldots\ldots\ldots \quad (2)$$

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The inclusion of the ith security in the investor's portfolio which otherwise contains only the market portfolio, alters both the rate of return and the risk of his portfolio. From equations (1) and (2) above, the incremental return to the investor's portfolio of assets per unit of risk (measured by the variance of return) could be ascertained.

From equation (1), the change in the portfolio mean rate of return per unit change in the proportion of assets invested in the ith security is:

$$\frac{dW}{d\alpha} = R_i - R_m \qquad \ldots\ldots\ldots \quad (3)$$

Similarly from equation (2), the change in the risk of the investor's portfolio as a result of a unit change in the total value of investments in the ith security is:

$$\frac{dV}{d\alpha} = 2\alpha \text{ Var } (R_i) - 2(1-\alpha) \text{ Var } (R_m) + 2(1-2\alpha) \text{ Cov } (R_i, R_m) \qquad \ldots\ldots\ldots\ldots \quad (4)$$

But, $\frac{dW}{dV} = \frac{dW}{d\alpha} / \frac{dV}{d\alpha}$

Taking limits, as α tends to zero (i.e. as the proportion of the investor's fund invested in the ith security becomes insignificant), equation (4) reduces to:

$$\frac{dV}{d\alpha} = - 2\text{Var}(R_m) + 2 \text{ Cov}(R_i, R_m) \qquad \ldots\ldots\ldots \quad (5)$$

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From equation (3) and (5), the change in the return on the investor's portfolio due to a unit change in the risk of the portfolio becomes:

$$\frac{dW}{dV} = \frac{R_i - R_m}{-2Var(R_m) + 2Cov(R_i, R_m)} \quad \ldots\ldots\ldots \quad (6)$$

$$= \frac{R_m - R_i}{2\{Var(R_m) - Cov(R_i, R_m)\}} \quad \ldots\ldots\ldots \quad (7)$$

But,

$$ß_i = \frac{Cov(R_i, R_m)}{Var(R_m)} \quad \text{(by definition)} \quad \ldots\ldots\ldots \quad (8)$$

where $ß_i$ = the beta (systematic risk) of the ith asset.

Thus

$$ß_i \; Var(R_m) = Cov(R_i, R_m) \quad \ldots\ldots\ldots \quad (9)$$

Substituting $ß_i \; Var(R_m)$ for $Cov(R_i, R_m)$ in equation (7) we obtain

$$\frac{R_m - R_i}{2 \; Var(R_m) - ß_i \; Var(R_m)} \quad \ldots\ldots\ldots \quad (10)$$

$$\frac{dW}{dV} = \frac{R_m - R_i}{2(1 - ß_i) \; Var(R_m)} \quad \ldots\ldots\ldots \quad (11)$$

The Capital Asset Pricing Model assumes that there is a risk-free rate of return at which investors can borrow and lend. If we take $ß_f$ to be the risk measure for the risk-free asset, then symbolically:

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$$ß_f = 0$$

In other words, the expected return on the risk-free asset equals the realised return. This implies that the return on the asset will have zero variance.

Assume that an investor invests a portion of his fund in the riskless asset instead of on the ith asset. In this case, the incremental return per unit of risk could be derived by the substitution of R_f for R_i and $ß_f$ for $ß_i$ in equation (11).

Thus for this investor

$$\frac{dW}{dV} = \frac{R_m - R_f}{2(1 - ß_f)\ Var(R_m)} \quad \ldots\ldots \quad (12)$$

$$= \frac{R_m - R_f}{2\ Var(R_m)} \quad \ldots\ldots\ldots \quad (13)$$

where;

R_f = the rate of return on the risk-free asset

$ß_f$ = the variance of R_f which is zero.

The model assumes that the capital market is efficient and thus competitive. In a competitive capital market, the expectations of different investors with respect to realisable rate of returns per unit of risk attendant to any investment in a capital asset will be the same. In effect equation (11) and (13) will yield the same result, viz:

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$$\frac{R_m - R_i}{2(1 - \beta_i)\ Var(R_m)} = \frac{R_m - R_f}{2\ Var(R_m)} \qquad \ldots\ldots\ (14)$$

On multiplying both sides of equation (14) by $2(1 - \beta_i)\ Var(R_m)$ and rearranging, the equation could be simplified to

$$R_i = R_f + (R_m - R_f)\ \beta_i \qquad \ldots\ldots\ (15)$$

Equation (15) is the traditional Capital Asset Pricing Model. We have to note, however, that the model is an ex-ante expectational model. In terms of expected values, the model is stated as follows:

$$E(R_i) = E(R_f) + E(R_m) - E(R_f)\ \beta_i \qquad \ldots\ldots\ (16)$$

The expected rate of return on the ith capital asset is a function of the risk-free rate of return and the beta (ß) of the asset. Beta is a measure of the systematic risk of the asset.

Jensen (1969) has shown that the ex ante expectational CAPM can be translated into an ex post estimable model. We therefore have an estimable traditional CAPM model represented by:

$$R_{it} = R_{ft} + (R_{mt} - R_{ft})\ \beta_{it} + e_{it} \qquad \ldots\ldots\ (17)$$

where;

R_{it} = the return on the ith asset at time t;

R_{ft} = the return on the risk-free asset at time t;

$(R_{mt}-R_{ft})$ = the coefficient of β_{it};

β_{it} = the beta of the ith asset at time t; and

e_{it} = the error term.

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Appendix 5: Monthly Rates of Return on 50 Nigerian Equities (R_1–R_{50}) (Percentages) (Equation 4.1)

R1	R2	R3	R4	R5	R6	R7	R8
.00	.00	.59	1.20	-10.09	3.38	-1.01	.78
.00	.00	4.11	5.95	-21.60	37.85	.00	.00
-29.58	.00	-18.31	3.37	3.11	1.69	-8.16	.00
1.18	.00	4.14	2.17	1.29	.00	-4.44	.00
.00	.00	3.31	.00	.85	1.00	-12.79	-3.85
22.09	.00	60.26	11.70	102.53	59.74	-2.67	.00
.00	.00	-3.00	14.29	-10.21	-1.86	-9.59	-.80
.00	.00	-3.09	.89	-1.18	-3.16	-1.64	-.82
.00	.00	-1.09	1.77	-1.19	-2.17	.00	.83
.00	.00	-1.54	1.74	-1.69	-2.67	-3.33	.00
.00	.00	-2.90	8.55	-1.96	-3.20	-13.79	-4.92
.00	.00	-4.37	1.57	-6.25	-2.83	.00	-6.90
.00	16.00	-2.40	.00	2.67	-8.75	.00	-9.26
.00	-6.90	-1.72	.78	-2.08	-4.11	.00	-6.12
.00	.00	-4.76	.00	.00	-.29	.00	.00
.00	-3.70	-.53	1.54	-.80	-.57	.00	.00
.00	-3.85	-1.85	.76	-1.07	-1.73	.00	13.04
.00	.00	-.54	1.50	1.89	-.59	6.00	2.00
.00	.00	-.81	.00	-2.71	-10.32	1.89	9.80
.00	24.00	-1.64	5.60	.00	-.66	.00	11.61
.00	6.45	-1.69	5.30	.00	.66	3.92	12.80
.00	1.52	.00	.72	.28	.00	7.55	3.55
.00	4.48	.00	.00	.00	.00	.00	1.37
.00	4.29	.00	.00	.28	.00	1.75	4.73
87.78	1.37	.29	.00	-3.32	.00	6.90	4.03
5.33	1.35	.00	.00	-69.34	.00	3.23	13.55
5.62	.00	-.57	.00	.00	-.67	4.69	.63
.58	1.33	-6.03	.00	1.15	.00	.00	.00
-1.72	.00	.00	.00	.00	.00	.00	-9.94
2.34	1.32	-.61	.00	.00	1.68	.00	1.38
.57	3.90	-49.85	.71	-3.41	.00	2.99	3.40
1.70	5.00	2.76	-2.84	.00	.00	14.49	20.39
1.68	8.33	.00	7.09	.00	.72	17.57	10.38
4.40	5.81	3.64	5.15	.00	.71	5.75	9.41
7.89	3.30	2.34	.00	.00	.00	15.22	13.57
7.32	11.70	.57	.00	.00	.00	.00	5.18
1.82	.00	.57	1.40	8.24	.00	-2.83	1.14
11.61	.00	1.13	1.38	-36.96	.00	-.97	3.75

CODESRIA - LIBRARY

Appendix 5 contd.

9.20	-.95	-5.59	.00	72.41	-.71	-.98	3.97
-7.06	7.69	.00	.00	.00	-.36	-1.98	-1.39
5.49	3.57	.00	.00	.00	.00	-4.04	6.69
.00	.00	.00	.00	4.20	.00	-7.37	-28.38
7.20	.00	.00	.00	.00	-21.15	-3.41	4.61
2.99	6.03	.00	.00	-3.06	.00	-11.76	2.64
3.26	-.57	5.92	.00	-3.16	.51	-2.86	.00
7.37	-.86	-2.44	.00	-13.04	.51	-5.88	3.86
6.21	-5.22	-7.50	.73	-10.00	.00	-7.81	4.13
.00	3.67	-2.70	-.72	-11.53	5.08	-6.78	9.13
.62	-3.54	-2.78	-2.19	25.42	.48	-5.45	1.20
1.83	-4.59	-2.86	.00	7.41	.00	-3.85	8.66
.30	.00	.00	.00	3.45	.48	.00	10.14
.30	-2.88	-4.41	-1.49	.00	.00	.00	4.93
5.97	-3.96	-4.62	-1.52	-8.33	-.48	.00	4.70
2.08	.00	-2.42	.00	.00	4.81	.00	11.68
2.03	-3.09	-19.83	4.62	3.64	-5.05	.00	5.26
.00	.00	.00	-35.88	.00	-44.93	20.00	.00
9.40	1.06	-2.06	.00	.00	.00	.00	.00
1.82	2.11	.00	.00	.00	.96	.00	.00
1.28	-1.12	.00	.00	-21.05	.00	.00	.00
1.01	-2.27	.00	.00	-2.22	.00	.00	.00

CODESRIA - LIBRARY

Appendix 5 contd.

R9	R10	R11	R12	R13	R14	R15	R16
.00	.00	.00	1.18	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00
-7.77	-1.33	-13.51	-3.45	.00	-1.33	-5.33	-1.32
7.37	-5.41	-12.50	-2.38	1.96	.00	-1.41	-6.67
-4.31	.00	.00	.00	7.69	.00	.00	.00
2.27	87.86	1.92	.00	25.00	21.62	58.73	-14.29
23.33	.00	7.55	-2.44	.00	-18.89	1.00	-10.00
-.90	.00	.00	.00	.00	1.59	.00	.00
4.55	-2.50	1.75	-1.88	.00	17.19	-.99	-1.96
.00	-.85	.00	-.64	.00	.00	.00	.00
-6.09	5.17	17.24	-1.92	1.43	.00	.00	.00
1.85	.00	4.41	-1.96	.00	1.33	.00	.00
.00	1.64	.00	2.67	.00	2.63	3.00	.00
.00	3.23	4.23	1.42	1.41	.00	-3.88	.00
.91	1.56	24.32	1.40	2.78	2.56	3.03	.00
18.02	.00	3.26	.69	.00	1.25	7.84	.00
6.87	.00	6.17	.00	.00	1.23	-27.27	.00
8.94	.00	4.65	2.74	-16.89	3.66	7.14	.00
6.72	3.85	8.89	.00	1.82	17.65	6.67	.00
29.37	-18.15	7.14	.00	.00	15.29	5.00	10.00
16.76	15.31	1.90	.00	1.79	5.10	8.33	.00
4.48	3.54	.93	.00	.00	2.91	2.20	-1.96
1.43	.00	.93	.67	.00	1.89	.00	2.00
8.92	.00	.00	.00	.00	.00	.00	3.92
7.33	.00	1.83	2.65	1.75	1.85	.00	3.77
-1.61	3.42	.00	.00	.00	.00	.00	1.82
.82	.00	.00	2.14	.00	.00	19.35	1.79
3.64	.83	-28.83	.70	.00	.91	5.41	.00
-7.81	.00	.00	.00	6.03	.00	.85	.00
.42	12.70	1.54	2.08	.00	.00	1.94	.00
5.49	-9.68	-3.03	2.04	.00	.00	.00	1.75
2.40	1.79	10.94	1.33	1.96	4.17	.95	37.07
25.39	7.89	39.44	1.32	5.77	11.00	9.43	6.94
7.91	1.63	23.23	3.90	1.82	12.61	11.21	5.19
5.67	10.40	.82	1.88	3.57	9.60	5.43	2.47
5.68	2.90	12.20	.61	.00	8.03	6.62	26.51
6.27	3.52	5.07	1.22	5.17	4.73	6.90	3.81
3.93	11.56	2.07	-5.42	4.92	.00	14.84	.92

COESRIA - LIBRARY

Appendix 5 contd.

.81	5.49	1.35	7.30	4.69	.00	2.81	.00
4.56	.58	19.33	.68	.00	1.29	6.01	4.55
3.87	9.77	-4.24	4.05	10.45	5.10	2.06	1.74
5.93	2.09	.63	1.95	12.84	.61	.00	.85
5.94	.00	.00	.64	4.11	.00	.55	18.64
2.64	1.72	.00	2.53	7.89	.00	1.09	.00
2.89	1.69	.00	.62	4.88	.00	.54	3.08
3.13	2.22	.00	.00	2.33	.00	.00	1.49
4.85	11.41	.00	4.29	2.27	.00	1.07	2.21
7.23	5.37	.00	.00	.00	.00	.53	.72
5.66	3.70	.00	1.18	2.22	.00	1.58	.71
6.38	6.70	.00	.00	1.09	.00	1.04	1.42
6.71	6.28	.63	.58	.00	.00	15.90	2.80
6.97	3.15	.00	7.51	3.23	.00	6.19	.68
2.31	9.54	-2.07	.60	1.04	4.79	-12.08	3.38
3.94	14.11	.00	2.99	.00	4.58	4.19	7.84
6.84	1.64	2.11	.00	1.03	.00	12.56	9.70
3.20	5.81	2.07	.00	3.06	3.75	4.46	1.17
3.68	2.44	2.03	.58	.99	1.37	2.99	1.16
1.31	4.17	7.95	1.16	.00	1.35	2.49	1.71
.92	3.43	1.23	1.71	.00	.00	2.43	.00
4.20	3.31	.00	.00	.00	1.33	7.11	.00

CODESRIA - LIBRARY

Appendix 5 contd.

R17	R18	R19	R20	R21	R22	R23	R24
2.04	.75	.81	.00	4.27	.84	.00	2.78
.67	.00	2.40	.00	1.17	.00	-.97	.00
-2.65	-.75	-1.56	-1.88	-2.89	-8.33	-8.82	-2.70
.00	-.75	-1.59	-4.46	2.38	.00	-20.65	.00
.00	.00	.00	-.33	.65	-.91	.00	-4.17
6.46	13.64	20.97	9.02	49.35	.92	15.38	-2.90
8.33	.00	-6.00	-6.90	-.87	.00	-6.67	-1.49
.00	3.33	1.42	-5.19	.00	.00	-11.43	1.52
.64	-20.65	.00	.00	.00	8.18	-6.45	-2.84
3.18	3.88	.00	.00	.00	.00	-6.90	-10.17
.62	1.87	1.40	-2.34	.00	.00	-7.41	-1.89
.00	4.59	-.76	-1.60	.00	-.91	.00	.00
1.23	18.42	.00	-2.44	.00	.00	2.00	1.92
4.24	6.67	.00	-1.67	.00	-.92	18.82	3.77
4.07	1.39	.76	-2.54	.00	-23.15	7.69	3.64
.56	3.42	.00	.00	.00	2.63	25.00	5.26
8.33	1.99	.00	1.74	.00	1.28	1.43	.00
5.13	3.90	.00	.00	.00	3.80	26.76	-1.67
1.24	1.88	-2.26	2.80	.00	3.66	7.78	.00
5.52	4.29	.00	1.82	.00	.00	18.56	3.39
4.65	1.18	.00	1.79	.00	.00	5.22	-9.84
1.11	.00	.00	7.02	-21.30	.00	.00	3.64
.55	1.32	.00	2.46	1.18	.00	.00	1.75
.00	1.30	-.31	.80	.00	1.18	3.72	3.45
.00	.64	5.17	-15.87	.00	1.16	1.79	11.67
1.09	.00	1.64	22.64	.00	.00	18.42	19.40
.00	.00	3.23	.00	1.16	-8.05	29.04	-2.50
.54	.64	.00	15.38	-14.94	.00	8.84	3.85
.54	.00	1.56	-32.31	.00	3.75	3.13	1.23
.11	.00	.00	3.41	11.76	2.41	6.06	2.44
.00	.00	.00	12.09	1.32	.00	4.00	1.19
1.44	.00	.00	3.92	1.95	.00	13.19	12.94
15.60	20.89	9.23	4.72	14.65	-29.41	3.88	5.73
20.86	-16.96	29.58	.00	3.89	.00	2.80	13.33
12.69	.00	8.70	.00	3.21	.00	1.36	13.73
3.60	.00	6.00	.00	1.55	.00	4.48	12.07
5.65	2.82	3.77	.00	1.02	.00	8.15	4.62
2.06	6.16	3.64	.00	1.52	.00	11.47	-29.41

CODESRIA - LIBRARY

Appendix 5 contd.

1.21	1.29	2.63	.00	5.47	.00	5.22	2.08
.40	.64	1.71	.00	.47	41.67	1.24	-2.04
7.14	7.59	10.08	.00	.94	15.29	13.06	.00
-22.59	9.41	2.29	23.76	5.13	14.29	11.91	.00
4.00	-24.19	1.49	.00	.98	-1.87	2.58	.00
13.08	19.01	.74	.00	.48	-6.67	2.20	.00
6.80	2.08	2.92	.00	.00	-3.06	1.85	.00
10.19	.00	.71	-13.60	-1.92	-13.68	-26.28	.00
4.05	.00	2.82	-12.96	-6.86	-18.29	46.31	.00
6.11	.00	4.11	-10.64	-2.63	-17.91	.56	.00
7.33	.00	1.97	-3.57	-3.78	-9.09	1.11	.00
15.61	.00	2.06	-1.23	-1.12	8.00	6.61	.00
7.59	17.69	.66	.00	.00	5.56	6.72	23.26
12.16	1.16	.66	15.00	4.55	.00	1.69	.94
5.59	1.14	1.31	-.54	-23.56	3.51	5.95	.00
5.66	3.39	.65	.00	.00	3.39	3.37	-.93
8.24	3.28	.64	13.10	-.75	-1.64	4.32	.00
5.96	1.06	-7.64	6.32	2.27	5.26	4.83	.00
3.13	.00	.00	2.97	14.81	.00	6.58	-.94
.00	-2.17	.00	1.92	9.68	.00	5.35	.00
.00	2.78	-6.90	.00	-1.18	.00	2.54	.00
.00	.00	.00	.00	-.60	.00	1.14	.00

CODESRIA - LIBRARY

Appendix 5 contd.

R25	R26	R27	R28	R29	R30	R31	R32
3.85	1.36	.56	.00	2.26	3.62	4.62	2.86
-3.70	.00	-2.21	-4.76	2.21	2.80	1.10	2.78
.00	-3.36	3.95	.00	1.44	4.08	-4.92	1.80
.00	4.17	2.17	.00	-8.51	1.96	-3.45	.88
.00	3.80	2.13	2.00	1.75	3.85	2.38	3.51
15.00	17.65	25.00	17.65	12.93	19.72	16.28	39.83
.00	-6.25	.42	.00	.76	.59	.00	.61
1.89	.67	.00	4.17	-1.52	1.17	.00	.60
.00	1.99	.41	.00	.77	1.16	-21.00	1.20
.00	2.60	7.02	.00	.76	.57	.00	.59
.00	-.63	1.83	.00	1.52	5.11	1.27	7.06
1.85	.00	.00	.00	-.75	.00	1.25	.00
.00	5.73	.45	.00	.00	9.19	5.56	.00
1.82	2.41	.45	.00	.75	1.49	6.43	.00
.00	4.12	.00	.00	.00	1.46	4.95	.00
1.79	8.93	.00	.00	.00	1.92	3.14	.00
.00	1.84	.00	.00	.81	4.72	4.06	.00
.00	1.20	2.22	.00	.00	1.80	2.44	53.09
14.04	4.17	2.61	.00	.00	3.23	2.86	17.74
5.38	.00	2.54	.00	12.00	4.69	2.78	10.27
3.45	.00	3.31	.00	1.43	7.46	4.50	9.32
3.33	.00	.40	.00	.00	2.78	.00	5.68
1.61	.00	-15.54	11.11	1.41	.45	.00	6.99
4.76	.00	3.49	5.45	1.39	.45	.00	1.16
.00	9.71	4.49	.86	.68	1.34	1.87	3.45
1.52	2.08	5.91	4.27	.68	1.76	.00	3.33
.00	4.08	14.72	3.28	17.57	.43	1.83	1.08
1.49	19.51	2.38	1.59	-15.52	.00	.45	.00
1.47	14.50	1.40	.00	.79	.00	.00	1.06
1.45	4.00	2.75	.00	4.69	1.29	.00	5.79
14.29	4.49	.89	1.56	5.22	3.00	3.14	52.74
7.50	11.66	5.31	6.92	6.38	4.37	.43	-30.29
5.81	17.03	1.68	1.61	6.67	3.26	2.16	.93
21.62	27.70	23.97	.00	16.25	19.37	-.42	4.63
13.33	9.19	13.46	-12.70	3.23	.00	5.99	20.35
3.92	14.48	7.12	.00	.00	.38	6.09	6.76
8.49	13.24	5.38	.00	.00	2.63	7.38	8.44
.87	4.16	5.41	.00	.00	2.56	6.49	5.45

CODESRIA - LIBRARY

Appendix 5 contd.

.00	.75	8.26	.00	.00	.71	1.43	3.32
.86	.25	.79	.00	.00	5.67	.71	2.50
.85	-13.83	4.70	.00	-.26	5.37	7.02	4.53
1.69	8.97	2.49	.00	.00	.32	6.23	11.67
.83	2.44	.00	20.91	.00	.00	2.47	1.49
32.23	4.46	.49	1.69	12.14	.00	1.51	.88
8.75	1.71	.00	-4.17	4.12	.00	-16.62	1.46
7.47	3.64	19.13	.87	5.94	.00	.00	1.15
-25.67	4.05	28.32	7.76	13.08	.00	.00	49.43
7.02	3.12	9.66	.80	1.65	.00	.00	18.70
14.75	5.29	10.69	.79	5.69	4.64	.00	6.59
7.14	5.98	10.80	10.24	12.31	13.65	.00	8.25
3.33	6.32	7.69	4.29	9.93	8.11	.00	6.67
1.94	3.18	5.24	.00	-14.64	3.06	.00	5.36
11.39	.22	5.88	3.42	11.24	12.67	.00	7.63
15.91	.22	4.27	1.99	14.44	-14.59	.00	2.89
6.37	1.56	2.66	4.55	14.51	14.91	24.56	6.12
.00	2.42	3.19	.62	17.08	11.35	5.14	3.37
.00	1.29	.00	12.35	7.06	10.44	1.63	.70
.00	8.26	-11.80	-3.85	10.99	2.20	4.81	.92
.00	1.76	4.38	2.86	3.56	9.68	.80	.00
.00	.00	2.65	4.44	7.07	3.33	3.18	52.40

CODESRIA - LIBRARY

Appendix 5 contd.

R33	R34	R35	R36	R37	R38	R39	R40
1.04	6.67	15.79	.00	.00	.00	.00	.00
.00	.00	-15.15	-1.52	-4.35	.00	.00	.89
.00	1.25	-1.79	-7.69	-34.09	-1.47	-1.82	2.65
-18.56	3.70	.00	.00	-13.79	-7.46	.00	3.45
10.71	1.19	-1.82	.00	.00	.00	.00	1.67
93.55	18.82	11.11	.00	100.00	.00	-5.56	18.85
1.67	-.99	.00	.00	.00	3.92	.00	.69
.00	.00	3.33	.00	.00	3.77	.00	-14.73
1.64	.00	-14.52	.00	.00	.00	1.96	2.80
2.42	.00	.00	-5.00	.00	5.45	-3.85	11.82
-1.57	3.00	.00	-3.51	10.00	5.17	.00	2.44
-2.40	.97	-2.08	6.36	3.64	.00	.00	3.17
.00	.00	.00	.00	1.75	.00	.00	3.85
-.82	.96	.00	.00	3.45	1.64	.00	8.15
.00	.00	.00	2.00	1.67	.00	.00	4.11
.00	.00	.00	13.73	.00	12.90	.00	1.97
.00	.00	6.38	1.72	.00	2.86	.00	3.87
.00	2.86	-10.00	5.08	16.39	1.39	.00	1.24
.00	3.26	.00	14.52	4.93	30.36	.00	2.45
.00	2.11	.00	8.45	.00	15.07	.00	3.59
.90	1.03	15.56	23.38	7.46	7.14	15.00	.00
.00	.00	.00	.00	.00	11.11	.00	1.25
3.57	.00	.00	2.11	1.39	.00	.00	.00
.00	1.02	2.00	.21	4.11	1.00	-10.00	.00
.00	4.04	.00	5.00	.00	.00	.00	.00
3.45	.00	1.96	1.19	1.32	.99	.00	.62
.00	.97	7.69	2.35	.00	.98	.00	1.84
.00	.00	.00	3.45	.00	.00	.00	.00
.00	.00	.00	1.11	.00	.00	.00	1.20
.00	-25.00	.00	.00	1.30	16.50	.00	.00
.00	9.38	.00	9.89	-17.95	.00	13.33	4.17
2.78	7.14	.00	1.00	11.11	-1.94	1.96	-23.43
6.31	21.33	16.07	8.91	25.00	.00	58.65	14.05
2.54	28.57	-14.75	45.45	36.00	15.84	-12.00	13.04
.83	13.68	.00	6.25	6.86	3.42	10.61	5.13
.00	9.77	28.85	-1.65	23.85	.83	-32.88	11.59
2.46	3.42	1.49	.67	5.19	2.46	.00	3.83
.80	1.32	.00	8.61	2.11	.80	.00	2.11

CODESRIA - LIBRARY

Appendix 5 contd.

4.76	1.96	4.41	.61	3.45	.79	8.16	1.03
-16.67	.64	.00	.00	.00	14.17	-3.77	.00
.00	8.28	.00	.00	1.33	10.34	.00	7.65
.00	-9.41	.00	.00	20.20	10.00	.00	1.01
.00	5.11	.00	6.67	21.09	4.49	.00	.00
.00	15.28	.00	1.14	10.97	3.68	1.96	.00
.00	4.82	.00	1.12	6.98	12.43	9.62	.00
-2.73	4.02	.00	.00	1.63	1.05	52.63	3.00
-4.67	6.08	.00	1.67	5.35	4.17	23.61	.49
-18.63	7.81	.00	1.09	.00	3.00	.00	.48
-22.89	6.28	-7.69	.00	1.52	4.85	2.25	.96
-14.06	10.45	-3.33	.00	2.50	2.78	2.20	5.71
21.82	2.88	.00	-21.08	1.46	1.80	-1.08	1.35
-3.51	9.20	-1.72	9.92	.00	3.98	.00	.44
3.64	8.79	-3.51	15.04	-.48	3.40	.00	1.55
5.26	5.05	.00	6.54	.48	4.94	.00	.00
.00	8.90	-5.45	17.79	-5.77	13.33	2.17	1.90
11.67	7.55	-3.85	10.42	5.61	11.76	35.11	2.38
1.49	3.80	12.00	2.36	.00	5.26	-4.72	10.91
.00	1.97	.00	10.60	.97	4.33	-10.38	6.56
1.47	.55	.00	2.08	4.78	.96	.00	.77
4.35	1.92	.00	8.57	.00	2.53	.00	.38

CODESRIA - LIBRARY

Appendix 5 contd.

R41	R42	R43	R44	R45	R46	R47	R48
.98	5.60	2.97	.00	57.14	.61	.00	.00
.97	3.03	3.85	.69	-32.73	.61	.00	.00
.96	4.41	1.85	.00	3.60	.00	.00	.00
-4.76	1.41	1.82	-5.48	-4.35	.00	.00	.00
6.49	.69	4.46	-1.81	-27.27	1.20	1.16	.00
46.34	14.48	22.22	2.36	-.37	28.57	14.94	51.52
4.17	2.41	.77	.00	2.67	.52	22.00	1.00
.80	.65	.00	.77	5.19	1.56	3.92	.00
.79	1.92	1.53	11.45	3.70	1.54	.00	3.96
3.15	1.89	5.26	.00	7.14	1.52	.00	-13.33
3.82	2.47	3.57	1.37	5.56	.00	.94	2.47
.74	.00	2.76	2.70	.00	.00	.00	1.20
.73	2.41	.67	.66	.00	.00	.00	3.57
2.90	2.35	3.33	3.27	1.05	.50	.93	4.60
6.34	.57	3.23	1.90	.00	.50	.93	1.10
3.97	-14.29	2.50	10.56	.00	1.48	.00	.00
.00	20.00	8.54	1.46	1.04	-11.17	6.42	.00
.00	-9.61	1.40	.61	1.03	8.84	2.59	1.09
2.19	3.42	.62	.61	18.88	2.50	4.20	1.08
2.14	2.65	1.84	.00	.00	6.71	3.67	1.06
1.40	4.52	2.41	.00	.00	4.00	2.65	2.11
.00	4.94	.00	-1.20	.00	.55	1.72	1.03
2.76	1.76	5.29	.61	13.16	.55	.00	.00
.67	5.78	2.79	1.82	12.79	1.09	3.39	.00
.67	.55	2.17	.00	21.65	1.61	.00	.00
.00	.00	.00	.00	11.86	1.59	2.46	4.55
.66	3.26	6.38	.00	6.06	4.17	9.60	8.70
.00	.00	4.00	.00	5.00	.00	3.65	2.00
13.16	.00	1.92	10.48	1.36	.50	1.41	.00
-.66	.00	-26.89	-7.74	4.03	1.49	.69	.00
.00	.00	2.94	.00	-27.10	1.09	7.59	.00
.00	.00	5.71	.00	15.04	3.24	.71	2.94
.00	.00	14.86	.00	27.69	5.24	.00	6.67
-13.25	.00	23.53	.00	21.69	.50	.00	5.80
.00	.00	8.10	.00	1.49	1.98	.00	4.72
.00	17.65	1.76	.00	12.68	.49	.00	1.80
.00	21.00	6.06	.00	12.12	4.35	.00	3.54
.00	4.13	2.86	.00	-2.32	.00	.00	2.56

CODESRIA - LIBRARY

Appendix 5 contd.

.00	2.38	2.78	.00	.40	.00	.00	3.33
.00	.78	3.09	12.90	.39	.00	17.61	9.68
-3.82	-27.31	3.75	20.34	-11.37	4.17	28.14	5.15
-14.29	15.85	-17.69	21.31	1.45	7.56	1.40	2.10
-21.30	8.42	2.39	6.76	1.43	1.89	.00	.68
-1.18	6.80	.93	5.91	.94	2.31	.00	.68
.00	6.82	3.24	5.98	.00	3.62	.00	71.62
-13.10	4.26	4.48	9.40	2.33	3.49	.00	-34.25
-4.11	8.57	8.58	10.65	5.91	18.57	-1.93	4.79
-14.29	.38	3.16	2.80	1.72	6.41	.00	2.50
-16.67	6.74	4.98	4.23	4.22	7.69	.49	.61
-6.00	5.26	8.03	3.77	5.67	7.45	.98	1.21
-25.53	4.33	3.04	1.96	1.15	3.47	-1.46	.00
-14.29	3.19	3.93	10.41	.38	.00	-3.94	-1.20
.00	.93	5.99	3.72	1.89	-16.48	-4.10	1.21
.00	-26.99	-23.21	5.26	.00	3.44	-1.60	.00
.00	42.86	6.85	10.75	.79	8.12	-2.17	.60
3.33	1.54	1.13	7.67	.00	7.85	-4.44	.00
.00	5.76	.75	3.77	.00	2.85	-9.88	.00
3.23	.29	.00	2.83	.39	1.85	.00	5.95
.00	.00	1.85	3.54	.00	6.04	.00	.00
.00	.00	6.55	1.71	7.81	3.42	.00	-10.11

CODESRIA - LIBRARY

Appendix 5 contd.

R49	R50
.00	1.48
.00	.00
.00	.00
.00	.00
-1.35	-7.30
43.84	10.24
1.90	.71
8.41	.00
.99	.00
.00	.00
-.98	-2.13
-.99	.00
.00	.00
1.00	.00
.00	.00
1.98	.00
1.94	.00
.00	3.25
1.90	7.09
9.35	8.09
9.28	.68
1.89	1.35
1.85	2.67
1.82	1.49
4.46	.74
2.56	2.19
16.67	8.57
1.43	.00
2.11	.00
3.45	.66
-23.33	1.31
33.33	1.29
31.67	17.20
37.34	-13.04
3.23	22.86
4.91	7.56
6.81	9.73
3.59	5.42
2.31	5.61

CODESRIA - LIBRARY

Appendix 5 contd.

1.88	3.10
3.69	4.72
10.32	2.05
3.55	2.01
1.87	2.76
.33	.77
1.32	1.14
4.23	2.63
.63	.73
.31	.00
1.55	.39
1.83	1.95
.30	.38
.60	.76
.89	.38
9.41	.75
-11.29	3.75
6.23	.00
3.70	.36
1.49	.72
1.76	.00

CODESRIA - LIBRARY

Appendix 6: **Summary Results for the Regression**

$$R_{it} = X_o + B_i R_{mt} + S_{it}$$

Security	X_o	B_i	S_i	D.W	R^2
1	.4760	1.0969*	11.9377	1.9645	.0778
	(.2490)	(2.4460)			
2	.7632	.2341	4.8198	1.8293	.0280
	(.9910)	(1.2930)			
3	-6.3351	2.0496*	8.3648	1.9168	.4132
	(-4.7290)	(6.5220)			
4	-.1517	.3690	5.5502	1.9189	.0349
	(-.1710)	(1.7690)			
5	-8.7997*	3.4956*	16.2896	1.9415	.3490
	(-3.3730)	(5.7120)			
6	-4.0543*	1.6604*	9.9365	1.4661	.2415
	(-2.5480)	(4.4480)			
7	-1.3420	.4638*	6.1240	1.1036	.0494
	(-1.3680)	(2.0160)			
8	1.5738	.4171	6.9334	1.5825	.0258
	(1.4170)	(1.6010)			
9	3.4658*	.4987*	6.4578	1.8895	.0679
	(3.3510)	(2.0560)			
10	-2.6183*	2.7034*	7.6995	1.6558	.5941
	(-2.1230)	(9.3460)			
11	.5411	.8939*	8.4552	1.6434	.1050
	(.4000)	(2.8140)			
12	.4967	.1284	2.0577	2.0980	.0289
	(1.5070)	(1.6610)			
13	.0719	.7775*	3.9006	1.3329	.3268
	(.1150)	(5.3060)			
14	.0550	1.0035	4.5035	1.5614	.3668
	(.0760)	(5.9310)			
15	2.1432	2.1544*	6.0432	1.9776	.6015
	(1.2143)	(9.4890)			
16	2.2911*	-.0125	7.0598	1.6042	-.0172
	(2.0260)	(-.0470)			
17	2.2959*	.5641*	5.5198	1.5978	.0979
	(2.5978)	(2.7200)			
18	.5009	.5390*	7.0349	2.5928	.0503
	(.4450)	(2.0320)			

* **Significant at 5% level**

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Appendix 6 contd.

Security	X_o	B_i	S_i	D.W	R^2
19	-.8364 (-1.3640)	1.0804* (7.5130)	3.8277	1.4810	.4845
20	-.5411 (-.4180)	.4370 (1.4390)	8.0836	2.2385	.0178
21	-3.2761* (-3.2730)	1.7457* (7.4350)	6.2493	1.6155	.4792
22	.0450 (.0310)	-.1330 (-.3860)	9.1626	1.3567	-.0146
23	2.2235 (1.3440)	1.0417* (2.6840)	10.3288	1.8915	.0951
24	.7025 (.6290)	.2952 (1.1270)	6.9688	1.6887	.0046
25	2.1582 (1.9110)	.6863* (2.5900)	7.0528	1.8864	.0882
26	2.0425* (2.3010)	.9115* (4.3780)	5.5418	1.2850	.2354
27	1.7426 (1.7590)	1.0141* (4.3640)	6.1847	1.2975	.2342
28	.7397 (.9960)	.4579* (2.6290)	4.6356	1.8239	.0911
29	1.7324 (1.7890)	.7388* (3.2520)	6.0469	1.8762	.1396
30	1.7851* (2.4260)	.7324* (4.2430)	4.5943	2.2803	.2238
31	1.3152 (.9546)	.7031* (3.5890)	5.2146	1.6932	.1676
32	4.4882* (2.0420)	1.1847* (2.2970)	13.7273	1.8914	.0676
33	-6.0257* (-4.1360)	2.9826* (8.7280)	9.0960	1.2462	.5603
34	1.0418 (1.1110)	1.1408* (5.1840)	5.8572	1.6505	.3049
35	-.8333 (-.7850)	.6109* (2.4530)	6.6277	2.3611	.0784
36	2.2699 (1.7300)	.6071* (1.9720)	8.1942	1.7723	.0467

* Significant at 5% level

CODESRIA - LIBRARY

Appendix 6 contd.

Security	X_o	B_i	S_i	D.W	R^2
37	-5.2351*	3.9860*	7.4838	1.7785	.7722
	(-4.3680)	(14.1750)			
38	3.7011*	.2330	6.0187	1.5579	.0011
	(3.8400)	(1.0310)			
39	1.9730	.2336	12.8813	1.9672	-.0132
	(.9560)	(.4830)			
40	.6212	.7224*	5.1596	2.1107	.1793
	(.7520)	(3.7270)			
41	-3.7830*	1.2563*	8.0117	.8039	.2177
	(-2.9480)	(4.1740)			
42	1.6790	.5383	9.2872	2.5919	.0228
	(1.1290)	(1.5430)			
43	.2749	1.0421*	6.4252	2.0158	.2301
	(.2670)	(4.3170)			
44	3.1199*	.0239	5.2649	1.0301	-.0170
	(3.7000)	(.1210)			
45	1.5153	.7660	11.8693	1.8155	.0320
	(.7970)	(1.7180)			
46	.2370	.9900*	4.3920	1.5262	.3723
	(.3370)	(6.0000)			
47	.9865	.3726	5.7459	1.1435	.0325
	(1.0720)	(1.7260)			
48	-1.7080	1.8317*	10.7687	2.6123	.2611
	(-.9900)	(4.5270)			
49	-1.0743	2.1651*	6.6699	2.0913	.5552
	(-1.0060)	(8.6400)			
50	.7103	.5671*	4.4404	2.6420	.1518
	(.9990)	(3.3990)			

* Significant at 5% level

Source: Estimates

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Appendix 7: Variables used in the Analysis of Asset Returns and Measured Systematic Factors

INFL	INF_PRED	INF_U	ER	IAV	M1	M2
.5600	-.6006	1.1606	3.6471	13.8000	12503.2000	24669.5000
.1500	1.1907	-1.0407	3.7014	13.7000	12112.5000	24403.7000
.2600	1.2084	-.9484	3.9213	13.8000	12236.6000	24022.4000
.1500	.3588	-.2088	3.9054	13.8000	12181.3000	24318.4000
1.1200	.9956	.1244	4.1617	11.7000	12222.0000	24605.4000
.6000	1.2123	-.6123	4.0506	13.6000	11811.2000	24369.8000
1.9400	.3697	1.5703	3.8081	13.9000	11883.2000	24636.5000
.7500	.9717	-.2217	3.9698	18.4000	12282.7000	25306.8000
1.6700	1.0973	.5727	4.2072	18.8000	12403.9000	26021.9000
1.0800	.7624	.3176	4.2761	19.1000	13033.3000	27064.7000
1.2500	1.3082	-.0582	4.2890	19.1000	14139.9000	28347.1000
1.1000	.5829	.5171	4.1664	19.0000	14905.9000	29994.6000
3.4900	.9456	2.5442	4.1740	17.3000	14878.9000	30609.5000
3.2400	2.1412	1.0988	4.2611	17.5000	15761.0000	32137.1000
4.8800	2.6144	2.2656	4.5288	17.5000	15884.0000	32620.8000
3.0100	3.4520	4.5580	4.2023	17.6000	16120.5000	33037.8000
4.2500	5.7539	-1.5039	4.1103	17.6000	16608.7000	34052.3000
5.2100	4.1162	1.0938	4.1913	17.5000	16899.2000	34904.8000
5.1600	3.3332	1.8268	4.6087	17.7000	17554.9000	35676.1000
5.9400	4.7082	1.2318	4.5830	17.3000	17140.4000	35149.0000
1.1700	3.0171	-1.8471	4.6997	17.4000	17168.3000	35390.1000
2.6200	1.1070	1.5130	5.1479	17.0000	17664.0000	35985.3000
.5100	2.0968	-1.4868	5.3530	17.0000	18361.5000	36781.4000
5.9500	2.0311	3.9189	7.0229	17.0000	21148.6000	42780.3000
4.0900	4.4817	-.3917	7.3823	18.0000	20549.3000	42654.4000
7.4400	5.4149	2.0251	7.5872	17.0000	21457.1000	44348.3000
2.3700	4.3185	-1.9485	7.5803	18.0000	22654.0000	46679.4000
7.1100	5.8069	1.3011	7.5051	19.0000	22841.0000	48540.6000
4.2400	3.4412	.7988	7.3477	18.0000	23703.4000	50500.6000
.1300	4.7778	-4.6478	7.1388	19.0000	23948.4000	46976.6000

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Appendix 7 Contd.

-5.1500	.3956	-5.5456	7.2593	20.0000	24698.8000	45930.4000	
-1.0500	-2.3223	1.2723	7.3401	21.5000	23955.5000	45048.5000	
-1.2100	-1.5358	.3258	7.3934	22.0000	24439.6000	44703.4000	
.6100	-.3629	.9729	7.5037	23.7000	24325.2000	45104.5000	
1.1300	1.7578	-.6278	7.6135	24.9000	23817.1000	44124.5000	
.3400	2.4746	-2.1346	7.8621	25.7000	26297.9000	46922.3000	
1.0300	1.1456	-.1156	7.9009	24.5000	25262.9000	45470.7000	
.6000	1.8198	-1.2198	7.9358	26.5000	27732.5000	48565.0000	
1.6400	1.9121	-.2721	7.9400	30.0000	26722.2000	49248.8000	
1.7100	-.3688	2.0788	7.9400	26.2000	26199.7000	48350.6000	
.5700	1.0206	-.4506	7.9432	26.0000	26117.9000	49361.1000	
.6700	.0899	.5801	7.9522	25.9000	25002.3000	48081.5000	
.1000	.2993	-.1993	7.9623	25.5000	28568.1000	53074.6000	
-2.0600	.4958	-2.5558	7.9743	27.4000	30522.3000	55363.8000	
-.6100	-1.2856	.6756	8.0089	27.1000	28210.8000	58598.2000	
-.2400	-.5534	.3134	8.3246	28.0000	34695.6000	61517.3000	
1.1000	.0355	1.0645	8.7071	27.7000	30614.8000	58283.8000	
-.2400	.3587	-.5987	9.2121	21.0000	36634.6000	64358.0000	
3.7300	1.1768	2.5532	9.6109	21.0000	36348.8000	65299.9000	
.4600	1.8176	-1.3576	9.4521	21.0000	39362.1000	69732.2000	
3.1600	1.6322	1.5278	8.8691	21.0000	38781.4000	69626.7000	
4.0100	1.2292	2.7808	9.3700	21.0000	40269.2000	72110.9000	
2.0900	3.4726	-1.3826	10.1725	20.0000	45049.4000	77897.3000	
.7100	.8016	-.0916	11.0474	21.0000	42107.0000	75516.0000	
2.0100	.7224	1.2876	11.3290	21.0000	43586.9000	77519.5000	
-1.1600	1.6363	-.4763	10.3415	21.0000	44922.2000	79749.8000	
1.0500	.1030	.9470	9.8205	21.0000	48703.3000	84370.2000	

INFL = inflation rate
INF-PRED = the expected inflation rate
INF-U = the unexpected inflation rate
ER = the exchange rate
M1 = money supply (narrow)
M2 = money supply (broad)
IAV = average lending rate

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