AN ESTIMATION OF THE SYSTEMATIC RETURN RISK AT THE NAIROBI STOCK EXCHANGE

BY

MUNYWOKI, STEPHEN K.

A Management Research Project Submitted in Partial Fulfillment of the Requirements for the Degree of Master of Business and Administration, Faculty of Commerce, University of Nairobi

JUNE, 1998

DECLARATION

This Management Research Project is my original work and has not been presented for a degree in any other University.

Signed: _____ Date: 14/10/98

STEPHEN K. MUNYWOKI

This Management Research Project has been submitted for examination with my approval as University Supervisor.

Signed: _____ Date: 28.10.98

M. ANYANGU

DEDICATION

To my parents, Henry M. Kinyae and Cypriana M. Munywoki, who remained patient during the long period of studies.

TABLE OF CONTENTS

ACKNOWLEDGEMENTS

I am greatly indebted to my Supervisor, Mr. Anyangu for his invaluable guidance and suggestions throughout this study.

I owe appreciation to all my lecturers who took me through the MBA course. I am also grateful to Charles F. M. for the financial support and understanding during the programme.

Last and not the least, is a big THANK YOU to all my classmates and friends, particularly Paul K. Kurgat, Stanley C. Langat, Robert K. Lesiew and Tony Juma for their encouragement and co-operation.

ABSTRACT

Investors are mainly interested in knowing the degree of risk exposure in any investment undertaking or set of undertakings. They are also interested in how much return they would receive in exchange for their investment funds. Academicians and other parties also have a stake in these market parameters. These serve as yardsticks in determining which market or asset portfolio to invest in.

This research project intended to measure the market risk and return for the Nairobi Stock Exchange. Secondary data on forty six quoted companies was utilised to compute the various market parameters.

The results obtained revealed a market risk of 3.55% and a market return of 14.80%. The market return of 14.8% added to the coupon rate on the one-year Central Bank of Kenya Treasury Bonds of 15.0% gives a total of 29.8%. This does not deviate much from the general market interest rates which ranged between 28% and 32% towards the end of 1997.

The coupon rate on Central Bank of Kenya Treasury Bonds that is currently applicable is that of one-year Floating Rate Treasury Bonds whose coupons are based on the 91 day Treasury Bill rate. This will affect returns on equity portfolios because investors make rational decisions based on a set of available investments. The effect of the one-year Floating Rate Treasury Bonds will be to suppress the return that could be obtained from equities due to the high yields on these bonds.

CHAPTER 1. INTRODUCTION

1.1. Background of the Study

1.1.1 History of the Nairobi Stock Exchange

Dealing in stocks and shares started in 1921 with the incorporation of Muter & Oswald Limited. This company dealt with property broking as its main business and stockbroking as a side business. Kenya was still a British Colony.

In 1950, Francis Drummond started Kenya's first full-time professional stock brokerage firm. In 1954 the Nairobi Stock Exchange was set up as an Association of Stockbrokers. In the same year the London Stock Exchange (LSE), at the behest of Mr. Drummond and the then Finance Minister, Sir Ernest Vasey, recognised the Nairobi Stock Exchange as an overseas exchange. The London Stock Exchange therefore gave the six founding brokers clearance to formally start the NSE as an organisation with a legal basis to regulate share dealing fees, subscriptions, broker charges as well as the relationship among themselves and theirs clients. The NSE was also registered under the Societies Act of 1933 as a voluntary association of members existing mainly for the purpose of offering facilities for the buying of shares and stocks.

Until Kenya attained independence in 1963, trade in securities was a preserve of the Europeans in which Africans and Asians were forbidden. The dealers at the time were accountants, auctioneers, estate agents and lawyers. These dealers used to meet at the coffee shop at Nairobi's New Stanley Hotel. Business was conducted more on the basis of trust and there were neither rules nor regulations.

After the NSE was formalised in 1954 and constituted as a voluntary association of brokers registered under the Societies Act and an affiliate of the London stock Exchange, the stock exchange gained significant credibility as a result of this development.

Market Shocks at the NSE

The first major shock at the NSE came at the dawn of independence in 1963. Many Europeans, apprehensive about the future of the country, were selling off their states and migrating back to their motherland. Three years later, the new government had gained confidence of pundits resulting in the resurgence of the economy. The market was back on its feet.

The depression of 1972 -73, resulting from the high inflation sparked by the oil crisis of 1972, was another significant event in the history of the Nairobi Stock Exchange.

In 1975, the government also introduced a capital gains tax (subsequently suspended in 1985) which further depressed activity in the market. Subsequent government economic policies, the introduction of exchange controls, nationalization of policies, and restrictions on import and export trade, tended to discourage a freer market.

Perhaps the event with the most far reaching impact on NSE was the 1977 break up of the East African Community, a formidable economic union of Kenya, Uganda and Tanzania. This led to the nationalization in the three countries, of companies some of

which were listed at the NSE and had subsidiaries in all three countries. Examples are Kenya Breweries Limited, Cooper Motor Corporation (CMC) Holdings limited and Lonrho Motors Limited.

In the early 1980's, the government begun to focus more intensely on the financial system, adapting more market friendly reforms, to foster a sustainable economic growth. But the economic reform process begun in earnest in the late 1980's, with the privatization program, targeting several state enterprises. The objective was to encourage local investment through the Nairobi Stock Exchange. Kenya Commercial Bank, the state corporation floated to the public in 1988 realised a 227% oversubscription.

The culmination of structural reforms in the capital market, leading to the formation of the Capital Markets Authority in 1989, re-emphasized the governments commitment to the reform process which was a further boost to investor confidence. These were in line with the 1984 study on "Development of Money and Capital Markets in Kenya" by International Finance Corporation (IFC) and Central Bank of Kenya (CBK) which was a blue-print for structural reforms in the financial markets.

In January 1991, the NSE changed status from a society and took on a life of its own as a corporate entity limited by guarantee. The old call-over trading system was

abandoned in favour of the floor based "open outcry" system as recommended by Bishop in 1988, who undertook a study sponsored by United States Agency of International Development (USAID) on the Rules and Regulations of the Nairobi Stock Exchange.

The period beginning 1994 saw a significant turning point for the NSE in many ways. In July 1994, the NSE moved to its present location, a modern and more spacious premises at Nation Centre, with a well equipped and modern information centre. Computerization and electronic trading including a Central Depository System (CDS) are presently in the pipeline. New staff were also recruited and trained in the same year. These efforts started to bear fruits and it was not surprising when the International Finance Corporation (IFC), Capital Markets Division, rated the NSE as the world's best performer in dollar terms in 1994 among the emerging markets. Although the fact was not repeated in 1995, the NSE has continued to perform extremely well year after year since the early nineties.

1.1.2. Recent Privatisations

The Nairobi Stock Exchange has seen several companies sell shares to the public in the last two years. These were Kenya Airways, REA Vipingo Plantations, National Bank of Kenya, Kenya Commercial Bank, Tourism Promotion Services (Serena Hotels) and Athi River Mining. Foreign investors were allocated a maximum number of shares which they

could take up in each issue. All these issues were oversubscribed leading to allocation based on a criteria determined by each company. The major portion of the oversubscription was contributed to by foreign investors who were very active in these issues. Most of them ended up with very little being allotted to them. For instance, in the Serena issue foreign investors who applied for three million shares were allotted six hundred and fourty shares only during the allocation.

1.2. Statement of the Problem

Several researches have been done on the Nairobi Stock Exchange since its inception. The most recent that addressed the issue of risk was that by Muli (1991) when the market was less developed and the economy was structured differently. Major changes have taken place in the Kenyan economy that have affected the stock market significantly and thus the amount of risk exposure. Liberalisation of public enterprises in various sectors of the economy peaked in the early 1990s and this has had a major impact on the Nairobi Stock Exchange.

The companies originally listed on the stock exchange have changed in that some were delisted while others were listed during the ten-year period ended December 31, 1997. This indicates a change in the market portfolio and might result in different risk for the mix of securities held by an investor. The system of trading also changed from the call over system to the floor based open outcry system. These changes in the market make it totally different in terms of systematic risk measured in previous periods.

1.3. Objective of the Study

The main objective of the study will be:

1. To estimate the systematic return-risk, $\delta_{m,}$ at the Nairobi Stock Exchange.

1.4. Significance of the Study

The study will benefit various categories of stakeholders.

1. Investors on the Nairobi Stock Exchange who are very much concerned with the degree of risk involved in investing in quoted stocks.

2. Prospective investors will have more information for their investment decisions.

3. Investment advisors will have a better position in recommending the NSE to both foreign and local investors

4. Academicians who would like to enhance their knowledge of the stock exchange will rely on this study as a foundation.

1.5. Organisation of the Study

This study was confined to the Nairobi Stock Exchange although reference was made to other stock markets in the emerging markets. The study constitutes five chapters. Chapter one is the introduction covering the background of the study, statement of the problem, objectives of the study and significance of the study.

Chapter two covers the literature review on definitions and concepts of risk, risk measurement and relevant previous researches on the Nairobi Stock Exchange. Chapter three is the research design covering definition of the population, the sample. data collection and data analysis. Chapter four covers findings and interpretations while chapter five comprises of a conclusions, limitations and recommendations.

CHAPTER 2: LITERATURE REVIEW

2.1. Definitions and Concepts of Risk

Risk refers to some expected danger, peril or hazard. This definition represents a more basic or fundamental understanding of risk to an ordinary person. From a scholarly perspective, the concept of risk is defined with more precision and mathematical elegance. The variability school of thought and the volatility school of thought have given contemporary definitions of risk.

March and Shapira (1987) of the variability school perceive risk as the variation in the distribution of possible outcomes, their distribution and their subjective values. Their perception of risk compares with Robicheck's (1969) perception of risk being the possibility that actual returns may vary from the expected returns. Thus risk is quantified in terms of variability measures like ranges, standard deviations, variances, co-variances and coefficients of variation.

According to the volatility school of thought, risk is the volatility of returns in relation to the market returns. Thus securities whose returns are highly correlated with the market returns are said to have low volatility, while securities whose returns have little correlation with the market returns are said to be highly volatile. A measure of risk based on the volatility concept quantifies only that portion of the total variation which is associated with the market variation or systematic risk and ignores any unsystematic risks. (Bower and Wippern, 1969).

Although there are various definitions of risk, a more meaningful definition of risk and quantification of risk should incorporate both variability and volatility. For instance, the Capital Asset Pricing Model (CAPM), considers both the variability of Assets returns and the volatility of those returns resulting in the quantification of risk into two components; diversifiable risk and non-diversifiable risk.

Machol and Eugene (1969) defined risk as the possibility of loss while March and Shapira (1987) defined it as the potentiality of a hazard. These definitions were from a managerial perspective.

2.2. Systematic Risk

Risk can be classified as systematic or unsystematic (Weston and Copeland 1986). The unsystematic risk can be reduced or eliminated through diversification whereas the systematic risk cannot be diversified away. The systematic risk is a market-related risk while the unsystematic risk is a non-market risk.

Diversification can thus reduce the risk of a portfolio by reducing the unsystematic component of the total risk (Phillips and Richie 1983). The extend to which diversification reduces risk in a portfolio depends on the relationship between the returns of the securities in the portfolio.

The risk as measured by the variance of the returns of the above portfolio can be calculated as:

$$\delta^2_p = w_i\delta^2_i + w_j\delta^2_j + 2w_iw_jCov_{ij}$$

Where: δ^2_p = variance of portfolio returns.

Cov_{ij} = covariance between the returns of securities i and j.

For computational purposes, the covariance is usually standardised by dividing it by the product of the standard deviations of the individual securities. This gives the correlation coefficient, ρ_{ij}, without loss of, or change in the underlying properties of the covariance.

In portfolio theory literature, systematic risk refers to the beta of a security or portfolio (Bowman, 1979). The beta of security i is its co-variance with the market divided by the market variance.

$$\beta_i = Cov_{im}/Var_m$$

This normalisation standardizes the risk measure but the underlying risk as stated above remains the covariance between the security and the market.

2.3. Variance as a measure of risk

The Mean-Variance Criterion has remained the most widely used basis for portfolio selection since the portfolio theory was originally postulated by Harry Markowitz in 1952. The main objective of portfolio selection is to maximise investor's utility. The Mean-Variance Criterion is an appropriate measure of risk for any risk-averse investor. These are investors who will prefer more to less return for any given level of risk and less to more risk at a given level of return. This method is also attractive because it is simple to apply.

This method has, however been criticised. Hanoch and Levy (1970) pointed out that the Mean-Variance criterion is sufficient for dominance only when the utility function is quadratic or the probability distributions of the resultant portfolio can be fully described by two parameters that are independent of each other. It is also valid when the returns are normally distributed. As reported by Muli (1991), most returns tend to be lognormally distributed and thus the mean variance criterion may not, in practice, provide the best basis for portfolio selection.

It has also been considered that higher moments which are also measures of risk, may lead to portfolio selection that vary from those selected using the Mean-variance criterion alone. Studies on the direction of preference if higher moments are considered suggest that preferences using the first two moments are likely to be consistent with those arrived at using the third and fourth moment (i.e. Skewness and Kurtosis). The first two

moments can thus be considered adequate for purposes of portfolio selection. Selection computations become rather complicated when higher moments are considered and thus these moments have little practical use.

Kroll, Levy and Markowitz (1984) found that for an infinite number of securities the results of portfolios constructed using mean-variance and direct utility maximisation can be very different. They concluded that the mean-variance criterion is less reliable where the number of securities is infinite. This research, however, supported previous research by Levy and Markowitz (1997) in which they found the two approaches to give the same or very similar results for a finite number of securities. The mean-variance criterion can thus be considered in selecting portfolios that are at least approximately similar to those that could be selected using the direct utility maximisation criterion where the number of securities is finite.

Meyer (1979) extended the above argument further by contending that Mean-Variance analysis gives efficient sets that are larger than necessary and hence sub-optimal. He proposed new definitions that he used to reduce the efficient sets.

2.4. Alternative Portfolio Selection Criteria

As a result of the arguments against the Mean-variance approach in portfolio selection, other frameworks have been developed that offer better results or require less restrictive conditions.

The stochastic dominance criterion comprises of sets of inequalities involving functions of the probability distributions of the returns. These functions induce partial orderings of the set of probability distributions. These orderings produce an admissible set of choices under restrictions on the decision makers utility functions, that follow some prevalent and appealing modes of economic behaviour. This model is of limited practical application compared to the mean-variance approach and also calls for complex mathematical computations.

Time dominance consists of rules which provide partial orderings of temporal prospects, yielding an efficient set from which the ultimate choice will be made (Ekern, 1981). Temporal prospects are decisions alternatives distributed over time and inferior alternatives are eliminated using the Net Present Value rule.

The minimax criterion was developed by William Krasker (1982). His model assumed that investors select their portfolios such that the portfolios have some minimax properties i.e. they have for instance some guaranteed level of some minimum utility. This criterion also gave some portfolios that were fully identical to those selected under other

criteria such as the Mean-variance. Since portfolio selection involves the utilisation of all available information, minimax behaviour seeks to protect the investor from the possibility that their probability distribution is incorrect due to the nature of information that the investor has. In a portfolio context, investors will feel uncomfortable when they make decisions based on subjective probability distributions formed on the basis of vague information.

Shalit and Yitzhaki, (1984) developed a framework which combines the characteristics of both the Mean-Variance criterion and stochastic dominance. They used Mean-Gini (MG) instead of the traditional Mean Variance to construct optimum portfolio. This method incorporated the simplicity of Mean Variance approach and was considered more adequate for evaluating the variability of a prospect than the Mean-Variance criterion.

From the foregoing, the search for the best portfolio selection criteria is still going on. But so far, the Mean-Variance criterion remains the most widely used portfolio selection method. This is due to its simplicity in application as it is based only on two measures; Mean and Variance which are relatively easy to compute. The effects of market conditions such as restrictions on short sales will be simpler if we are willing to accept the concept of homogeneous investor behaviour. Where short sales are not allowed, the effect will be to increase the price of risky assets consistently (Jarrow, 1980). The Mean-Variance approach can then be considered as correctly reflecting the best portfolios to maximise the investor's utility.

2.5. Risk-Return Relationship

The relationship between risk and return is important in a portfolio context since these two parameters are considered the main tools of choice. The risk-return relationship is based on the mean variance framework of portfolio selection. It is theoretically expected that there should be a positive risk-return relationship because investors need to be compensated through the provision of a risk premium if they are to take on additional risks. The theoretical risk-return relationship is thus based on the premise of risk aversion (Markowitz, 1952 and Sharpe, (1965).

However, there have been exceptions to this conclusion. Bowman (1982) discovered that within most industries, risks and return were negatively correlated. Fiegenbanm and Thomas, (1988) also discovered a negative relationship between risk and return. Various explanations have been advanced to explain this contradictions. Laughbumn, et al, (1980) established that individuals are not uniformly risk averse, but adopt a mixture of risk seeking and risk averse behaviours. They further established that target levels are important in determining this behaviour. This indicates that when returns are below target, most investors will be risk averters. Fiegenbanm and Thomas (1988) and Bowman (1980) also established that troubled firms whose returns are below prospect or target returns are more risk-seeking than healthy firms.

From the above, it is clear that the non-universality of risk-aversion is the most important explanation for any negative risk-return relationship. In Kenya, very few studies have been carried out to determine the relationship existing between risk and return in the recent past.

2.6. Market Versus Accounting Based Measures of Risk and Return.

There are two main bases on which returns can be calculated. These are market based measures and accounting or financial based measures. The two measures have been found to be related. Bowman (1979) found that there is a theoretical correlation between some accounting measures and market measures and concluded that accounting measures can thus be used for predicting future returns/risk. However, he did not find evidence of correlation in the case of earnings and dividends.

In this study market based measures will be appropriate because of the following reasons. Accounting measures are rarely an indication of economic return (Aaker and Jackobson, 1987). Return on investment is the most widely used accounting based measure. It is considered to have little relationship with economic activity. This is because the earnings used in the computation are as a result of decisions made in the past while the assets value can influence past, current and future earnings.

Although the above problem can be solved by adjusting the accounting data for price level changes, current cost accounting is still at a nascent stage and does not offer much assistance as far as agreed method of making such adjustments are concerned. In Kenya, the problem of inflation accounting still remains unsolved todate. Experts in the field have neither agreed on the modalities of adjusting accounting data for inflation nor the level of inflation. Thus accounting measures may prove meaningless.

Thirdly, market based data is both readily available and does not require as many adjustments as accounting based data. Accounting based data is not readily available as the market based measures which are collected at the Nairobi Stock Exchange.

2.7. Related Researches on the Nairobi Stock Exchange.

A study by Gitari (1990) found out that it was apparent that Kenyan Publicly quoted companies do exhibit a positive relationship between systematic risk and return. This relationship was not statistically significant thereby suggesting that investors may either be under or over-compensated for taking high risks. This suggested the need for risk analysis on the part of investor, rather than being mere risk takers. The results also indicated a negative but statistically insignificant relationship between unsystematic risk and return.

He also found that the nature of risk-return relationship was independent of the nature of the industry in which a company operates reinforcing the conclusion on the relationship between unsystematic risk and returns.

Another study by Muli (1991) on the estimation of the systematic return-risk for the Nairobi Stock Exchange indicated a market risk of four percent and a return of approximately six percent. With one-year Government of Kenya Treasury bonds having a coupon rate of fifteen percent (July 1991), the full market return was twenty one percent which was consistent with the general market interest rates in the commercial sector. The market risk and risk premium calculated appeared to be good estimates of the total market parameters. Further, the market risk and return were therefore approximately 4% and 5.7% respectively. However, this study was done eight years ago when the market was at a very low stage of development. One of the limitations was that lack of a trading floor might have affected the diversification effectiveness of the market by inhibiting activity level (Muli, 1991). There were also six stockbrokers in the market, less than the current twenty and more securities have been listed since then, opening up more avenues for investment diversification.

CHAPTER 3: RESEARCH DESIGN

3.1. The Population

The population of the study consisted of all the companies listed on the Nairobi Stock Exchange (NSE) as at December 31, 1997. The study covered equity companies only and thus excluded those trading exclusively on preference shares.

3.2. The Sample

The sampling plan included those companies that have been listed on the Nairobi Stock Exchange continuously for ten years since January 1, 1988. The study covered five years to December 31, 1997 and where price information is not available for one year consecutively, such a company was excluded from the sample. The five-year period was chosen in order to capture the influence of major factors in the economy that could have affected share prices and dividends. The five year period is comparable to that used in previous researches (Gitari, 1990 and Muli, 1991). It is also assumed that investors require about five years to assess the risk of a certain stock. A similar period was used by Sharpe and Cooper, (1972) to determine the risk return classes among New York Stock Exchange stocks under a similar assumption. A second justification for the use of the five year period is that a much longer period would increase the stochasticity of betas (Sharpe and Cooper, 1972, Blume, 1973, Fabozzi and Francis, 1978).

3.3. Data Collection

Data required was collected from the Nairobi Stock Exchange and brokerage firms in the form of secondary data. All the data was collected on a quarterly basis for fourty six companies for five years, giving in total 920 observations. The first, second, third and fourth quarter were defined as January to March, April to June, July to September and October to December respectively, regardless of when the company's financial year ends. Appendix 2 shows the companies in the sample and their weights.

3.4. Data Analysis

The data collected was converted into returns using the formula;

$$R_{it} = (P_{it+1} - P_{it} + D_{it})/P_{it}$$

Where: R_{it} =Return on security i for quarter t.

P_{it+1}, P_{it} = Prices of security i at the end and beginning of quarter t, respectively.

D_{it} = Cash dividend on security i for quarter t.

The closing prices were used in all cases and annual dividends converted into quarterly equivalents by dividing them by four. All shares prices were adjusted for bonuses and rights issues. For each company, mean return and standard deviation were computed using Statgraphics Statistical Package (SSP) which gives summary statistics for any series of data points. These were then used as the inputs into the BASIC program, to estimatesystematic return-risk.

Systematic Risk for the Market

The mean-variance criterion was used to compute the market risk. Starting with a two security portfolio, additional securities were introduced, one at a time until all the securities were included. Each security was weighted by its market capitalisation according to the definition of market risk (Weston and Copeland 1986). Thus for each security i its weight, w, was computed as:

w_i = market capitalisation of security i/total market capitalisation of all securities in the portfolio.

Market capitalisation was defined as the closing price multiplied by the number of issued shares outstanding of each security on December 31, 1997. A custom-made BASIC computer program was used to compute the systematic risk for the market. This computed risk as:

$$\delta_m = [\sum w^2_i \delta^2_i + \sum \sum w_i w_j \delta_i \delta_j \rho_{ij}]^{1/2}$$

Where: $\rho_{ij} = Cov_{ij}/\delta_i \delta_j$

δ_i, δ_j = Standard deviation of the returns of security i and j respectively.

δ_m = systematic return risk for the market.

The market return associated with this level of risk, Market return was computed as:

$$R_m = \sum w_i R_i$$

It should be noted that the nature of the curve traced in the portfolio risk space by the addition of new securities depends on the order in which the new securities are introduced. However weighting the securities ensures that there is only one risk that can be attained for a portfolio of all the securities in the market. The results for the return and risk are as shown together with the Basic Progam in appendix 4.

CHAPTER 4: FINDINGS AND INTERPRETATION

4.1. Introduction

The principal objective of this study was to estimate the systematic return-risk for the Nairobi Stock Exchange.

The asset returns used in the analysis are given in appendix 1 together with the weights used as surrogates in all the computations. Weights based on the market capitalisation were used for the purpose of comparison since only share prices are reliable. Weighting the securities ensures that there is only one risk that can be attained for a portfolio of all the securities in the market.

The results for the return and risk are as shown together with the Basic Progam in appendix 4.

4.2: Systematic Risk and Return for the Nairobi Stock Exchange

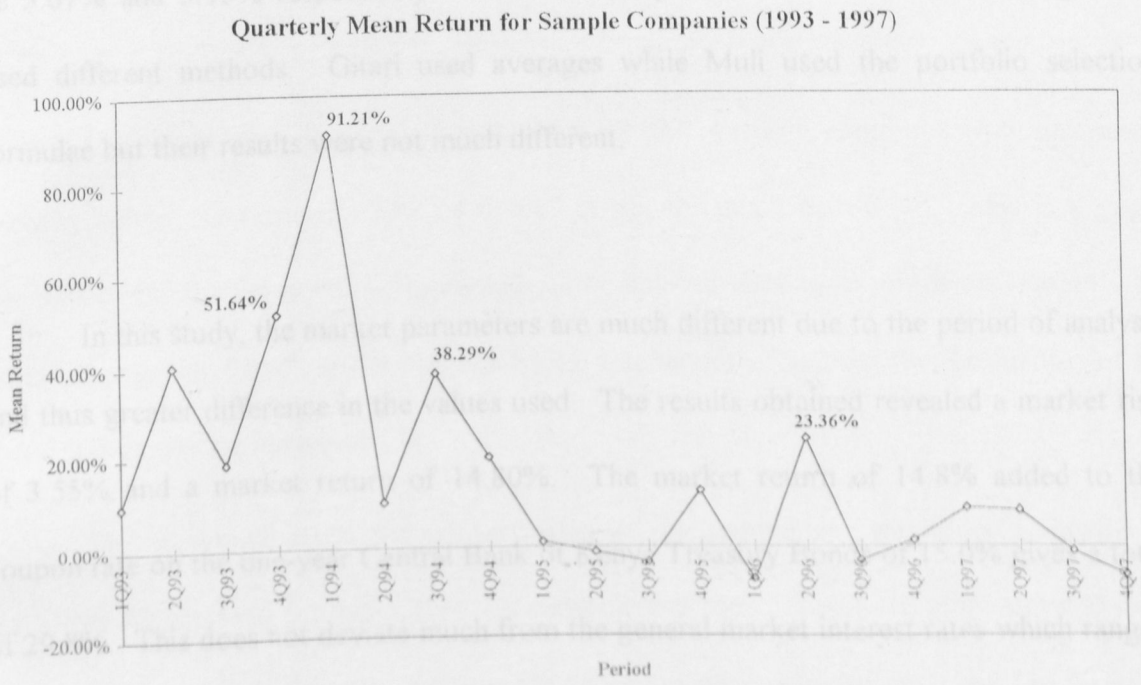
The table below shows the systematic risk and return at the Nairobi Stock Exchange.

Table 1

Market risk	3.55%
Market return	14.80%

The systematic risk of 3.55% is the excess risk undertaken by an investor when investing in the market portfolio at the Nairobi Stock Exchange. The return associated is the risk premium offered by the market for undertaking such risk. The basic program summarises the formula for computing risk as indicated under data analysis in chapter 3.

Below is a graphical analysis of quarterly mean returns for the portfolio over the five years period ending December 31, 1997.



The fourth quarter 1993 and first quarter 1994 experienced the highest mean returns of 51.6% and 91.21% respectively. This means that if an investor put in money in the portfolio at the beginning of the first quarter 1994, received dividends during the period and divested at the end of the quarter, they could have earned 91.21% return. This was just a few months before the Nairobi Stock Exchange was opened to foreign investors and share prices adjusted significantly. The Kenyan economy recorded GDP growth of 3.0% during the financial year 1994 up from 0.2% in 1993. The stock market being one of the measures of economic growth reflected this growth in the form of higher returns.

Gitari (1990) calculated quarterly return and risk for the market and found these to be, on the average, 6.0% and 3.6% respectively. Muli (1991), found the return and risk to be 5.67% and 3.95% respectively. These market parameters were stable although they used different methods. Gitari used averages while Muli used the portfolio selection formulae but their results were not much different.

In this study, the market parameters are much different due to the period of analysis and thus greater difference in the values used. The results obtained revealed a market risk of 3.55% and a market return of 14.80%. The market return of 14.8% added to the coupon rate on the one-year Central Bank of Kenya Treasury Bonds of 15.0% gives a total of 29.8%. This does not deviate much from the general market interest rates which ranged between 28% and 32% towards the end of 1997.

4.3: Average Beta for the Nairobi Stock Exchange

Table 2: Estimated beta for the NSE

Average beta	0.9002

The above table gives the average beta for the portfolio computed from individual security betas. The average beta of 0.9002 is not far much below 1.0. This is a good estimate of the market portfolio since only 46 companies were used out of the market's 57 equity companies listed on the Nairobi Stock Exchange. The beta for the market of all listed companies should equal 1.0.

The individual betas for all securities in the sample are shown in appendix 3. Securities whose beta is greator than 1.0 indicate that their returns are more variable than the market portfolio's returns. Returns for securities with negative betas are less variable than the portfolio's. Examples are Hutching Biemer, Carbacid Investments and Kenya Orchards.

CHAPTER 5: CONCLUSIONS, LIMITATIONS AND RECOMMENDATIONS FOR FURTHER RESEARCH

5.1. Conclusions

The systematic return risk has been estimated to be 3.55%. This can be interpreted as the excess risk undertaken by an investor in a portfolio of assets. The return of 14.80% is the reward associated with this risk.

The excess risk includes a small portion of unsystematic risk as noted by Muli (1991), which the market does not diversify. The portfolio beta of 0.902 is less than 1.0 as result of sampling. If data was available for all securities listed on the exchange then this could have been achieved.

Further diversification would lead to a lower risk depending on the risk associated with the additional securities.

5.2. Limitations of the Study

The study relied on the Mean-Variance model to determine the market risk and return. The Mean-Variance criterion has been questioned before. Other criteria such as the stochastic dominance, time dominance, Mean-Gini and the minimax model have been used as substitutes. Thus the results obtained in this study might be inferior to those attainable using a different analysis criteria.

Market capitalisation weights used as surrogates in computing the market portfolio return and risk might not necessarily reflect the value of assets used. This is because price is dependent upon other factors like demand and supply which are based on future expectations. The value of an asset is determined by the assets base and strength.

The sample size of 46 companies was used due to lack of data for some listed companies. This was due to short periods of trading since these securities were listed on the Nairobi Stock Exchange recently. Including them could have distorted the results. Sampling could have led to differences in the calculated market parameters.

5.3. Recommendations for Further Research

Future researchers should utilise all the listed securities to compute these market parameters. This will perhaps give a better feel of the overall market risk and return.

A different criterion of analysis should be used and not the Mean-Variance criterion. The results can then be compared with those obtained in previous researches.

However, the true market risk is subject to the availability of adequate data for all the securities in the market.

APPENDICES

APPENDIX 1: Quarterly Returns for Sample Companies

COMP. CODE	1993 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr
X1	0.3600	1.4082	0.0018	1.3030
X2	0.0000	0.0000	0.0000	0.3167
X3	0.5200	- 0.1053	0.1765	3.9250
X4	0.1538	0.1461	0.3400	0.6530
X5	0.0000	0.0000	0.0000	0.0092
X6	0.0870	0.0000	0.0600	3.0000
X7	0.0000	0.0000	1.3636	0.0577
X8	0.1563	10.0000	- 0.8512	2.6690
X9	0.0000	0.0000	0.0000	0.0000
X10	0.0000	0.0000	0.0000	0.1667
X11	0.1034	0.0938	0.0343	0.0286
X12	-0.0870	0.1476	0.1064	0.1154
X13	-0.0800	0.0435	0.1250	1.2593
X14	0.0000	0.4211	0.0000	0.0000
X15	0.2380	- 0.0548	- 0.0435	- 0.0303
X16	0.0000	- 0.1000	1.3333	0.0000
X17	0.1373	0.0121	0.3056	0.1471
X18	0.0909	0.0000	- 0.0417	0.0000
X19	0.0000	0.0000	0.0000	0.0000
X20	0.0602	0.3864	0.2705	0.4400
X21	-0.0156	- 0.0159	- 0.1935	0.3280
X22	0.3019	0.1304	0.0769	0.3810
X23	0.1692	0.0789	0.0146	0.5854
X24	-0.0370	0.0577	0.0364	0.4906
X25	-0.2333	- 0.1136	- 0.0769	0.3333
X26	0.0270	- 0.1579	0.0403	0.2381
X27	0.1667	0.0200	0.0588	0.7778
X28	0.2063	0.2132	0.2727	0.0595
X29	0.0000	0.3375	0.0000	0.0000
X30	0.3040	0.3607	0.3614	0.5636

COMP. CODE	1993 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr
X31	0.1250	0.3551	0.0069	0.8414
X32	0.1071	0.8182	0.4500	- 0.0216
X33	0.0436	0.2109	0.2462	0.2346
X34	0.1367	0.0299	0.1594	0.0225
X35	0.0000	0.0580	0.0351	- 0.0169
X36	0.3261	0.0000	0.1967	0.0000
X37	0.0000	- 0.0541	0.1714	1.6341
X38	0.1071	0.2581	0.1538	0.8889
X39	-0.0833	- 0.0909	0.6500	1.0303
X40	0.0984	0.1515	0.1711	0.1279
X41	0.2133	0.2500	0.9500	0.0000
X42	0.3333	1.5833	0.5484	1.0417
X43	0.0000	0.2500	0.0000	- 0.2000
X44	0.0919	0.3235	- 0.0222	- 0.0682
X45	0.2639	0.2048	0.9800	0.0787
X46	0.0000	1.0000	0.1000	0.3455

COMP. CODE	1994 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr
X1	- 0.3125	- 0.3341	0.0058	- 0.0819
X2	0.0000	0.0000	15.6667	0.0550
X3	0.3282	- 0.1004	- 0.3562	- 0.0345
X4	0.6364	- 0.2500	0.0685	- 0.1469
X5	0.0000	0.0000	- 0.1705	0.0000
X6	0.0050	0.2890	- 0.1959	0.0000
X7	0.3208	0.1429	0.0000	0.0250
X8	- 0.5924	0.1495	- 0.0165	- 0.0085
X9	0.0000	0.0000	0.0000	0.0000
X10	2.7500	- 0.3000	0.0833	- 0.0659
X11	- 1.0574	0.0326	- 0.3189	0.5238
X12	1.7034	0.2680	0.2990	0.1349
X13	0.3770	0.0417	0.2000	- 0.0381
X14	0.0000	0.4211	0.0000	0.0000
X15	0.7241	0.2600	0.0476	0.3053
X16	1.5000	- 0.2615	0.0833	0.1351
X17	2.0962	0.0085	0.0000	0.4895
X18	1.5217	0.0000	0.0000	- 0.1552
X19	0.0000	0.0000	4.5000	0.8182

COMP. CODE	1994 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr
X20	0.1317	0.0862	0.2540	0.2387
X21	1.3438	0.0000	- 0.3333	0.0300
X22	1.1552	- 0.1360	0.0509	0.2162
X23	- 0.1518	0.2515	- 0.1824	0.5000
X24	1.2133	- 0.0663	0.0400	0.2564
X25	0.8333	0.0952	- 0.1413	0.4051
X26	0.3590	0.2740	- 0.2214	0.4216
X27	0.3542	0.0323	0.0547	0.4538
X28	0.7753	- 0.2020	- 0.1282	0.0882
X29	0.5800	0.3038	0.0452	0.1442
X30	- 0.0378	0.1180	- 0.1944	0.0559
X31	- 0.4094	0.3517	- 0.2015	0.4423
X32	1.1116	0.1111	- 0.1692	0.2106
X33	0.8980	- 0.0289	- 0.0056	- 0.0689
X34	0.0000	1.7688	- 0.0818	- 0.0243
X35	0.8793	- 0.1800	0.0732	0.3133
X36	5.6667	0.2000	0.0854	0.0000
X37	0.1058	- 0.0870	- 0.0095	- 0.1827
X38	0.9136	- 0.0323	0.0733	- 0.0248
X39	0.0000	2.0769	- 0.4750	0.0667
X40	2.0825	- 0.2770	- 0.1355	0.2921
X41	2.6154	- 0.0851	- 0.2868	0.9435
X42	1.6735	- 0.1527	- 0.0802	0.2103
X43	0.0000	0.0000	0.0000	0.0000
X44	2.7902	- 0.1946	0.0000	0.5833
X45	0.9583	0.2054	- 0.1704	0.3514
X46	4.0000	- 0.3814	- 0.1412	1.0000

COMP. CODE	1995 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr
X1	- 0.2219	0.0194	- 0.3776	0.4615
X2	0.0000	0.0000	- 0.3500	- 0.0554
X3	- 0.1000	- 0.2976	- 0.2938	0.3920
X4	- 0.4481	0.4851	- 0.2825	0.3239
X5	- 0.2286	- 0.1852	0.0091	0.0545
X6	0.1117	0.1364	- 0.0034	0.0450
X7	0.9500	0.0256	0.2000	0.0573
X8	- 0.2759	- 0.1548	- 0.0797	0.0157
X9	0.0591	- 0.0698	0.0000	0.0000

COMP. CODE	1995 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr
X10	0.0976	- 0.1111	0.2000	- 0.0260
X11	- 0.0599	0.0139	0.0710	0.0510
X12	- 0.1714	- 0.1336	- 0.2111	0.3758
X13	- 0.2670	0.0357	- 0.0138	0.3427
X14	1.5263	0.0000	0.0000	0.0000
X15	- 0.0395	0.0616	- 0.0323	0.6213
X16	0.7378	- 0.4246	0.4634	- 0.3621
X17	- 0.2224	0.2201	- 0.1718	0.4463
X18	0.1429	- 0.1929	- 0.0265	0.0500
X19	- 0.3000	- 0.0750	- 0.0656	0.0744
X20	- 0.2581	0.0290	- 0.0704	0.2558
X21	0.0600	0.0566	- 0.0179	0.0509
X22	- 0.7778	0.1667	- 0.2357	0.0952
X23	- 0.2788	- 0.1765	0.0792	0.0196
X24	- 0.3263	- 0.0938	0.0776	0.0560
X25	- 0.1081	0.0000	0.0632	0.0808
X26	- 0.3138	- 0.0955	- 0.0167	0.0925
X27	- 0.2593	0.0500	0.0786	0.1806
X28	- 0.2297	0.0058	- 0.0233	0.2095
X29	- 0.0252	0.3448	- 0.3609	0.2850
X30	- 0.2517	0.0000	- 0.1204	0.1368
X31	- 0.4085	- 0.1462	- 0.1171	- 0.0816
X32	- 0.4904	0.1000	- 0.2448	0.3241
X33	0.0440	- 0.2847	0.1333	0.3235
X34	- 0.1200	- 0.0941	0.0390	0.1950
X35	- 0.2881	0.0232	0.2228	- 0.0667
X36	0.0200	- 0.0196	0.0120	0.0000
X37	- 0.0600	- 0.2819	0.3148	0.0704
X38	- 0.2500	- 0.1228	- 0.2600	0.0203
X39	0.8333	0.1010	- 0.0367	0.0000
X40	- 0.4087	0.0147	- 0.1942	0.0342
X41	0.0409	0.0719	- 0.0426	0.1889
X42	0.0085	0.0672	- 0.0420	0.0614
X43	2.8833	0.0000	0.4764	- 0.0116
X44	0.2484	0.0435	- 0.1167	- 0.0991
X45	- 0.4412	0.0000	- 0.1812	- 0.2434
X46	0.2676	0.2911	- 0.0783	0.4226

COMP. CODE	1996 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr
X1	- 0.1037	0.0412	0.0068	- 0.0508
X2	- 0.0917	0.0000	0.0000	0.0000
X3	- 0.2180	- 0.0379	0.0394	0.0606
X4	0.0106	0.0611	- 0.0350	0.0249
X5	0.0000	0.0000	- 0.4009	0.0294
X6	0.0148	0.0000	0.0038	0.0000
X7	0.0400	0.3846	0.0694	0.0179
X8	- 0.2248	0.1224	- 0.0364	0.1415
X9	- 0.8950	7.5238	0.0000	0.0000
X10	- 0.2193	- 0.0071	0.0072	- 0.0571
X11	0.0244	0.0119	- 0.0588	0.0050
X12	0.2037	- 0.0385	0.0080	0.0714
X13	0.0114	- 0.1236	0.0321	0.0559
X14	1.0625	0.0000	0.0000	0.0101
X15	- 0.0909	0.1200	0.0714	0.1417
X16	0.0473	0.0000	0.2129	0.0319
X17	- 0.1753	0.2203	0.1146	0.0292
X18	0.0693	- 0.0324	- 0.1674	- 0.0251
X19	- 0.0462	- 0.1855	- 0.2129	0.1321
X20	- 0.2903	0.0273	- 0.0796	- 0.0433
X21	0.0000	0.0000	0.0714	- 0.1333
X22	- 0.1217	- 0.1287	- 0.1295	0.0188
X23	- 0.1731	0.0605	- 0.1500	- 0.1634
X24	- 0.2172	0.3742	- 0.0821	0.2195
X25	- 0.2673	0.0890	0.1298	- 0.2149
X26	0.1005	- 0.1202	- 0.0852	- 0.1392
X27	- 0.2824	- 0.0427	- 0.0089	0.3846
X28	- 0.1235	0.0801	- 0.0698	0.0688
X29	0.0403	0.0388	- 0.1231	- 0.1228
X30	- 0.1132	0.0966	- 0.0415	0.1215

COMP. CODE	1996 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr
X31	- 0.2303	0.0846	- 0.0567	- 0.0526
X32	- 0.2762	0.2376	- 0.0720	0.0086
X33	- 0.1136	- 0.1038	- 0.0580	0.0000
X34	0.0667	- 0.1700	0.0723	- 0.0876
X35	- 0.0357	- 0.1111	- 0.3971	- 0.0732
X36	- 0.0040	- 0.0079	0.0400	- 0.0192
X37	0.0139	- 0.0616	0.0073	- 0.0217
X38	- 0.0464	- 0.0278	0.0000	- 0.0143
X39	- 0.8400	2.0952	- 0.1058	- 0.0753
X40	- 0.2435	0.1488	- 0.0466	0.1739
X41	- 0.0255	- 0.0408	0.0638	- 0.1000
X42	0.1570	0.0429	- 0.2754	0.0000
X43	0.0588	0.0000	0.0833	0.0000
X44	- 0.0457	0.1018	0.3043	0.2417
X45	0.0292	- 0.0058	- 0.1588	- 0.0909
X46	0.0563	0.0280	0.0458	0.0425

COMP. CODE	1997 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr
X1	- 0.1964	- 0.0815	- 0.0242	- 0.0909
X2	- 0.0459	0.0000	0.0000	0.5962
X3	0.0500	- 0.0272	0.8429	- 0.3333
X4	0.0359	0.0198	0.4706	- 0.3483
X5	0.0000	0.0000	0.0214	0.0000
X6	0.0192	- 0.2288	- 0.1500	- 0.0441
X7	0.0000	0.1299	0.2069	0.0381
X8	0.2712	0.1533	0.1529	- 0.0255
X9	0.0000	0.0000	0.0000	- 0.4413
X10	0.2273	- 0.3580	- 0.2692	- 0.1816
X11	0.0000	- 0.1500	- 0.0588	0.0125
X12	0.2462	0.0185	- 0.0303	0.0313
X13	- 0.0353	- 0.1341	- 0.1831	0.0172
X14	0.4100	0.0000	0.0000	0.0000
X15	- 0.4832	- 0.0625	- 0.2480	- 0.1702
X16	- 0.0103	0.6042	- 0.5844	0.2813
X17	- 0.3211	0.5811	0.0862	0.0536
X18	0.0309	0.0250	- 0.0244	0.0500
X19	0.7813	0.7544	1.0000	- 0.2200

COMP. CODE	1997 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr
X20	0.0251	0.0784	0.0091	0.1495
X21	0.2692	0.0833	- 0.0490	0.0441
X22	0.1053	0.2381	- 0.2308	- 0.1200
X23	- 0.0547	0.0000	- 0.1570	- 0.1471
X24	0.3214	0.1243	- 0.3150	0.0657
X25	0.3008	- 0.0208	- 0.1489	- 0.0475
X26	0.2132	0.0364	- 0.1084	- 0.0068
X27	0.3542	0.2234	- 0.1174	- 0.2143
X28	- 0.0488	0.2308	0.0417	0.0000
X29	0.0600	0.1887	- 0.3373	0.0438
X30	0.0000	0.0053	0.0000	0.0444
X31	0.0159	- 0.0161	- 0.1639	0.0588
X32	- 0.0627	0.4063	0.1200	- 0.1101
X33	0.1377	0.0629	- 0.0658	- 0.0704
X34	0.0688	- 0.0175	- 0.1071	- 0.1200
X35	0.2737	0.0192	0.0849	- 0.1391
X36	0.1569	- 0.0847	0.6852	- 0.7802
X37	- 0.0560	0.1186	- 0.0303	- 0.0938
X38	- 0.0217	- 0.0074	- 0.1418	- 0.1478
X39	0.7805	0.2055	- 0.2045	- 0.4094
X40	0.2277	0.0000	- 0.2125	0.1111
X41	- 0.1822	0.3056	- 0.1170	- 0.1084
X42	0.3600	0.0882	- 0.1643	- 0.1752
X43	0.0000	0.0000	- 0.0051	0.0000
X44	- 0.1986	- 0.4956	0.0234	0.1657
X45	- 0.0462	0.0403	- 0.1163	- 0.0789
X46	- 0.2975	0.3622	0.0933	- 0.2146

Notes to Appendix 1: The company codes X1 to X46 refer to the listed companies as indicated in appendix 2. To exemplify, the code X1 in appendix 1 refers to company number 1 (Brooke Bond Kenya) in appendix 2, in that order.

APPENDIX 2: List of Sample Companies and Weights

	COMP. CODE	*Mkt. Cap. (Ksh mlns)*	*Weights*
AGRICULTURAL SECTOR			
1 BROOKE BOND KENYA	X1	5,376.25	0.05250
2 EAAGADS LIMITED	X2	266.90	0.00261
3 GEORGE WILLIAMSON KENYA	X3	753.04	0.00735
4 KAKUZI LTD.	X4	1,881.60	0.01837
5 KAPCHORUA TEA	X5	273.84	0.00267
6 LIMURU TEA	X6	150.00	0.00146
7 OL PEJETA RANCHING	X7	163.50	0.00160
8 SASINI TEA & COFFEE	X8	2,381.91	0.02326
9 THETA GROUP	X9	9.64	0.00009
COMMMERCIAL & SERVICES SECTOR			
10 A. BAUMANN & COMPANY	X10	59.71	0.00058
11 CAR & GENERAL	X11	326.09	0.00318
12 CMC HOLDINGS	X12	971.20	0.00948
13 EXPRESS KENYA	X13	283.20	0.00277
14 HUTCHINGS BIEMER	X14	63.45	0.00062
15 LONRHO MOTORS	X15	2,486.68	0.02428
16 MARSHALLS EAST AFRICA	X16	590.12	0.00576
17 NATION PRINTERS & PUBLISHERS	X17	2,335.25	0.02280
18 PEARL DRYCLEANERS	X18	16.78	0.00016
19 STANDARD NEWSPAPERS GROUP	X19	453.79	0.00443
FINANCIAL SECTOR			
20 BARCLAYS BANK	X20	14,787.56	0.14440
21 CITY TRUST	X21	141.65	0.00138
22 CFC BANK	X22	1,760.00	0.01719
23 DIAMOND TRUST BANK	X23	1,729.13	0.01689
24 I.C.D.C. INVESTMENTS COMPANY	X24	974.83	0.00952
25 HOUSING FINANCE COMPANY	X25	1,752.60	0.01711
26 JUBILEE INSURANCE	X26	1,102.50	0.01077
27 KENYA COMMERCIAL BANK	X27	8,639.40	0.08436
28 NIC BANK	X28	3,296.58	0.03219
29 PAN AFRICA INSURANCE	X29	542.75	0.00530
30 STANDARD CHARTERED BANK	X30	7,582.14	0.07404

INDUSTRIAL SECTOR	*COMP. CODE*	*Mkt. Cap. (Ksh mlns)*	*Weights*
31 B.A.T. KENYA	X31	3,750.00	0.03662
32 BAMBURI CEMENT	X32	13,155.78	0.12847
33 BOC KENYA	X33	1,284.69	0.01255
34 CARBACID INVESTMENTS	X34	622.91	0.00608
35 CROWN BERGER	X35	213.54	0.00209
36 DUNLOP KENYA	X36	200.00	0.00195
37 E.A. CABLES	X37	587.25	0.00573
38 E.A. PACKAGING	X38	376.32	0.00367
39 E.A. PORTLAND CEMENT	X39	1,800.00	0.01758
40 KENYA BREWERIES	X40	4,539.71	0.04433
41 KENYA NATIONAL MILLS	X41	995.09	0.00972
42 KENYA OIL CO.	X42	347.40	0.00339
43 KENYA ORCHARDS	X43	7.76	0.00008
44 KENYA POWER & LIGHTING	X44	9,495.36	0.09272
45 TOTAL KENYA	X45	2,940.00	0.02871
46 UNGA GROUP	X46	937.18	0.00915
TOTAL MARKET CAPITALISATION		**102,405.06**	**1.00000**

APPENDIX 3: List of Companies and their Average betas

	COMP. CODE	*AVERAGE BETA*
AGRICULTURAL SECTOR		
1 BROOKE BOND KENYA	X1	0.0462
2 EAAGADS LIMITED	X2	0.2261
3 GEORGE WILLIAMSON KENYA	X3	0.0995
4 KAKUZI LTD.	X4	0.0499
5 KAPCHORUA TEA	X5	0.0057
6 LIMURU TEA	X6	0.0638
7 OL PEJETA RANCHING	X7	0.0044
8 SASINI TEA & COFFEE	X8	0.1889
9 THETA GROUP	X9	0.0559
COMMMERCIAL & SERVICES SECTOR		
10 A. BAUMANN & COMPANY	X10	0.1419
11 CAR & GENERAL	X11	0.0488
12 CMC HOLDINGS	X12	0.0881
13 EXPRESS KENYA	X13	0.0519
14 HUTCHINGS BIEMER	X14	- 0.0257
15 LONRHO MOTORS	X15	0.0378
16 MARSHALLS EAST AFRICA	X16	0.0626
17 NATION PRINTERS & PUBLISHERS	X17	0.1025
18 PEARL DRYCLEANERS	X18	0.0716
19 STANDARD NEWSPAPERS GROUP	X19	0.0561
FINANCIAL SECTOR		
20 BARCLAYS BANK	X20	0.0314
21 CITY TRUST	X21	0.0626
22 CFC BANK	X22	0.0779
23 DIAMOND TRUST BANK	X23	0.0175
24 I.C.D.C. INVESTMENTS COMPANY	X24	0.0773
25 HOUSING FINANCE COMPANY	X25	0.0496
26 JUBILEE INSURANCE	X26	0.0206
27 KENYA COMMERCIAL BANK	X27	0.0380
28 NIC BANK	X28	0.0426
29 PAN AFRICA INSURANCE	X29	0.0363
30 STANDARD CHARTERED BANK	X30	0.0172

INDUSTRIAL SECTOR

31 B.A.T. KENYA	X31	0.0141
32 BAMBURI CEMENT	X32	0.0724
33 BOC KENYA	X33	0.0535
34 CARBACID INVESTMENTS	X34	- 0.0049
35 CROWN BERGER	X35	0.0489
36 DUNLOP KENYA	X36	0.2677
37 E.A. CABLES	X37	0.0412
38 E.A. PACKAGING	X38	0.0784
39 E.A. PORTLAND CEMENT	X39	0.0283
40 KENYA BREWERIES	X40	0.1109
41 KENYA NATIONAL MILLS	X41	0.1271
42 KENYA OIL CO.	X42	0.1287
43 KENYA ORCHARDS	X43	- 0.0337
44 KENYA POWER & LIGHTING	X44	0.1310
45 TOTAL KENYA	X45	0.0595
46 UNGA GROUP	X46	0.2069

APPENDIX 4: BASIC PROGRAM

```
5 REM PRG TO CALCULATE MARKET RISK AND RETURN
6 REM VAR. DFNS : A$ = CO. CODE, A1 = RETURN, A2 = RISK, B=WEIGHT
7 REM C=RETURNS MATRIX FOR COVARIANCE CALCULATIONS
8 REM LINE 1O-80 INITIALIZE VARIABLES AND SET ARRAYS
10 DIM A$(46), A1(46), A2(46), C(46, 21), M(1, 21), Q(46)
15 FOR D = 1 TO 46
20 READ A$(D), A1(D), A2(D)
25 NEXT D
30 B1 = 0
35 FOR E = 1 TO 46
40 READ B(E)
45 B1 = B1 + B(E)
50 NEXT E
55 FOR F = 1 TO 46
60 FOR G = 1 TO 21
65 READ C(F, G)
70 NEXT G
75 NEXT F
77 FOR R = 1 TO 46
78 READ Q(R)
79 NEXT R
80 T = U = V = W = X = Y = S10 = S30 = 0
85 FOR I = 1 TO 46
90 FOR J = 1 TO 46
95 IF I = J THEN 125
100 GOSUB 600
105 X = X + ((B(I) * B(J)) / (B1) ^ 2) * (A2(I) * A2(J)) * W
110 Y = Y + ((B(I) / B1) ^ 2 * (A2(I) ^ 2))
115 Z = (X + Y) ^ 1 / 2
120 NEXT J
125 V = V + (B(I) / B1 * A1(I))
130 NEXT I
133 PRINT "MARKET PARAMETERS"
134 PRINT "----------"
135 PRINT "MARKET RISK = ", TAB(30); Z * 100; "%"
140 PRINT "MARKET RETURN = ", TAB(30); V * 100; "%"
141 PRINT "----------"
145 PRINT
150 N = S1 = T = T1 = N1 = 0
155 FOR I = 2 TO 21
160 H = 0
```

```
170 FOR J = 1 TO 46
180 H = H + (C(J, I) * B(J) / (B1))
190 NEXT J
200 M(1, I) = H
210 N1 = N1 + M(1, I)
215 N = N1 / (20 * 25)
220 NEXT I
230 FOR K = 1 TO 46
240 FOR L = 2 TO 21
250 T1 = T1 + ((C(K, L) - A1(K) * (M(1, L) - N) / 400))
260 NEXT L
270 T = T + T1
280 NEXT K
300 S1 = (X) ^ 1 / 2
310 PRINT "FULLY DIVERSIFIED MARKET PORTFOLIO"
320 PRINT "----------------------------------------"
330 PRINT "MARKET RISK =", TAB(30); S1 * 100; "%"
340 PRINT "----------------------------------------"
350 GOTO 650
600 W1 = 0
605 FOR K = 2 TO 21
610 W1 = W1 + ((C(I, K) - A1(I) * (C(J, K) - A1(J))) / 400)
615 NEXT K
620 W = W1 / (A2(I) * A2(J))
625 RETURN
650 U = 0
655 FOR O = 1 TO 46
660 U = U + Q(O) * (B(O) / B1)
665 NEXT O
670 PRINT "AVERAGE BETA FOR COMPANIES = ", U
900 END
```

NOTE: Data for the computations is as shown in appendix 1 for returns matrix, appendix 5 for risk and returns, and appendix 3 for average betas. The weights used are as indicated in appendix 2.

Results of the Basic Program run:

Market risk = 3.550562%

Market return = 14.80027%

Fully diversified risk = 3.012534%

Average beta of companies = 0.900231

APPENDIX 5: Returns and Risk for sample companies

	Mean	*RISK*
AGRICULTURAL SECTOR	*Return*	*(STD DEV)*
1 BROOKE BOND KENYA	0.0866	0.4664
2 EAAGADS LIMITED	0.8046	3.4139
3 GEORGE WILLIAMSON KENYA	0.2215	0.9000
4 KAKUZI LTD.	0.0959	0.3056
5 KAPCHORUA TEA	-0.0431	0.1104
6 LIMURU TEA	0.1575	0.6613
7 OL PEJETA RANCHING	0.2015	0.3418
8 SASINI TEA & COFFEE	0.5783	2.2569
9 THETA GROUP	0.3088	1.6689
COMMMERCIAL & SERVICES SECTOR		
10 A. BAUMANN & COMPANY	0.0968	0.6286
11 CAR & GENERAL	0.0709	0.2700
12 CMC HOLDINGS	0.1529	0.3880
13 EXPRESS KENYA	0.0833	0.3098
14 HUTCHINGS BIEMER	0.1926	0.4025
15 LONRHO MOTORS	0.0668	0.2673
16 MARSHALLS EAST AFRICA	0.1844	0.5175
17 NATION PRINTERS & PUBLISHERS	0.2028	0.4907
18 PEARL DRYCLEANERS	0.0658	0.3437
19 STANDARD NEWSPAPERS GROUP	0.3478	1.0231
FINANCIAL SECTOR		
20 BARCLAYS BANK	0.0850	0.1846
21 CITY TRUST	0.0789	0.3205
22 CFC BANK	0.0528	0.3526
23 DIAMOND TRUST BANK	0.0062	0.2229
24 I.C.D.C. INVESTMENTS COMPANY	0.1098	0.3270
25 HOUSING FINANCE COMPANY	0.0479	0.2555
26 JUBILEE INSURANCE	0.0269	0.1906
27 KENYA COMMERCIAL BANK.	0.1132	0.2538
28 NIC BANK	0.0713	0.2140
29 PAN AFRICA INSURANCE	0.0721	0.2214
30 STANDARD CHARTERED BANK.	0.0705	0.1956

INDUSTRIAL SECTOR		
31 B.A.T. KENYA	0.0199	0.2894
32 BAMBURI CEMENT	0.1279	0.3624
33 BOC KENYA	0.0768	0.2367
34 CARBACID INVESTMENTS	0.0868	0.3982
35 CROWN BERGER	0.0337	0.2557
36 DUNLOP KENYA	0.3237	1.2514
37 E.A. CABLES	0.0749	0.3782
38 E.A. PACKAGING	0.0659	0.3031
39 E.A. PORTLAND CEMENT	0.2759	0.7483
40 KENYA BREWERIES	0.1058	0.4899
41 KENYA NATIONAL MILLS	0.2327	0.6309
42 KENYA OIL CO.	0.2643	0.5380
43 KENYA ORCHARDS	0.1768	0.6336
44 KENYA POWER & LIGHTING	0.1839	0.6391
45 TOTAL KENYA	0.0789	0.3472
46 UNGA GROUP	0.3471	0.9085

REFERENCES

Blume, E. M., "Price, Beta, and Exchange Listing," The Journal of Finance, May 1973.

Bower, R. S. and Wippern, R. F., "Risk-Return measurement in portfolio selection and Journal of Financial and Quantitative Analysis, Vol. IV No. 4, December 1296.

Bowman, E. H., "A Risk/Return Paradox for Strategic Management", Sloan Managemnt Review, 1980.

Bowman, R. G., "The Theoretical Relationship Between systematic Risk and Financial (Accounting) Variables", The Journal of Finance, 34, No.3, June 1979, pp 747 - 749.

Chen, S. N. and Brown, S. J., "Estimation Risk and Simple Rules for Optimal Portfolio Selection", The Journal of Finance, 38, No. 4, September 1983, pp. 1087 - 1093.

Christy, G. A. and Clendin, J. C., (1982), "Introduction to Investments", 8th Edition, McGraw-Hill Book Company.

Conover, W. J., "Practical Nonparametric Statistics, John Wiley and Sons (New York), 1980, 2nd Edition.

Ekern, S., "Time Dominance Efficiency Analysis" , The Journal of Finance, December 1981.

Fabozzi, F. J. and Francis, J. C., "Beta as a Random Coefficient", Journal of Financial and Quantitative Analysis, March 1978.

Fiegenbamn, A and Thomas, H. , "Attitudes Towards Risk and the Risk Return Paradox: Prospect Theory Explanations", Academy of Management Journal, March 1988.

Gichana, M. J., "Assessment of the Systematic Risk and Securities on the Nairobi Stock Exchange in Inflationary Conditions", Unpublished MBA Project, University of Nairobi, 1994.

Gitari, A., "An Empirical Investigation into the Risk-Return Relationship Among Kenyan Publicly Quoted Companies" Unpublished MBA Project, University of Nairobi, 1990.

Green, R. C., "Positively Weighted Portfolios on Minimum Variance Frontier", The Journal of Finance", No. 5, December 1986, pp. 1051 - 1069.

Hanoch; Go and H. Levy, "Relative Effectiveness and Efficiency Criteria for Portfolio Selection, "Journal of Finance and Quantitative Analysis, Vol. V(1), March 1970.

Jarrow, R., "Heterogeneous Expectations, Restriction on Short Sales and Equilibrium Asset Prices", The Journal of Finance, 35, No. 5, December 1980, pp. 1105-1113.

Karanja, J. M., "Dividend Practice of Publicly Quoted Companies in Kenya ", Unpublished MBA Project, University of Nairobi, 1987.

Kroll, Y., Levy, H., and Markowitz, H. M., "Mean Variance Versus Direct Utility Maximisation", The Journal of Finance 39, No. 1, March 1984,pp. 47-61.

Laughbumn, D. J., et al., "Managerial Risk Preferences for Below Target Returns," Management Science, 26, 1980.

March J. G. and Shapira Z., "Managerial Perspective on Risk and Risk Taking", Journal of Management Science Vol. 33 (II); November 1987.

Markowitz H. M., "Portfolio Selection", Journal of Finance March 1952

Meyer, J., "Mean-Variance, Efficient Sets and Expected Utility," The Journal of Finance, 34, No. 53, December 19798, pp. 1221-1229.

Muli, S. M., "Estimating the Systematic Return-Risk for the Nairobi Stock Exchange", Unpublished MBA Project, University of Nairobi, 1991.

Nairobi Stock Exchange, "Monthly Bulletin", Vol. I No. 5, December 1995

Nairobi Stock Exchange, "Monthly Bulletin", Vol. II No. 12, December 1996

Obonyo, E. A., "Investigation into the Existence and Characteristics of the Dividend Yield Clientele Phenomenon Among the Equity Stock Investors in Kenya", Unpublished MBA Project, University of Nairobi, 1989.

Phillips, H.E. and Richie, J.C., (1983), Investment Analysis and Portfolio Selection, 2nd edition, South-Western Publishing Co., Cincinnati.

Robicheck, A. A. "Risks and the Value of Securities", Journal of Financial and Quantitative Analysis, December, 1969.

Shalit, H. and Yitzhaki, S., "Mean-Gini, Portfolio Theory, and the Pricing of Risky Assets", The Journal of Finance, 39, No. 5 December 1980, pp.1449-1469.

Sharma, M., "Factors Considered Important by Multinational Firms when Deciding on the Host Country to Invest In", A Case Study of Kenya ,1989.

Sharpe, W.F., Risk Aversion in the Stock market, Journal of Finance, September 1965.

Sharpe, W.F. and Cooper, G., "Risk-Return Classes of New York Stock Exchange Common Stocks," Financial Analysts Journal, March/April 1972.

Weston, J .F and Copeland, T. E, (1986), Managerial Finance, 8th edition, The Dryden Press, Orlando, Florida.

Williams, A. O. and Pfeifer, P., "Estimating Security Price Risk Using Duration and Price Elasticity", The Journal of Finance, May 1982.