A COMPARATIVE TECHNICAL PORTFOLIO RETURN-RISK ANALYSIS IN A SEGMENTED EQUITY MARKET --- A CASE OF NAIROBI STOCK EXCHANGE: 2001-2005

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DECLARATION

I declare that this is my original work and that it has never been presented for a degree at the University of Nairobi or any other institution of higher learning.

CHERUTICH PETER KIPKOECH

SIGNATURE: _____ DATE 06/09/2010

This proposal has been submitted for examination with my approval as university supervisor

PROF. PATRICK WEKE

SIGNATURE: _____ DATE 06/09/2010

DEDICATION

This study is dedicated to my parents Mr. and Mrs Cherutich for their upbringing, mentoring and the enormous support they continuously accorded me throughout the period of my studies and project work.

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I would like to express my deep appreciation to my supervisor, Prof. Weke for his insightful guidance and assistance at every stage of writing this project; I thank my family for their encouragement, support and constant prayers.

Special thanks, to all those who have provided the necessary support during my entire course.

ACRONYMS AND ABBREVIATIONS

ADRS	**American Depository Receipts**
CAPM	**Capital Assets Pricing Model**
CBK	**Central Bank of Kenya**
CMA	**Capital Markets Authority**
IFC	**International Finance Corporation**
IPO	**Initial Public Offers**
NSE	**Nairobi Stock Exchange**
MIMS	**Main Investment Market Segment**
MPT	**Modern Portfolio Theory**
AIMS	**Alternative Investment Market Segment**
FISMS	**Fixed Income Securities Market Segment**
SIC	**Security Investments Code**
SMM	**Single Market Model**
US	**United States**
US$	**United States Dollar**

DEFINITION OF TERMS

BONUS ISSUE

These are additional shares issued to existing shareholders without further payment on their part. It involves capitalization of reserves, that is , turning the reserves into fully paid new share capital.

BOOK VALUE OF EQUITY

The sum of cumulative retained earnings and other balance sheet entries classified under ordinary shareholders funds such as ordinary shares and share premium.

BROKER

A member of the stock exchange who facilitates the buying and selling of shares and bonds for investors.

DIVERSIFICATION

The process of adding securities to a port in order to reduce the portfolio's total risk.

DIVIDEND

These are monies paid out of distributable profits and a paid in proportion to the number of shares held.

EARNINGS YIELD

This is earnings per share as a percentage of current market prices per share.

INVESTMENT

The sacrifice of certain present value for future value.

LISTED COMPANY

An issuer any part of whose shares have been listed.

MARKET INDEX

This is a collection of shares and, at times bonds, whose prices are averaged to reflect the investment performance of a particular market of financial assets e.g. the NSE 20 share index.

MARKET PORTFOLIO

This is a portfolio consisting of investment in all securities representative of the market

MARKET CAPITALIZATION

This is the total value of a security. It is calculated by multiplying the market price of per unit to the number of outstanding units of security.

PERFECT MARKETS

These are securities markets in which no impediments to investing exist. Impediments include taxes, transaction costs, and costly information.

PORTFOLIO MANAGER

A manager who uses the information provided by financial analysts to construct and manage a portfolio of financial assets.

RISK

The uncertainty associated with the end of period value of an investment in an asset or portfolio of assets.

SPECULATOR

An investor in securities whose primary objective is to make profit from purchases and sales of shares and bonds.

TREASURY BILLS

This is a redeemable financial security, normally with a life of three months, issued by the Central Bank of Kenya on behalf of the government.

ABSTRACT

The study focused on comparative evaluation of portfolio analysis models of Modern Portfolio Theory and Capital Asset Pricing Model using historical data of stock prices, trading volumes of shares, the NSE 20 share indices and the 91-day treasury bill rates for the years 2001 to 2005. Chapter one introduced portfolio analysis in the context of a fund such as pension schemes and outlined the historical development of the Nairobi Stock Exchange. The study then described the research problem as the challenge of selecting and managing an optimal portfolio in a vibrant stock market such as the Nairobi Stock Exchange. The study objectives included the selection of an optimal portfolio based on the most actively traded stocks at the segmented NSE, a comparative evaluation of the MPT and CAPM portfolio analysis models as well as recommendations based on the study findings.

Chapter two did a theoretical review of portfolio analysis and management, fundamental analysis, technical analysis, market segmentation theory, risk, the relationship between risk and market segmentation, and the efficient market hypothesis. An empirical review of past global studies on the standard finance theories and studies on portfolio analysis and finance theories based on the Nairobi Stock Exchange was done.

The portfolio analysis models of the Modern Portfolio Theory and the Capital Asset Pricing Model were described in chapter three. In each model, a historical background is given, the assumptions explained, the model is developed with their formulae and graphs and their past criticisms and limitations discussed.

The study methodology described in chapter four included the research design which was an event study descriptive case study on the Nairobi Stock Exchange, the target population, the sample frame and sample design mainly comprised of the most actively traded stocks at the NSE, data collection procedures as well as data analysis techniques which involved the use of MS EXCEL spreadsheet and the statistical SPSS software in the comparative evaluation of returns and risks from the three techniques of the Single Market Model, the Modern Portfolio Theory and the Capital Asset Pricing Model. The study findings were then outlined with significant

variations in the returns from the three techniques. The overall average returns for the same portfolio of eight selected stocks yielded returns of 13, 49 and 5 percent from the SMM, MPT and CAPM portfolio analysis models respectively.

In order to establish the statistical significance of the study findings on the returns, a correlation analysis, a regression analysis, the student t-test and a chi-square analysis all indicating that the MPT and CAPM portfolio analysis techniques were not accurate in predicting the historically observed returns calculated using the Single Market Model. However, the CAPM was better than the MPT model in accuracy because it incorporated more parameters such as standard deviation, beta, covariance, the NSE 20-share index and the 91-day tax free rate in its calculations making it more realistic compared with MPT which relied on weighted average returns.

The study concluded in chapter five that the MPT model exaggerated positive returns because of the weighting factors of the traded volumes. The fact that both MPT and CAPM models ignored dividends reduced their accuracy and pragmatism compared with the SMM model. The study noted that CAPM included more parameters such as the standard deviation, beta, covariance, the NSE 20-share index and the 91-day treasury bill rate in its calculations making it more realistic compared with MPT which relied on weighted average returns.

On the MPT model, the study recommended that the weighting factors in the form of traded volumes of stocks can be adjusted so that they do not magnify positive changes in the prices of shares. A trend analysis such as decomposition and cyclical variations could be incorporated so that the weighting factors are more accurate.

The study made recommendations on how to improve both the MPT and CAPM models. For example, the weighted mean concept of the MPT model could be improved by introducing geometric means instead of arithmetic mean used at the moment.

The study recommended that the MPT models adjusts its recommendations so that they are more realistic of the capital markets in the real world. Although, removing some of the assumptions

would complicate the MPT calculations, the study recommended that this was justified given the study findings which revealed that the MPT returns were not accurate in estimating portfolio returns.

On the CAPM model, the study recommended that the use of the 91-one day treasury bill rate as the risk free rate used in the CAPM model could further be improved through globalization into an international standard such as the European Union rate, the United States of America treasury bill rate or even a rate from the International Monetary Fund. This will have the impact of globalizing the research findings and anchor the results on a larger and stable economic basis.

The CAPM model assumes that the variance of returns is an adequate measurement of risk. This might be justified under the assumption of normally distributed returns, but for general return distributions other risk measures (like coherent risk measures) will likely reflect the investors' preferences more adequately. Indeed risk in financial investments is not variance in itself, rather it is the probability of losing: it is asymmetric in nature. The model assumes that all investors have access to the same information and agree about the risk and expected return of all assets.

The study therefore recommended that a more concise risk measurement which include fundamentals such as Earnings Per Share, industry issues and the macro-economic outlook be adopted under CAPM calculations.

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CHAPTER 1: INTRODUCTION AND BACKGROUND

1.1 INTRODUCTION

Actuaries, financial economists, and statisticians have always made an attempt to study the equities markets around the world with an aim of scientifically predicting equity returns in a risky business and economic environment (Brealy R.A., Merys S.C., and Marcus J.A., 2007). Traditionally, investment analysts have attempted to identify undervalued stocks to buy and overvalued stocks to sell. With time, schools of thoughts such as technical analysis, fundamental analysis, efficient market hypothesis and behavioural finance have emerged as models of prediction of returns of individual stocks, a portfolio and sometimes in an industry.

Investors and investment analysts who attempt to achieve superior returns by spotting and exploiting patterns in stock prices from historical data are called technical analysts(Elton E.J., Gruber M.J. 1995). They try to beat the market by buying stocks when their prices are rising and sell them when their prices are falling. The technical analysts believe that the forces of demand and supply are reflected in the patterns of price and volume of stocks traded.

Fundamental analysts, however are investors and investment analysts who forecast stock prices on the basis of economic, industry, and company statistics (Fischer E.D., Jordan J.R. 2009). The fundamentalist makes a judgement of the stock value with a risk-return framework based upon earning power and the economic environment. The principal decision variables ultimately take the form of earnings and dividends.

In recent years, the influence of the efficient market hypothesis (sometimes known as the random walk theory) has suggested that stock prices nearly always fully reflect all available information. As a result, it would be exceedingly difficult for the average investor and analyst to earn exceptional returns especially on a consistent basis on the basis of technical and fundamental analysis (Weaver C.S., Weston F.J., 2009).

Some scholars however, believe investors behaviour and psychology play an important role in determining share prices apart from the fundamentals(Brealy R.A., Merys S.C., and Marcus J.A., 2007). They cite the fact that investors are not always 100 percent rational 100 percent of the time. To this end, investors have been observed to be risk averse and tend to have the tendency to assume that historical prices and returns will recur in the future. Once an investor has suffered a loss, they may even be more cautious not to risk a further loss. On the other hand, an investor who places too much weight on recent events may judge that glamorous growth companies are very likely to continue to grow rapidly, even though very high rates of growth can continue to grow indefinitely. Speculative retail investors in Kenya who were encouraged by the increase in prices immediately after the initial public offers of Kengen, Kenya Airways, Mumias Sugar and Kenya Commercial Bank have been disappointed by Safaricom whose share price dropped from the initial Kenya Shillings 5 after the initial public offer. Behavioural economists have also observed herd mentality where investors move from one stock to another like a herd irrespective of the fundamentals of the stocks(Fischer E.D., Jordan J.R. 2009).

Against this background, investors and more so fund managers, investment analysts and financial advisors have the onerous task of ensuring high returns for their portfolios in a risky business and economic environment (Weaver C.S., Weston F.J., 2009). They should believe in long term, fundamental value-oriented investing and continuously fine-tune their approach to adapt to changing conditions. It is important they understand that significant inefficiencies exist in the equities market. These inefficiencies include information asymmetry where professional investment analysts deliberately source information such as financial statements and relevant events such as new company products, innovations and management changes and use it in their equity risk-return analyses. By combining traditional analysis with innovative technology, fund managers must add value by exploiting these inefficiencies across sectors. They should emphasis the value of active management by utilizing multiple investment strategies, including active sector and issuer selection. This is especially true in a market segmented into counters such as agricultural, financial, industrial and commercial services as is the case in the Nairobi Stock Exchange.

To help realize the fund's financial and investment goals, it is important that fund managers employ an investment evaluation process based on sound, well-proven portfolio analysis models and economic practices(Fischer E.D., Jordan J.R. 2009). The first step is to review the fund's investment goals which should be broad, yet clearly defined for each pool of assets. For example, investment goals of defined benefits pension plans might be to ensure the present and future liabilities of the pension plan are met and to be cost-effective while attempting to outperform the fund's financial resources. Other investment goals might be to maximize shareholder wealth and value. For funded depreciation, the investment goals might be to have adequate funds to meet planed capital expenditures.

Once goals have been defined, it is important to tie them to specific investment objectives (Weaver C.S., Weston F.J., 2009). A portfolio manager should find the right fit of an investment strategy to a specific investment objective. A fund manager should project obligations such as pension lump sum and annuity payments and identify the return to meet these obligations. The next step is to discount these obligations to a present value. It is important to examine a portfolio's and a fund's investment allocation strategy. Evaluation of policy asset allocation ultimately improves portfolio returns. Establishing policy allocation targets represents the heart of the investment process. Asset allocation policy plays a very important role in determining a fund's ultimate performance. Prudence requires that a thorough review of each pool's policy asset allocation when capital market expectations or the fund's risk profile has changed. The review should examine the asset classes within the policy portfolio.

A consideration of adding uncorrelated higher yielding asset classes to the policy asset allocations such as bonds, equities, real estate, unit trusts and private equity in order to improve the risk-return characteristics of the policy allocations. It has been demonstrated that including international equities in a portfolio yields better returns than a fully domestic equities portfolio (Elton E.J., Gruber M.J. 1995). Both Jorion and Grauer Hakanson advocated for international diversification by forming an optimal portfolio of international and domestic securities using historical data and comparing the returns to an exclusively domestically held portfolio over the same period. A portfolio manager needs to take care when including these options or changing asset weightings. The evaluation and analysis is done to improve the likelihood of success, not

to chase returns or time the market. It is important to consider the portfolio's re-balancing plans. A well-reasoned re-balancing plan improves returns without adding more risk.

The portfolio fund's board needs to discuss the asset allocation policy(Fischer E.D., Jordan J.R. 2009). The portfolio fund manager should explain to the board the reasons for the need to change the policy allocations or weightings. The manager should explain to the board how these changes will contribute to the realization of the fund's objectives and why these changes should be made at that particular time. It is important for the board to discuss the risk-return associated with these changes and possible implications for the portfolio. Focus should then shift to the best way to implement the investment policy statement and possible implications for the portfolio.

1.2 BACKGROUND

1.2.1 The history of Nairobi Stock Exchange (NSE)

In Kenya, dealing in shares and stocks started in the 1920s when the country was still a British colony. There was however, no formal market, nor rules or regulations to govern stock broking activities. Trading took place on a gentleman's agreement, in which standard commissions were charged with clients being obligated to honor their contractual commitments of making good delivery and settling relevant costs. At that time, stock broking was a sideline business conducted by accountants, auctioneers, estate agents and lawyers, who met to exchange prices over a cup of coffee. Since these firms were engaged in other areas of specialization, the need for association did not arise.

The NSE was constituted in 1954 as a voluntary association of stockbrokers registered under the societies Act. This was made possible after clearance was obtained from the London Stock Exchange which recognized the NSE as an Overseas Stock Exchange. This was important because an exchange not recognized by the leading stock exchange was of little value and credibility. The business of dealing in shares was then confined to the resident European community, since Africans and Asians were not permitted to trade in securities until after the attainment of independence in 1963. This partly explains why it was difficult to convince the

local people, who had hitherto been barred from holding quoted shares purely on racial grounds, that this institution was vital vehicle for handing over economic power from foreign dominance to local control.

At the dawn of independence, stock market activity slumped due to uncertainty about the future of independent Kenya. However, after three years of calm economic growth, confidence in the market was rekindled and the exchange handled a number of highly over-subscribed public issues. The growth was, however, halted when the oil crisis of 1972 introduced inflationary pressures on the economy which depressed share prices. A 35% capital gains tax introduced in 1975 (suspended since 1985) inflicted further losses to the exchange. At the same time it lost its regional character following the nationalizations, exchange controls and other inter-territorial restrictions introduced in neighbouring Tanzania and Uganda. For instance, in 1976 Uganda compulsorily acquired a number of companies which were either quoted, or were subsidiaries of companies quoted on the NSE.

In the 1980s the Kenyan Government realized the need to design and implement policy reforms to foster sustainable economic development with an efficient and stable financial system. In particular, it set out to enhance the role of the private sector in the economy, reduce the demands of public enterprises on the exchequer, rationalize the operations of the public enterprise sector to broaden the base of ownership and enhance the capital market development. In 1984 an IFC/CBK study, Development of Money and Capital Markets in Kenya, became a blue print for structural reforms in the financial markets, culminating in the formation of a regulatory body "The Capital Markets Authority (CMA) in 1989, to assist in the creation of an environment conducive to the growth and development of the country's markets.

In 1991, the NSE was registered under the Companies Act and phased out the 'call over' trading system in favour of the floor- based 'open outcry system'. Subsequently the stock exchange embarked on an extensive modernization exercise, including a move to more spacious premises at the Nation Centre in July 1994. The facilities include a modern information centre. Computerization has also been enhanced, and with increasing trading volumes electronic trading has become feasible. In 1995, the Kenyan Government also relaxed control for locally

controlled companies subject to an aggregate limit of 20% and an individual limit of 2.5%. These were doubled to 40% and 5% respectively in June 1995 budget to help encourage foreign portfolio investments. A series of incentives are in place to encourage investments in the NSE. A favourable tax regime exempts listed securities from stamp duty, capital gains tax and value added tax. Withholding tax in dividends is low at 5% for residents and 10% for non residents. The entire Exchange Control Act was repealed in December 1995.

The number of stock brokers has grown steadily to 20 from the original six (one of whom still survives) at its inception in 1954. Commission's rates, which were once among the highest, have also come down considerably, from 2.5% to between 2% and 1% on a sliding scale for equities and 0.05% for all fixed interest securities for every shilling. The NSE is poised to play an increasing important role in the Kenyan economy, especially in the privatization of state-owned enterprise. In the last 20 years, 9 public enterprises have been successfully privatized through the NSE where government has raised about Ksh 17 billion. The privatization process started in 1988 when the government floated 7.5 million shares (20% equity) of the Kenya Commercial Bank. The issue was oversubscribed 2.3 times. Subsequent issues have also proved highly popular, with subscription rates as high as 400%. In the privatization of Kenya Airways, for example, the stock exchange enabled more than 110,000 shareholders to acquire a stake in the airline. The NSE has enabled Kenya to receive more than US$ 50 million in a year and half (1995/6), in the form of foreign portfolio investments.

The biggest challenge facing the NSE is to increase its turnover ratio, currently standing at only 3% (as of July 2010). For the foreseeable future, the exchange will have to be driven by local investors who are now being targeted by a public education programme conducted by the NSE through brochures, radio and television programmes, seminars and group presentations.

1.2.2 Investing in equities at Nairobi Stock Exchange

The Nairobi Stock Exchange in Kenya is small and somewhat speculative (NSE Bulletin). It was established in 1954. The Exchange is Sub- Saharan Africa's fourth- largest bourse. Twenty brokers (1995) are licensed to operate, and there are about 53 companies listed , with an

approximate capitalization of $1.9 billion. Like many emerging markets, NSE, suffers from the lack of liquidity in the market (averaging 4% in the 2006). Foreign investment in the NSE and foreign ownership of the companies is by application. Foreign investment in the local subsidiaries of foreign controlled companies is banned so as to encourage input into Kenyan Companies.

The Government has made several reforms aimed at attracting foreign investors through the NSE. The exchange was opened to foreign investors for the first time in January 1995, but with a maximum limit of 20% shareholding for institutions and 2.5% for individuals. The ceiling on foreign investment has recently been increased to 40% for the institutions and 5% for individuals, but fewer than 20 of the 58 listed companies are available to foreigners. Since 1995 the Kenyan Government has opened trade in the NSE and gilts to foreign portfolio investors; removed exchange controls; and introduced a favorable tax regime with non residents paying a 10% withholding tax on dividends (local 5%) but no capital gains, stamp duty or value added tax and the introduction of depository system is expected to speed up clearing and settlement. Trading takes place on Mondays through Fridays between 10.00 am and 12.00 noon. The 20 member brokerages commissions have dropped from a fixed 2.5% to a sliding scale between 1.1% and 2%.

According to the Capital Markets (Licensing Requirements) (General), Regulations, 2002 for listing in any of the segments, the following eligibility criteria must be satisfied.

The MIMS requires that the issuer should be a public company limited by shares and registered under the company's act Cap 486. In addition, the minimum authorized, issued and fully paid up capital must be Kshs 50 million. It's net assets should not be less than Kshs 100 million immediately before the public offer.

This segment further requires that the shares to be listed shall be freely transferable. For this to be enforced, the directors of the issuer must be competent persons without any legal encumbrances. There is also need for the issuer to present audited financial statements for five preceding years. This helps the investors in analyzing the profitability of the company. In the

statements, the issuer must have declared positive profits after tax attributable to shareholders in at least three years within five years prior to the application.

Further a field, the issuer should be solvent and have adequate working capital. In it's ownership structure, at least 25% of the shares must not be held by not less than 1000 shareholders excluding the employees of the issuer. Dividend policy must be clear. Debt ratios maintenance, issuing in lots and renewal date are not a requirement just like AIMS.

Contrary to MIMS, AIMS requires the minimum authorized, issued and fully paid up capital must be Kshs 20 million not Kshs 50 million . The net assets immediately before the public offer should not be less than Kshs 20 million. Like MIMS, AIMS also requires that the issuer must be a public company limited by shares and registered under the company's Act (Cap 486). The shares to be listed must be freely transferable. The directors of the issuer must be competent persons without any legal encumbrances in line with the spirit of corporate governance. In addition, the issuer should be solvent and have adequate working capital to ensure the going concern concept.

There are other notable differences where the audited financial statements of the issuer for the three preceding years and not five years as in the case of MIMS must be availed. Also the issuer must have operated on the same line of business for at least two years of which it must have made profits with good growth potential unlike MIMS, three years of profitability. Regarding the ownership structure, at least 20% of the shares must not be held by not less than 100 shareholders excluding employees of the issuer or family members of the controlling shareholders.

Certificate of comfort like MIMS may be required from the primary regulator of the issuer if there is one. There are no requirements on debt ratios, issuing lots and renewal date. Dividend policy of the issuer however, must be clear.

FISMS like the other two segments, require that the issuer must be a public company limited by shares and registered under the companies Act (Cap 486) or any other corporate body. In

addition, the minimum authorized, issued and fully paid up capital must be Kshs 50 million. The net assets should not be less than Kshs 100 million immediately before the offer.

Shares may or may not be transferable. Regarding the financial records, the audited financial statements of the issuer for the preceding years be availed (except for the government). The directors of the issuing firm must be competent persons without any legal encumbrances.

There are however no requirements regarding track records, solvency, share ownership structure and dividend policy. Certificate of comfort may be required from the primary regulator of the issuer if there is one.

The major debt ratios required include total indebtedness including the new issue not to exceed 400% of the company's net worth as at the latest balance sheet date. Further, the funds from the operations to the total debt for the three trading periods preceding the issue to be kept at a weighted average of at least 40%. Also a range of other ratios to be certified by the issuer's external auditors.

The minimum issue lot size should be Kshs 100,000 for the corporate bonds or preference shares and Kshs 1,000,000 for commercial paper programme. Further, every issuer of commercial paper to apply for renewal at least three months before the expiry of the approved period of twelve months from the date of approval.

1.3 STATEMENT OF THE RESEARCH PROBLEM

The traditional financial paradigm seeks to understand financial markets using models developed within bounds of rationality, which assume market efficiency, and investor rationality. Scheifer(2000) argues that market efficiency is assumed from its believed self-adjustment nature where the security prices are deemed to reflect their fundamental values since any mispricing is eliminated by rational; arbitrageurs. Standard finance theories consider markets to be highly analytical and normative as represented by the arbitrage principles,

modern portfolio theory, CAPM and the option-pricing model. Efficient market hypothesis espouses the incorporation of market information in security prices to reflect the optimal estimates of true investment value at all times.

Shiller (2000) explains the attempt by behavioural finance to enhance understanding of financial markets using human behaviour, by importing theories from other social sciences such as psychology sociology and anthropology. Barberis and Thaler (2002) discount the completeness in market analysis done by traditional theorists by arguing that certain average returns and individual trading behaviour are not easily understood in this framework. DeBondt and Thaler (1985) argue that investors are subject to representative heuristics, becoming overly optimistic about past winners (companies with several years good performance) and overly pessimistic about past losers (companies with several years of poor performance) that lead to long term reversals. They further indicated that volatility in stock market prices were far from being justified by a rational model in which prices are equal to the expected net present value of future dividends. Daniel, Hirschlefer and Subrahmanyan (1998) attribute long run negative autocorrelation in stocks to over confidence of investors. Jegadeesh and Titman (1993) report evidence of short term trends (momentum) in stock prices. They showed that future movements in same direction typically follow certain movements in stock prices that persist over a period of six to twelve months.

Markowitz (1952) explained how an efficient portfolio is constructed by use of the mean variance analysis. He described how to combine assets into efficiently diversified portfolio. In this way, portfolio's risk can be reduced and expected return improved if investments having dissimilar price movements were combined. And in furtherance of the portfolio theory, Sharpe (1964) discuses the existence of great opportunity for risk reduction by the incorporation of all assets in the market including the risk free assets. According to Sharpe, the only relevant risk is the diversifiable risk. Black and Scholes (1997) developed a model for pricing derivative instruments. Their model is used in the valuation of stock options before maturity. Modigliani and Miller (1958) extensively wrote on the irrelevance of capital structure on a firm's valuation. Their finding discussed the market value of any firm to be independent of its capital structure and is given by capitalization of its expected return at the rate appropriate to its asset class. In

modern times, they concluded that capital structure is irrelevant and the firm value is equal to the present value of the free cash flow discounted at the relevant cost of capital.

It is clear from these past studies that a clear understanding of security price movements and market anomalies has been elusive. At the same time, investors the world over have an ever present problem of identifying the right balance of shares and other investment assets such as bonds in investment portfolios which guarantee the high returns that are much sought after. Investment analysts, stock brokers, fund managers, actuaries and other professionals have tried to design portfolio management strategies, models and procedures that guarantee high returns with minimum risk for their retail and institutional investors. These models include the Capital Assets Pricing Model (CAPM) and the Modern Portfolio Theory (MPT).

The fundamentals of an investment asset in every market keep changing according to the company, industry, and the economy concerned. These fundamentals include profitability and return ratios such as Earning Per Share (EPS) and Dividend Per Share (DPS). The fundamental and technical analyses can be done in a bid to estimate the portfolio's returns and risk profile. These analyses depend on the general global economic outlook and other macro-economic trends such as inflation, interest rates, foreign exchange rates and economic growth rates. At the same time, sentimental values such as investor confidence, a country's political stability, corruption levels as well as the industry's particular issues influence investors perceptions about a particular portfolio fund.

This study therefore was an effort by the researcher to contribute to the understanding of the theory and practice of investment analysis and portfolio fund management. The researcher intends to make a comparative predictive evaluation of the Capital Asset Pricing Model (CAPM) and the Modern Portfolio Theory (MPT) using historical data of an optimal portfolio based on Earnings Per Share (EPS) and the most actively traded stocks in the trading years 2001-2005 at the Nairobi Stock Exchange. The study was intended to consolidate and document a technical understanding of the local equities market.

1.4 OBJECTIVES OF THE STUDY

(a) To select/design an optimal equities portfolio based on the most actively traded stocks and the availability of information on dividends of the stocks categorized into the four counters of Agriculturals, Commercials, Industrials, and Financials of the MIMS market at the Nairobi Stock Exchange.

(b) To make a comparative predictive evaluation of the Capital Asset Pricing Model (CAPM) and the Modern Portfolio Theory (MPT) using historical data of the selected portfolio in the trading years 2001-2005 at the Nairobi Stock Exchange.

(c) To make recommendations based on the study findings on the theory and practice of portfolio fund management or equities trading at Nairobi Stock Exchange.

1.5 HYPOTHESIS

1.5.1 The Null Hypothesis:

$$= \frac{P_1 - P_0 + D}{P_0} \quad = \sum_i w_i \mathrm{E}(R_i) \quad = R_f + \beta_i (E(R_m) - R_f)$$

1.5.2 The Alternative Hypothesis:

$$= \frac{P_1 - P_0 + D}{P_0} \quad \not= \sum_i w_i \mathrm{E}(R_i) \neq R_f + \beta_i (E(R_m) - R_f)$$

It is expected that if the MPT and CAPM techniques are accurate in estimating the returns of the portfolio selected, then the their returns would be equal to the historical SMM Observed returns and the null hypothesis is accepted. If the opposite is the case, then the alternative hypothesis is accepted.

1.6 SCOPE

The study was carried out in Nairobi, Kenya and was based on the historical prices of stocks traded at the Nairobi Stock Exchange (NSE) for the years 2001-2005. The researcher selected this era because of the relative stability of the stock market. The Nairobi Stock Exchange (NSE) has its own segments and various sectors within the same segments. The key segments of interest include main investment market segment(MIMS), Alternative Investment Market Segment (AIMS) and Fixed Income Securities Market Segment (FISMS). The MIMS has sectors such as Agricultural Sector, Commercial and Services Sector, Financial Sector Industrial and Allied Sector which form the focus of this study.

The researcher sourced financial statements of the companies whose stocks are traded at the NSE's MIMS market segments from the Capital Markets Authority (CMA). The statements will be used to calculate Earnings Per share(EPS) in order to select the optimal portfolio from the four market segments of Agriculturals, Industrials, Financials and Commercial Services.

This study then focused on the return-risk values from each market segment and use them to make a comparative evaluation of MPT and CAPM portfolio analysis models. The price data are readily available from the NSE library.

1.7 IMPORTANCE OF THE STUDY

Risk and return play a crucial role in the investment decisions by the investors. The evidence provided by this study was important to the following stakeholders:

(a) Investors

The study enabled investors make informed decisions. Besides dependence on fundamental stock price estimation as the basis of their decisions, the study was able to infuse technical variables such as expected returns and risk as they make their investment decision enhancing the decision basis to broad spectra of market information.

(b) Scholars and researchers:

The study findings results fell the gap of technical comparative evaluation of portfolio analysis models as no research has ever been undertaken in this area. The study opened an avenue for further research in the area of risk and market segmentation.

(c)Regulatory authorities and government:

The Capital Markets Authority and the Ministry of Finance require all the information they can get in their efforts to stabilize the Capital markets in Kenya through participation and policy making. The study findings of this research was an addition to the arsenal of information available to these authorities.

(d) Investment Analysts/Advisors:

Investment practitioners such as fund managers, investment advisors and investment bankers can use the study findings to improve on their portfolio selection and management strategies in Kenya. They are able to use the information from the study in order to clearly advise their clients correctly on the segments to invest in given the risk differentials and the expected returns.

CHAPTER 2: LITERATURE REVIEW

2.1 INTRODUCTION

Prudent investors aim at maximizing returns and minimizing risks because investment entails sacrifice of the current shilling held against an expected shilling in future. The particular segment to be invested in must then promise better returns at a minimal risk. Investors therefore are very keen on the risk and its effect on the expected returns. There has been great controversy in trying to give a clear definition of risk. Many a finance literature has tried to advance the definition of risk. Many have likened it to uncertainty Brigham (2001), Brockington (1994), Reilly (1997). But majority others have looked it as the variation of actual from what is actually expected Sharpe (2004). In every day life, there are elements of risk prevalent. For example, the fear of losing one's investment, the danger of being knocked by a car, the fear of war outbreak among others.

According to investorwords.com (Accessed September 13, 2006), risk is defined as the quantifiable likelihood of loss or less- than – expected returns. Reilly and Brown (1997) define risk as the uncertainty that an investment will earn its expected rate of return. In the event of evaluating an investment alternative, he expects a certain rate of return. The investor might expect 10% and this is his point estimate of the returns. It may even range between -20% and 15% hence the element of risk. An investor determines how certain the expected rate of return on an investment by analyzing estimates of expected returns by assigning probability values 0 to 1. Where zero value represents no occurrence and 1 represents certainty. Examples include currency risk, inflation risk, principal risk, country risk, economic risk, mortgage risk, liquidity risk, market risk, opportunity risk, interest rate risk, prepayment risk, credit risk, unsystematic risk, call risk, business risk, counterparty risk, purchasing- power risk, event risk.(investorword.com.). The invetopedia dictionary definition says "risk is the chance that an investment's actual return will be different from the expected." This includes the possibility of losing some or all of the original investment.

Systematic risk is the portion of an asset's return variability that can be attributed to a common factor (Brigham 2001). It is called undiversifiable risk or market risk. Systematic risk is the minimum level of risk that can be obtained for a portfolio by means of diversification across a large number of randomly chosen assets. Therefore systematic risk results from general market and economic conditions that cannot be diversified away

The remaining portion of an asset return variability that can be diversified away is referred to as unsystematic risk. It is more often referred to as diversifiable risk, residual risk , or company – specific risk. It is the risk of price change due to unique circumstances of a specific security, as opposed to the overall market. This is the risk that is unique to a company such as a strike , the outcome of unfavorable litigation or a natural catastrophe. Therefore the total risk of an asset can be measured by its variance. In a nutshell the total risk can be decomposed into its systematic and unsystematic risk components Brigham (2001), Sharpe (2004), Reilly and Brown (1997).

In every day life, there is presumption that investors tend to be risk averse. This means they tend to avoid risk where they can. Further risk aversion means that investors prefer investments with a lower level of risk. On the other hand they prefer an investment giving the highest returns. This gives the risk-return trade off to determine the investments the investors would go for. There are other investors who are risk seekers. In this case they go for higher returns and higher risks. Not many a prudent investors would go for such given the fact that they can actually reduce the risk element elsewhere.

There are many measures of variation that have been postulated. They include range, mean deviation, variance, standard deviation and a relative measure called the coefficient of variation (Reilly and Brown 1997). However two measures of risk (uncertainty) have received support in theoretical work on portfolio theory: the variance and the standard deviation of the estimated distribution of expected returns.

Every stock market trade consists of one person selling shares in a company to another person, with each of them thinking they are making a wise move (Ray Turchansky, 2007). Turchansky,

a financial journalist, writing in Vancouver Journal that advises readers proposes some principles investors should always consider. He states that deciding which stocks to buy can be done in a variety of ways, from listening to a cab driver's hot tip, to performing technical analysis on hundreds of companies. There is no one correct way to invest in equities, but there are some basic principles an investor should consider.

Investors must go through information about companies whose stocks they want to buy. Publicly traded companies must disclose information ranging from finances to changes in board members through annual reports, quarterly financial statements and news releases.

The two primary types of analysis are fundamental and technical.

2.2 FUNDAMENTAL ANALYSIS

Fundamental analysis looks at factors like sales figures, earnings, assets, markets and management performance (Weaver, Western, 2009). It also considers how a company's data compares with that of its peers, and the effect of economic indicators such as interest rates on the company's sector.

The most-quoted figure in evaluating a stock is its price-to-earnings ratio -- also called an earnings multiple or multiple (Van Horne, 1980). It's the ratio of the price per share to the earnings per share over the past 12 months. For instance, a stock priced a $50 a share with earnings of $5 a share in the last year, has a P/E ratio of 10. While companies with multiples below about 20 are often said to be fairly valued, those with higher P/E ratios are often deemed too expensive.

Fundamental analysis of a business involves analyzing its financial statements and health, its management and competitive advantages, and its competitors and markets. When applied to futures and forex, it focuses on the overall state of the economy, interest rates, production, earnings, and management. When analyzing a stock, futures contract, or currency using fundamental analysis there are two basic approaches one can use; bottom up analysis and top

down analysis (Fischer E.D., Jordan J.R., 2009). The term is used to distinguish such analysis from other types of investment analysis, such as quantitative analysis and technical analysis.

Fundamental analysis is performed on historical and present data, but with the goal of making financial forecasts. There are several possible objectives which include conducting a company stock valuation and predicting its probable price evolution, making a projection on its business performance, evaluating its management and make internal business decisions, and to calculate its credit risk.

Fundamental analysis includes economic analysis, industry analysis, and company analysis (Van Horne, 2009). On the basis of these three analyses the intrinsic value of the shares are determined. This is considered as the true value of the share. If the intrinsic value is higher than the market price it is recommended to buy the share . If it is equal to market price hold the share and if it is less than the market price sell the shares.

Investors can use either a top-down or bottom-up approach(Weaver, Western, 2009). The top-down investor starts his analysis with global economics, including both international and national economic indicators, such as GDP growth rates, inflation, interest rates, exchange rates, productivity, and energy prices. He narrows his search down to regional/industry analysis of total sales, price levels, the effects of competing products, foreign competition, and entry or exit from the industry. Only then he narrows his search to the best business in that area. The bottom-up investor starts with specific businesses, regardless of their industry/region.

2.3 TECHNICAL ANALYSIS

Unlike fundamental analysis, technical analysis forecasts future share prices based on past share prices, using charts such as the MACD (moving average convergence divergence) (Ray Turchansky, 2007). .

Technical analysis employs models and trading rules based on price and volume transformations, such as the relative strength index, moving averages, regressions, inter-market and intra-market price correlations, cycles or, classically, through recognition of chart patterns (Paulos, J.A. 2003).

Technical analysis stands in contrast to the fundamental analysis approach to security and stock analysis. Technical analysis "ignores" the actual nature of the company, market, currency or commodity and is based solely on "the charts," that is to say price and volume information, whereas fundamental analysis does look at the actual facts of the company, market, currency or commodity (William, *et al* 1992). For example, any large brokerage, trading group, or financial institution will typically have both a technical analysis and fundamental analysis team.

Technical analysis is widely used among traders and financial professionals, and is very often used by active day traders, market makers, and pit traders. In the 1960s and 1970s it was widely dismissed by academics. In a recent review, Irwin and Park(2007) reported that 56 of 95 modern studies found it produces positive results, but noted that many of the positive results were rendered dubious by issues such as data snooping so that the evidence in support of technical analysis was inconclusive; it is still considered by many academics to be pseudoscience.[7] Academics such as Eugene Fama say the evidence for technical analysis is sparse and is inconsistent with the *weak form* of the efficient market hypothesis (Fama 1970). Users hold that even if technical analysis cannot predict the future, it helps to identify trading opportunities (Schwager J.D.1999).

In the foreign exchange markets, its use may be more widespread than fundamental analysis.[11][12] While some isolated studies have indicated that technical trading rules might lead to consistent returns in the period prior to 1987,[13][14][15][16] most academic work has focused on the nature of the anomalous position of the foreign exchange market(Paulos, J.A. 2003). It is speculated that this anomaly is due to central bank intervention.[18] Recent research suggests that combining various trading signals into a Combined Signal Approach may be able to increase profitability and reduce dependence on any single rule.

"The moving analysis is definitely a tool," says Watt. "There's an old expression 'the trend is your friend.' A pure technician does not care about fundamental analysis, but Watt advises investors to be prudent and to have as many sources of information as possible." Since figures such as earnings can be manipulated by accounting methods and taxation, making tax rates for a company important, it's important to look beyond statistics.

"You have to look at management experience," says Watt. "The market loves good CEOs. In the oil and gas industry, if you've got a person who got a company, built it up, sold it, then bought another company, built it up and sold it, an investor may feel comfortable with such people.

2.4 EFFICIENT MARKET HYPOTHESIS

Efficient markets hypothesis has been the central proposition in finance for several years. Harry Roberts (1967) coined the term "efficient market hypothesis" in the wake of his research on financial market behaviour. He defined as the incorporation of market information by the financial security prices such that the prices are regarded as optimal estimates of true investment value at any specific time.

According to Fama (1970), an efficient capital market is a market that is efficient in processing information. The prices of securities at any time are based on correct evaluation of available of available information at that time. In an efficient capital market, prices reflect available information. Fama (1970) identified three types of information based on different notions of what type of information is relevant. A market is said to be weak-form efficient if no investor can earn abnormal returns by developing trading rules based on historical price or return information. Semi-strong-form efficient markets do not allow investors to earn abnormal returns by developing trading rules based on information available publicly. Finally, in a strong-form efficient markets, no investor can earn abnormal profits by developing trading rules based on private information.

Shiller(1998) argued that efficient market hypothesis is based on the notion that investors behave rationally expecting to maximize returns from their investments by accurately processing all available information. As a consequence, the fact that all information is contained in stock prices means that it is impossible to make an above average profit and beat the market over time except by chance or by taking excess risks.

2.5 MARKET SEGMENTATION THEORY

Encyclopedia.thefreedictionary.com(2007), defines market segmentation as the process in marketing of dividing a market into distinct subsets (segments) that behave in the way or have similar needs. Because each segment is fairly distinct in their needs and attitudes, they are likely to respond similarly to a given marketing strategy. Further, markets can be divided according to a number of general criteria, such as by industry or public versus private sector.
Finance literature has focused on the issue of market segmentation and how it can affect various other variables. It is also interesting to note the key role played by risk in the many investors' decisions. This brings to mind the issue of mean variance criterion, standard deviation of the returns and the issue of risk differentials. Thus there is great interest in examining the risk element as well as the popular market segmentation theory.

Karolyi and Foerster (1999), studied the stock price performance and changes in risk exposure associated with the cross- listing of non –US stocks in the US markets Their sample comprised first- time US listings by 153 firms from Canada, Europe and the Asia Pacific Basin region from 1976 to 1992 and found evidence generally consistent with the market segmentation hypothesis that stock prices for firms that cross – list from segmented markets are expected to rise and their subsequent expected returns should fall as an additional built – in risk premium compensating for investment barriers. These barriers include regulatory barriers, taxes and information constraints.

Empirical evidence relating to market segmentation theory is mixed. Some studies have found the support for the existence of a market segmentation Pesando (1978), Van Horne(1980), Allen (1996), Gebhardt (2000), Nayak (1999) and Zaichkowsky (2004). Many other studies have contradicted market segmentation theory Modigiliani and Sutch (1966), Dobson, Sutch and Vanderford (1976), Elliot and Echols (1976). In the paper of Evolution of Market Segmentation, Snellman K. (2000) sees market segmentation as having its roots in microeconomics and has been influenced by other disciplines such as motivational research and buyer behavior. In this paper market segmentation is divided into four eras namely, the era of foundations, development and blossoming, stillness and stagnation and the era of re-emergence.

Market segmentation theory emerged in the mid 1950s and flourished during the period between mid 1950s and late 1970s. During the 1980s the theory lost interest in the scientific community and no significant contributions made.

Sharpe et al (2004) puts it clearly that market segmentation theory assumes that there is market segmentation and it explains the term structure of interest rates. They postulate that in a segment, various investors and borrowers are thought to be restricted by law, preference or custom to certain maturities. This creates a situation where there is a market for short term securities, intermediate term securities and one for long term securities. Further given the theory, spot rates are determined by supply and demand conditions in each market. In their argument especially on the most restrictive form of the theory, investors and borrowers will not leave their market and enter different one even when the current rates suggests to them that there is substantially higher expected returns available by making such a move.
The market segmentation theory postulates that there is a market segmentation.

In the NSE, the key interest would be to look at the risk exposure levels. The betas of the various sectors will give a clear indication of the relationship between risk and the market segmentation in the said segment. There is need to look at both market risk levels and market risk premiums an approach adopted by Allen and Jagtiani (1996).

2.6 RISK

There has been great controversy in trying to give a clear definition of risk. Many a finance literature has tried to advance the definition of risk. Many have likened it to uncertainty Brigham (2001), Brockington (1994), Reilly (1997). But majority others have looked it as the variation of actual from what is actually expected Sharpe (2004). In every day life, there elements of risk prevalent. For example, the fear of losing one's investment, the danger of being knocked by a car, the fear of war outbreak among others.

According to investorwords.com risk is defined as the quantifiable likelihood of loss or less-than – expected returns. Reilly and Brown (1997) define risk as the uncertainty that an

investment will earn its expected rate of return. In the event of evaluating an investment alternative, he expects a certain rate of return. The investor might expect 10% and this is his point estimate of the returns. It may even range between -20% and 15% hence the element of risk. An investor determines how certain the expected rate of return on an investment by analyzing estimates of expected returns by assigning probability values 0 to 1. Where zero value represents no occurrence and 1 represents certainty. Examples include currency risk, inflation risk, principal risk, country risk, economic risk, mortgage risk, liquidity risk, market risk, opportunity risk, interest rate risk, prepayment risk, credit risk, unsystematic risk, call risk, business risk, counterparty risk, purchasing- power risk, event risk. Etc.

The investopedia dictionary definition says "risk is the chance that an investment's actual return will be different than the expected." This includes the possibility of losing some or all of the original investment. Brigham and Gapenski (2001), defines risk as the chance that some unfavorable event will occur. They gave an example of one engaging in skydiving or bet on horses, both have the same thing in common risky. Accordingly no investment will be undertaken unless the expected rate of return is high enough to compensate the investor for the perceived risk of the investment. In a nutshell the total risk can be decomposed into its systematic and unsystematic risk components.

2.5.1 Systematic and unsystematic risk

Systematic risk is the portion of an asset's return variability that can be attributed to a common factor. It is called undiversifiable risk or market risk. Systematic risk is the minimum level of risk that can be obtained for a portfolio by means of diversification across a large number of randomly chosen assets. Therefore systematic risk results from general market and economic conditions that cannot be diversified away.

The remaining portion of an asset return variability that can be diversified away is referred to as unsystematic risk. It is more often referred to as diversifiable risk, residual risk , or company – specific risk. It is the risk of price change due to unique circumstances of a specific security, as opposed to the overall market. This is the risk that is unique to a company such as a strike , the

outcome of unfavorable litigation or a natural catastrophe. Therefore the total risk of an asset can be measured by its variance.

An asset risk can be analyzed in two ways Brigham and Gapenski (2001): (1) on a stand-alone basis, where the asset is considered in isolation, and (2) on a portfolio basis, where the asset is held as one of a number of assets in a portfolio. An asset's stand-alone risk is the risk an investor would face if he or she held only this one asset. In every day life, there is presumption that investors tend to be risk averse. This means they tend to avoid risk where they can. Further risk aversion means that investors prefer investments with a lower level of risk. On the other hand they prefer an investment giving the highest returns. This gives the risk-return trade off to determine the investments the investors would go for.

There are other investors who are risk seekers. In this case they go for higher returns and higher risks. Not many a prudent investors would go for such given the fact that they can actually reduce risk element elsewhere.

2.5.2 Measures of risk

There are many measures of variation that have been postulated. They include range, mean deviation, variance, standard deviation and a relative measure called the coefficient of variation. However two measures of risk (uncertainty) have received support in theoretical work on portfolio theory: the variance and the standard deviation of the estimated distribution of expected returns.

The range is the simplest measure of variability and is basically the difference between the highest and the lowest values of discrete data Srivastava et al (1997). It is also the difference between the highest class limit and the lowest class limit.

The range however has numerous limitations including; being influenced by the sample size, it ignores intervening values and that uses only two values in calculation. However, despite its numerous drawbacks, the range as a measure of dispersion, is widely used in industrial quality control for the construction of control charts. Because of these limitations, it is not a very good measure Reilly and Brown (1997).

Mean deviation is defined as the arithmetic average of deviations , where the deviations are taken from an average (mean, median and mode), taking all as positive Srivastava et al (1997). Mean deviation in most cases is the average distance of all the values in the data set from the average mean. The higher the mean deviation the greater the degree of variability. This is a good measure of variability because it involves the figures in the data set. However, the mean deviation is not suitable for advanced statistical analysis because of the difficulties in its mathematical manipulation. To overcome this difficulty, the variance and the standard deviation is used.

The larger the variances for an expected rate of return, the greater the dispersion of expected returns and the greater the uncertainty or risk of the investment. In perfect certainty, there is no variance of return because there is no deviation from expectations and therefore no risk or uncertainty Sears and Trennepohl (1993). Standard deviation is the square root of the variance.
Coefficient of variation is a relative measure of risk. In some cases an unadjusted variance and standard deviation can be misleading. If conditions are not similar or if there are major differences in the expected returns, it is necessary to use a measure of relative variability. This measure of relative variability and risk is used by financial analysts to compare alternative investments with very different rates of return and standard deviations of returns. The higher the coefficient of variation, the greater the degree of variability.

2.5.3 The Means to manage Risk

Most investors find it difficult to diversify effectively across the full spectrum of cash and individual stocks and bonds(Weaver, Western, 2009). That is why so many investors have chosen variable products to apply the strategies previously mentioned. Mutual funds, variable annuities, variable universal life insurance products offer the potential for maximizing investment performance, investment flexibility, and convenience. They allow one to allocate investments among several asset categories to tailor the mix to suit ones needs. In addition they offer professional investment management, and allow an investor to leave the day-to-day decisions to the "experts." Of course, like any investment, these products involve risk and an investor should read a prospectus carefully to see if they are right for investing.

2.7 RELATIONSHIP BETWEEN RISK AND MARKET SEGMENTATION

Cho J.J. and Rajan M (1996) advance a relationship between partial segmentation of international capital markets and the presence of exchange rate uncertainty. In their argument the segmentation of capital markets occurs not only because of government controls and restrictions on international capital flows, but also from political risks, transaction costs, information costs, accounting imperfections and differences in cultural and business institutions and practices. Further, exchange risk is a product of flexible exchange rate system and imperfect foresight.

Allen et al (1996) examined both the quantity and price of risk exposure for different segments of financial intermediaries in order to determine whether market segmentation exists in the financial services industry in the United States. Using the SIC code, they distinguished depository institutions, securities firms, insurance companies, mutual funds and other financial services and found evidence of market segmentation in both market risk levels and market risk premiums. They found that securities firms, as a group, had the most risk exposure, followed in order of descending market beta by banks, other financial firms, insurance companies, and mutual funds ,although the order is reversed when examining the market risk premium hence an inverse relationship between the quantity and price for market risk, but not for the interest rate risk.

Choi et al (1996) performed a joint test of market segmentation and exchange risk pricing based on individual stock data from seven major countries, outside of the U.S., for the period January 1981 to December 1989. They used a multifactor model with the domestic and world market factors and an exchange risk factor. Their results indicated (a) the factor structure of assets returns is internally heterogeneous, (b) many national capital markets can be described as partially segmented, rather the polar cases of complete segmentation or integration, and (c) exchange risk is a significant factor affecting asset returns in addition to the domestic and world market risk factors.

The variability of returns amongst the various segments could present a good case for the market segmentation. The need to examine such variability will be looked into in great detail to see how the segmentation theory comes in handy. Karolyi (2001) describes stock return volatility as representing the variability of stock price changes during a period. He further advances that investors, analysts, brokers, dealers and regulators care about stock return volatility not just because it's perceived as a measure of risk, but because they worry about excessive volatility in which observed fluctuations in stock prices do not appear to be accompanied by any important news about the firm or market as a whole.

Kadiyala and Subrahmanyan (2000) while studying international IPOs, Market segmentation, and Investor recognition, points out that a complicating factor in the study of how the market segmentation affects pricing around ADR listing which are normally followed by the public equity issue. They further advance that the impact of an ADR listing incorporates both the market segmentation effect and information conveyed by the issue. In their conclusion of the study, they found out that market segmentation affects IPO pricing as well as the pricing in the after market.

2.8 MITIGATING INVESTMENT RISK TO ACHIEVE FINANCIAL GOALS

The knowledge of how to manage investment risk is vital to a successful investment which can guarantee a comfortable retirement in the present volatile investment environment (Sharpe 1964).

Individual investors expose themselves to risks that they may not be aware of in four major ways. These include the equity market, the fixed-income segment, the foreign capital markets and the allocation of investment assets. For example if an investor's portfolio is weighted with the same stocks and sectors that influence the major market indices, the investor may not realize how sensitive the value of the portfolio is to the overall market volatility.

Investors can reduce risk by diversifying investments among a variety of stocks or unit trusts in different sectors, and keeping an eye on the major market indices like the NSE 20 share index.

2.8.1 Risk in the Equity Market

Many investors buy a stock because their friend recommended it. Many more do not do their research and have no idea why they the stock price will rise. It is advisable for investors to do research about the stocks they intend to purchase (Statman1984).

Once an investor owns a stock, it is important for them to keep abreast of with economic and political issues that could affect its value. These include changes in interest rates, economic growth rates, inflation rate and government regulations. Furthermore, investors should review company and investment analysts' reports to for insight into how well the company is doing in the market place.

Some investors make the mistake of focusing their portfolios in one area, because they an industry well. Other investors may think that their portfolios are well diversified because they own five or six stocks, but fail to recognize the concentration risk of their portfolios in one industry. Investors should also reduce risk by limiting the percentage of a portfolio in one stock or sector. Identifying expectations for a stock's performance may also assist investors in developing a sell discipline.

2.8.2 Risk in Fixed-Income Securities

Some investors with fixed-income securities think bonds provide long-term security, but they do not (Shiller1979). What bonds bring is certainty. While purchasing bonds will not increase an investor's purchasing power overtime, an investor will know when they will receive interest payments and when the principal will be returned.

The key in bond investments is to identify short and long term cash needs, and match them with bond maturities (Black and Scholes 1997). While typically as less volatile than equities, medium and long-term bonds do have significant price fluctuations. Using them for emergency cash needs is not a good strategy, since their prices could be depressed when you need to sell.

meet your cash needs. Bonds, particularly longer-term bonds, are sensitive to interest rates fluctuations. The solution is to keep abreast of interest rate changes and stagger the maturities of the bond portfolios.

Re-investment risk is a problem when interest rates are lower when a bond matures, and the investor depends on the bonds for cash flow. If that is the case, the investor can reduce the risk by spreading maturities and buying zero-coupon bonds, which are available at a deeper discount than other bonds and pay interest all at once at maturity.

2.8.3 Asset Allocation Risk

For investors who invest in the foreign capital markets as a way of diversifying a portfolio, awareness of political of political risk is of paramount importance (Ibbotson 1977). It is therefore important to know what is going on the countries that one has invested in. A good investment could quickly become bad in the wrong political environment. A related risk can be caused by interest rate fluctuations so that an investment in foreign currency may depreciate causing the value of the investment to drop, even when the individual security is doing well.

Knowing the investment objectives of an investor and the risk tolerance level can help figure out the best asset mix for the investor's portfolio. Individual investors need to take the time to develop the goals needed to determine the appropriate allocation of stocks and bonds in their portfolio (Fama and French 1992). It also equally risky to be unaware that goals change over time, as the investors situation changes.

Another factor that changes over time is the growth rate of the various assets in investor's portfolio. This creates an imbalance that may need to be corrected by taking profits in some of the winners. It is important to know that rebalancing is a necessary and significant part of portfolio management.

2.9 GLOBAL STUDIES ON STANDARD FINANCE THEORIES

Standard finance is a body of knowledge built on the pillars of the portfolio principles of Markowitz, the capital asset theory of Sharpe, the arbitrage principles of Miller and Modigliani and the options pricing model of Black and Scholes. It is compelling because according to Statman (1984), it uses minimum tools to built a unified theory intended to answer certain facets of financial security trade outcomes.

Markowitz (1952) described how that diversification reduces risk. He explained how an efficient portfolio is constructed by use of mean variance analysis. Assets were evaluated not by individual characteristics but by their effect on a portfolio. An optimal portfolio can be constructed to maximize return for a given standard deviation. He described how to combine assets into efficiently diversified portfolio. In this way, a portfolio's risk can be reduced and the expected rate of return can be improved if investments having dissimilar price movements were combined.

And in furtherance of the portfolio theory, Sharpe (1964), discussed the existence of a great opportunity for risk reduction by the incorporation of all the assets in the market including the risk free assets. According to Sharpe, the only relevant risk is the diversifiable risk. Samuelson (1965) determined that market prices are the best estimates of value. Price changes follow random patterns. Future share prices are unpredictable.

Fama(1966) did extensive research on stock price patterns. Develops Efficient Markets Hypothesis, which asserts that prices reflect values and information accurately and quickly. It is difficult if not impossible to capture returns in excess of market returns without taking greater than market levels of risk. He concluded that investors cannot identify superior stocks using fundamental information or price patterns.

Ibbotson (1977) developed an extensive returns database for multiple asset classes is first developed and will become one of the most widely used investment databases. This was the first extensive, empirical basis for making asset allocation decisions changes the way investors build portfolios. Banz (1981) finds that, in the long term, small companies have higher expected returns than large companies and behave differently.

Fama and French (1992) improved on the single-factor asset pricing model (CAPM). They identified market, size, and "value" factors in returns. They developed the three-factor asset pricing model, an invaluable asset allocation and portfolio analysis tool.

Dimensional, an asset management company in the United States, introduced value strategies based on the research. This leads to similar findings internationally

Black and Scholes (1997) developed a model for pricing derivative instruments. Their model is used in the evaluation of stock options before maturity. Modigliani and Miller (1958) extensively wrote on the irrelevance of capital structure on a firm's valuation. They concluded that a firm's value is unrelated to its dividend policy. Dividend policy is an unreliable guide for stock selection. Their finding discussed the market value of any firm to be independent of its capital structure and is given by capitalization of its expected return at the rate appropriate to its asset class. In modern terms, they concluded that capital structure is irrelevant and the firm value is equal to the present value of the free cash flow discounted at the relevant cost of capital.

Applied Core Equity(2004) used the Dimensional portfolio construction methodology to weigh securities by size and value characteristics instead of market capitalization. Total market strategies were launched to provide efficient, diversified risk factor exposure while limiting turnover and transaction costs. Core equity portfolios move beyond traditional, component-based asset allocation via vast diversification and cost-efficient market coverage.

In the recent past, observations and studies started to evidence practical, theoretical and empirical challenges to the traditional financial theories and the efficient market hypothesis. LeRoy and Porter (1981), researching on the stock market and Shiller(1979) on the bond market found excess volatility compared with predictions of efficient markets model. Their tests, known as volatility tests, were designed to test for rationality of market behaviour by examining the volatility of share prices relative to the volatility of their fundamental variables that affect share prices. LeRoy and Porter tested a model in which stock prices are the present discounted value of future dividends. Shiller used similar analysis for the bond market. These studies reveal significant volatility in both the stock and bond markets. They found that

fluctuations occurring in actual prices to be greater than those implied by the changes in the fundamental variables. They attributed the changes in the fundamental variables to fads or waves of optimistic or pessimistic market psychology.

Efficient market hypothesis becomes more controversial after the detection of certain anomalies in the capital markets. Anomalies arise out of observations of occurrences of significant market swings without any change in market fundamentals. They lead to the generation of trading volumes not predictable by efficient market hypothesis. Rossef and Kinney (1976) were the first to document evidence of higher mean returns in January as compared to other months of the year. Analyzing New York Stock Exchange stocks for the period 1904 to 1974, they found that average returns for the month of January compared to other months was 3.4 percent in comparison to 0.42 percent for other months. Another interesting pattern in stock price movements is the so-called " weekend effect". Fama (1980) analysed daily stock performances over the period 1953 to 1977 and observed that these movements in stock prices on Mondays and observed that negative returns on Mondays effect were highly significant. He provided evidence that these movements in stock prices on Mondays were only due to the weekend effect and not to a general closed market effect. Other anomalies include discoveries by Lakonishok and Smidt (1988) of Holiday and Tur of the month effect, Banz (1981) on small firm effect, Stickel (1985) on Value line enigma and Saunders (1993) on the controversial weather effect. These market reactions are not consistent with the traditional financial theories such as MPT and CAPM since there is lack of evidence of change in risk levels in January, on Mondays, after holidays or associated with any particular weather conditions.

Another study done by De Bondt and Thaler (1985) on investors' overreactions provide evidence of the failure of economic fundamentals in explaining market trends. They built two portfolios made by the best and the worst performing stocks in the previous three years, commonly referred to as extreme winners and loser's portfolio. They the computed the return of the built portfolios over the next successive five years. They found that the average performance of the portfolio built with the worst performance stock obtain higher returns. These observations are not explainable using risk adjusted models like MPT and CAPM models. This is because the beta of the extreme loser portfolio, in this case, seems to be lower than the extreme winners'. If CAPM is correct, then it would show the extreme losers' portfolio

to be less risky than the extreme winners' portfolio, but it does not. Consequently, the extreme losers' excess returns are not explainable by CAPM. DeBont and Thaler attributed this to overreaction of the stock prices to unexpected news.

Jegadeesh and Titman (1993) provided evidence for the existence of a momentum effect. In their study, they showed how trading strategies in which stocks are bought that obtain an increase in their value in a time period of between six to twelve months and to sell the stocks that obtained loss in the same period obtained supernormal profits. A higher level of risk of the stocks involved cannot explain the profitability of this strategy. They attributed these superior returns to stock price under reaction to company information and to the existence of positive feedback in the stock market.

Efficient market hypothesis is further challenged by a study done by Poterba and Summers (1988) which provided evidence that a long period of below average stock returns increase the probability of subsequent periods of above average returns. They called it the mean reversions effect. They observed a tendency of mean reversals in the stock market in a time horizon of three to five years with equally weighted portfolios. These results run against the short to medium term continuation predictability of risk based measures such as the capital asset pricing model.

The increased occurrences of market inefficiencies as evidenced in the given examples of anomalies and inconsistent investor behaviour lend more credence to the existence of irrationality in investors' investment behaviour. Alexander and Bailey (1999) assert that irrational market performance is inconsistent with rational investor decision making.

2.10 STUDIES ON NAIROBI STOCK EXCHANGE

In his paper, 'An Empirical Investigation into the risk return relationship among publicly quoted companies' Gitari (1990), attempted to inquire into the existence of a risk-return structure among Kenyan companies. The study sought to establish whether companies in Kenya do exhibit a positive risk – return relationship or not. He further wanted to find out whether there are any observable industrial patterns for the risk return relationships obtained. He found out that there is a positive relationship when systematic risk is related to the returns. The

relationship however, is negative when unsystematic risk is related to the returns. This then confirms the finance theory that systematic risk is more relevant in portfolio context than unsystematic risk. His analysis of the effect of the industry characteristics on the nature of systematic risk-return relationship reveals that the nature of industry and the type of relationship are independent. His results indicated that industrial peculiarities do not influence the nature of risk-return relationship.

Munywoki (1998) tried to estimate the systematic risk – return at Nairobi stock exchange. In his findings, the systematic risk was established at 3.55% meaning the excess of risk undertaken by the investor in a portfolio of assets. The markets return according to his work was 14.80%which is the reward associated with risk. The average beta for the market was 0.9002. This measure is not far from 1.0 since only 46 companies out of the possible 57 listed were used. The beta of all listed companies should be 1.0.

In trying to determine whether the reclassification of companies listed at NSE'S two key segments MIMS and AIMS reflect significant differences in performance levels, Kamau (2001), analysed the risk return relationship between the two segments using the Sharpe ratio. He concluded that during the period under investigations the companies quoted at NSE performed poorly. He also noted that the Sharpe ratios of the companies listed under the two segments at NSE showed no significant differences. According to Kamau (2001) the companies can be said to be the same in term of risk performance across the two segments. He concluded that reclassification of the two main segments did not take into consideration the return and risk levels of the companies when it was done.

Other studies focused on the relationship between the business risk and market risk, (Ndegwa 2001). Her study focused on the reliability of earnings variability as predictor of market risk. The results of this particular study showed that generally there is a very low relationship between earnings variability (business risk) and systematic risk. Further the results indicated that the relationship between systematic risk and earnings only hold for some companies as well because only 30% of these companies had a significant relationship between systematic risk and earnings.

In conclusion, most of the studies focused on the risk return trade off at the NSE. They basically focused on the relationship of the two. The study by Kamau 2001 was closer in the issue of market segmentation. However, it did not focus on the sectors given the fact that companies listed under AIMS were at one point listed in the different sectors of MIMS. It is against this backdrop that this study fits.

The researcher noted that although some studies have been done on standard finance theories based on the Nairobi Stock Exchange, no comparative portfolio analyses study based on the Modern Portfolio Theory and the Capital Asset Pricing Model has been done on the Nairobi Stock Exchange.

3.0 CHAPTER 3

3.1 RESEARCH METHODOLOGY

3.2 INTRODUCTION

This chapter outlines the three portfolio analysis methods of the Single-Index Market Model (SMM) ,Modern Portfolio Theory (MPT) and the Capital Asset Pricing Model (CAPM). The historical background, the assumptions, the formulae and the criticisms labeled against each of the three methods are described. The empirical studies based on the three methods have been well documented in other stock exchanges around the world.

3.2.1 THE SINGLE-INDEX MARKET MODEL

In the finance literature, the returns on common equity have been used widely to analyze two effects. First, in an event study, a preevent data set is used to estimate the parameters of a market model. The estimated parameters from this model then are used to generate forecast errors (or abnormal returns) from an event window(Klein ea al, 1987). A second use of equity returns has been the decomposition of a security's risk or a portfolio's risk into diversifiable (unsystematic) and undiversifiable (systematic) risks(BenHorin and Lev y, 1980). If the market model used in estimating either the decomposition of risk or the residuals in the event window is misspecified, the estimated coefficients may be biased and inconsistent(Brenner, 1977). If so, it may be inappropriate to use the estimated coefficients for the purposes of estimating a portfolio's systematic risk or excess returns. A similar problem also may exist if a misspecified model is used to estimate the cost of capital or the residuals for testing various announcement effects(Fama et al, 1969).

To assess the degree of misspecification inherent in the traditional valuation framework, Cheng and Lee (1986) examined three forms of the market model. Cheng and Lee employed the Ramsey version of the Reset test on the monthly returns of 451 individual securities from January 1965 through December 1977. Their results indicate that the Sharp-Lintner, the Fischer-Black, and the standard single index form of the market model all yield approximately

the same degree of misspecification(Black, 1972). These tests indicate that if the estimated model is not specified correctly, the estimated beta coefficient is biased and the accuracy in forecasting the rates of return may be reduced. As a result, traditional market model frameworks may be inappropriate in numerous contexts.

In addition, Brown and Warner (1985) suggest that daily and monthly returns differ in potentially important respects. For example, the use of daily returns rather than monthly returns in event studies increases the likelihood of detecting abnormal performance around a specific event. In general, their results indicate that the power of an event study increases threefold with the use of daily returns. Thus, the use of daily returns has significant advantages in determining abnormal returns. Furthermore, portfolio theory suggests that as the number of securities in a portfolio increases, two related things occur: the total risk of the portfolio declines to the market level of risk; and the returns of the portfolio begin to mirror the returns of the market portfolio.

If the securities included in the portfolio are misspecified, however, will this affect the degree of (mis)specification of the portfolio? That is, does the inclusion of individual securities that are misspecified affect the single index market model specification of the entire portfolio? If so, the estimated portfolio may yield biased and inconsistent estimates of the level of systematic risk.

This study extends the work of Cheng and Lee (1986) by applying a specification error test to determine whether the single index form of the market model for individual securities as well as portfolios of securities is specified correctly using daily returns. Four related types of evidence on the effects of model specification are presented. First, this paper updates work on whether the single index form of the market model for individual securities is specified correctly. Second, this paper investigates the effect of portfolio size (diversification) on the specification of the single index model. Third, evidence is presented on the effect that portfolio weighting has on model specification. Last, this research tests the effect of misspecification on the estimation of systematic risk.

The single-index model assumes that there is only one macroeconomic factor that causes the systematic risk affecting all stock returns and this factor can be represented by the rate of return on a market index, such as the NSE 20 Share Index, New York's Dow Jones and the S&P 500. According to this model, the return of any stock can be decomposed into the expected excess

return of the individual stock due to firm-specific factors, commonly denoted by its alpha coefficient (α), the return due to macroeconomic events that affect the market, and the unexpected microeconomic events that affect only the firm(Ross, 1976). Specifically, the return of stock i is:

$r_i = \alpha_i + \beta_i r_m + e_i$

The term $\beta_i r_m$ represents the stock's return due to the movement of the market modified by the stock's beta, while e_i represents the unsystematic risk of the security due to firm-specific factors.

Macroeconomic events, such as interest rates or the cost of labor, causes the systematic risk that affects the returns of all stocks, and the firm-specific events are the unexpected microeconomic events that affect the returns of specific firms, such as the death of key people or the lowering of the firm's credit rating, that would affect the firm, but would have a negligible effect on the economy. The unsystematic risk due to firm-specific factors of a portfolio can be reduced to zero by diversification(Cheng and Lee, 1986).

The index model is based on the fact that most stocks have a positive covariance because they all respond similarly to macroeconomic factors. However, some firms are more sensitive to these factors than others, and this firm-specific variance is typically denoted by its beta (β), which measures its variance compared to the market for one or more economic factors. Covariances among securities result from differing responses to macroeconomic factors(Brown and Warner, 1985). Hence, the covariance of each stock can be found by multiplying their betas and the market variance: Hence,

$$Cov(R_i, R_k) = \beta_i \beta_k \sigma^2.$$

This equation greatly reduces the computations required to determine covariance because the covariance of the securities within a portfolio must be calculated using historical returns, and the covariance of each possible pair of securities in the portfolio must be calculated independently. With this equation, only the betas of the individual securities and the market variance need to be estimated to calculate covariance (Cheng and Lee, 1986). Hence, the index

model greatly reduces the number of calculations that would otherwise have to be made for a large portfolio of thousands of securities.

In fact to make it much easier and more realistic, the Single Index Market Model used to analyze stock prices, dividends and traded volumes was the most popular model as it assumed a stable linear relationship between the market and security return (Mackinlay, 1977). Correlation studies especially ex post facto ("from after the fact") have the basic purpose of to determining the relationship between variables. The term is used to identify that the research in question has been conducted after the variations in the independent variable has occurred naturally.

The stock prices, traded volumes and dividends paid out were used to calculate annual required rates of return for the Single Index Market Model portfolio analysis model using the holding period formula as follows;

$$R_{it} = \frac{P_1 - P_0 + D}{P_0}$$

Where R_{it} = return on the stock i for the period t.

P_1 = market price of the stock at end of the quarter.

P_0 = market price of the stock at the beginning of the quarter.

D = cash dividend paid out in the quarter.

The SMM Observed returns were used as a standard in order to measure the accuracy of the Modern Portfolio Theory(MPT) and the Capital Asset Pricing Model(CAPM).

3.2.2 THE MODERN PORTFOLIO THEORY (MPT)

The foundation of modern portfolio theory (MPT) was introduced by Harry Markowitz in 1952. Thirty-eight years later, Harry Markowitz, Merton Miller and William Sharpe were awarded Nobel Prize for what has become a broad theory for portfolio selection. Modern portfolio

theory (commonly referred as mean variance analysis) established a whole new terminology which became a norm among investment managers. (Gupta, Francis Markowitz, Fabozzi, Frank. 2002) It has wide application in different areas of financial management such as: asset allocation through mean variance optimization, bond portfolio immunization, optimal investment trust or manager selection, international asset allocation decisions, portfolio risk management and hedging strategies.

The core concept of the Portfolio Theory is based on asset diversification and directly relies on the conventional wisdom which advice to avoid putting all eggs in one basket (Papers4you.com, 2006). In its simplest form MPT provides a framework to construct efficient portfolios by selection of the investment assets, considering risk appetite of the investor. MPT employs statistical measures such as correlation and co variation to quantify the effect of the diversification on the performance of portfolio. In it is essence MPT attempts to analyse how different investments are interrelated to each other. What happens if one investment goes broke? Does it mean that all other investments will go broke as well? How to minimize the negative effect of the downfall in one particular investment asset?

According to Markowitz (1952) investors should focus on selecting portfolios based on their overall risk-reward characteristics instead of merely compiling portfolios from securities that each individually has attractive risk-reward characteristics. In a nutshell, inventors should select portfolios not individual securities. (Risk glossary) While the theory behind MPT is quite straightforward, the implementation of efficient asset allocation can become quite complicated. The model employs a wide range of different factors such as security returns, volatilities and correlation between asset classes for constructing efficient mean variance frontier. The frontier is considered to be efficient because every point on this frontier is a portfolio that gives the greatest possible return for certain risk level. (Gupta, et al, 2002) Since asset allocation decisions are so important, majority of the financial advisors determine optimal portfolios for their clients, both institutional and private.

The assumptions of the Modern Portfolio Theory include the fact that asset returns are (jointly) normally distributed random variables (Markowitz 1952), correlations between assets are fixed

and constant forever, all investors aim to maximize economic utility (in other words, to make as much money as possible, regardless of any other considerations), all investors are rational and risk-averse, and that all investors have access to the same information at the same time. Furthermore, investors have an accurate conception of possible returns, that is, the probability beliefs of investors match the true distribution of returns, there are no taxes or transaction costs, all investors are price takers, any investor can lend and borrow an unlimited amount at the risk free rate of interest, and that all securities can be divided into parcels of any size.

While the implementation of the mean variance analysis requires specific skill and knowledge, the main concepts are relatively easy and can be easily presented to the wide audience (Papers4you.com, 2006). Surprisingly, MPT has wide implications in everyday life as well, since all of us are somehow involved into investment decisions. Everyone has to think about securing funds for the future education or pension, investing into property or buying a new car, and allocating some money for the coming vocation. How to justify these decisions, what would be the optimal solution? Familiarity with portfolio theory allows bringing up the ideas employed by professional investors into everyday life.

(a) Risk and expected return

MPT assumes that investors are risk averse, meaning that given two portfolios that offer the same expected return, investors will prefer the less risky one. Thus, an investor will take on increased risk only if compensated by higher expected returns (Gapenski 2001). Conversely, an investor who wants higher expected returns must accept more risk. The exact trade-off will be the same for all investors, but different investors will evaluate the trade-off differently based on individual risk aversion characteristics. The implication is that a rational investor will not invest in a portfolio if a second portfolio exists with a more favourable risk-expected return profile – i.e., if for that level of risk an alternative portfolio exists which has better expected returns.

Under the model:

- Portfolio return is the proportion-weighted combination of the constituent assets' returns.

- Portfolio volatility is a function of the correlations ρ_{ij} of the component assets, for all asset pairs (i, j).

- Expected return:

$$\mathrm{E}(R_p) = \sum_i w_i \mathrm{E}(R_i)$$

where R_p is the return on the portfolio, R_i is the return on asset i and w_i is the weighting of component asset i (that is, the share of asset i in the portfolio).

- Portfolio return variance:

$$\sigma_p^2 = \sum_i w_i^2 \sigma_i^2 + \sum_i \sum_{j \neq i} w_i w_j \sigma_i \sigma_j \rho_{ij}$$

where ρ_{ij} is the correlation coefficient between the returns on assets i and j. Alternatively the expression can be written as:

$$\sigma_p^2 = \sum_i \sum_j w_i w_j \sigma_i \sigma_j \rho_{ij}$$

where $\rho_{ij} = 1$ for $i=j$.

- Portfolio return volatility (standard deviation):

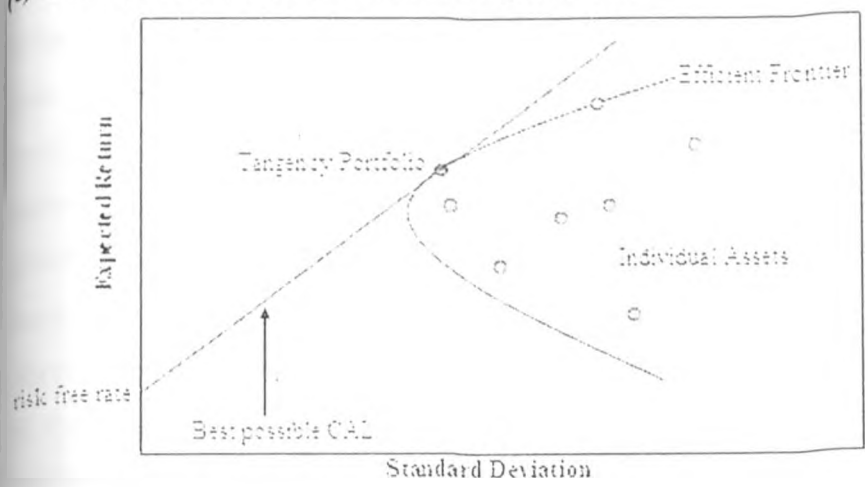
$$\sigma_p = \sqrt{\sigma_p^2}$$

(b) Diversification

An investor can reduce portfolio risk simply by holding combinations of instruments which are not perfectly positively correlated (correlation coefficient $-1 <= \rho_{ij} < 1$)). In other words, investors can reduce their exposure to individual asset risk by holding a diversified portfolio of assets (Gapenski 2001). Diversification may allow for the same portfolio expected return with reduced risk.

If all the asset pairs have correlations of 0—they are perfectly uncorrelated—the portfolio's return variance is the sum over all assets of the square of the fraction held in the asset times the asset's return variance (and the portfolio standard deviation is the square root of this sum).

(c) The efficient frontier with no risk-free asset



Adopted from D.E. Fischer and R.J. Jordan's Security Analysis and Portfolio Management

As shown in this graph, every possible combination of the risky assets, without including any holdings of the risk-free asset, can be plotted in risk-expected return space, and the collection of all such possible portfolios defines a region in this space (Shiller 1998). The left boundary of this region is a hyperbola, and the upper edge of this region is the *efficient frontier* in the absence of a risk-free asset. Combinations along this upper edge represent portfolios (including no holdings of the risk-free asset) for which there is lowest risk for a given level of expected return. Equivalently, a portfolio lying on the efficient frontier represents the combination offering the best possible expected return for given risk level.

(d) The risk-free asset and the capital allocation line

The risk-free asset is the hypothetical asset which pays a risk-free rate. In practice, short-term government securities such as the 91 Kenya Government treasury bill rate are used as a risk-free asset, because they pay a fixed rate of interest and have exceptionally low default risk(Weaver, Western, 2009). The risk-free asset has zero variance in returns (hence is risk-free); it is also uncorrelated with any other asset (by definition, since its variance is zero). As a

result, when it is combined with any other asset, or portfolio of assets, the change in return is linearly related to the change in risk as the proportions in the combination vary.

When a risk-free asset is introduced, the half-line shown in the figure is the new efficient frontier. It is tangent to the hyperbola at the pure risky portfolio with the highest Sharpe ratio (Fischer, Jordan, 2009). Its horizontal intercept represents a portfolio with 100% of holdings in the risk-free asset; the tangency with the hyperbola represents a portfolio with no risk-free holdings and 100% of assets held in the portfolio occurring at the tangency point; points between those points are portfolios containing positive amounts of both the risky tangency portfolio and the risk-free asset; and points on the half-line beyond the tangency point are leveraged portfolios involving negative holdings of the risk-free asset (the latter has been sold short—in other words, the investor has borrowed at the risk-free rate) and an amount invested in the tangency portfolio equal to more the 100% of the investor's initial capital. This efficient half-line is called the capital allocation line (CAL), and its formula can be shown to be

$$E(R_C) = R_F + \sigma_C \frac{E(R_P) - R_F}{\sigma_P}$$

In this formula P is the sub-portfolio of risky assets at the tangency with the Markowitz bullet, F is the risk-free asset, and C is a combination of portfolios P and F.

By the diagram, the introduction of the risk-free asset as a possible component of the portfolio has improved the range of risk-expected return combinations available, because everywhere except at the tangency portfolio the half-line gives a higher expected return than the hyperbola does at every possible risk level(Weaver, Western, 2009). The fact that all points on the linear efficient locus can be achieved by a combination of holdings of the risk-free asset and the tangency portfolio is known as the one mutual fund theorem, where the mutual fund referred to is the tangency portfolio.

(e) Systematic risk and specific risk

Specific risk is the risk associated with individual assets - within a portfolio these risks can be reduced through diversification so that specific risks "cancel out". Specific risk is also called

diversifiable, unique, unsystematic, or idiosyncratic risk. Systematic risk (a.k.a. portfolio risk or market risk) refers to the risk common to all securities - except for selling short as noted below, systematic risk cannot be diversified away within one market (Van Horne, 2005). Within the market portfolio, asset specific risk will be diversified away to the extent possible. Systematic risk is therefore equated with the risk (standard deviation) of the market portfolio.

Since a security will be purchased only if it improves the risk-expected return characteristics of the market portfolio, the relevant measure of the risk of a security is the risk it adds to the market portfolio, and not its risk in isolation(Weaver, Western, 2009). In this context, the volatility of the asset, and its correlation with the market portfolio, are historically observed and are therefore given. Systematic risks within one market can be managed through a strategy of using both long and short positions within one portfolio, creating a "market neutral" portfolio.

3.2.3 THE CAPITAL ASSET PRICING MODEL (CAPM)

In finance, the capital asset pricing model (CAPM) is used to determine a theoretically appropriate required rate of return of an asset, if that asset is to be added to an already well-diversified portfolio, given that asset's non-diversifiable risk(Van Horne, 2005). The model takes into account the asset's sensitivity to non-diversifiable risk (also known as systematic risk or market risk), often represented by the quantity beta (β) in the financial industry, as well as the expected return of the market and the expected return of a theoretical risk-free asset.

The model was introduced by Jack Treynor (1961, 1962), William Sharpe (1964), John Lintner (1965a,b) and Jan Mossin (1966) independently, building on the earlier work of Harry Markowitz on diversification and modern portfolio theory. Sharpe, Markowitz and Merton Miller jointly received the Nobel Memorial Prize in Economics for this contribution to the field of financial economics.

The assumptions of the Capital Asset Pricing Model include the fact that all investors aim to maximize economic utilities, and that they are rational and risk-averse (Sharpe1964). Portfolios are broadly diversified across a range of investments. Moreover all investors are price takers, and can lend and borrow unlimited amounts under the risk free rate of interest.

Trade in stocks is done without transaction or taxation costs. Securities are assumed to be highly divisible into small parcels (Lintner 1965). Of critical significance is that it is assumed that all information is available at the same time to all investors. The security markets are also expected to perfectly competitive (Mossin 1966).

(a) The formula

The CAPM is a model for pricing an individual security or a portfolio. For individual securities, the security market line (SML) and its relation to expected return and systematic risk (beta) are used to show how the market must price individual securities in relation to their security risk class. The SML enables an analyst to calculate the reward-to-risk ratio for any security in relation to that of the overall market(Weaver, Western, 2009). Therefore, when the expected rate of return for any security is deflated by its beta coefficient, the reward-to-risk ratio for any individual security in the market is equal to the market reward-to-risk ratio, thus:

$$\frac{E(R_i) - R_f}{\beta_i} = E(R_m) - R_f$$

The market reward-to-risk ratio is effectively the market risk premium and by rearranging the above equation and solving for E(Ri), the Capital Asset Pricing Model (CAPM) is obtained.

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

where:

- $E(R_i)$ is the expected return on the capital asset
- R_f is the risk-free rate of interest such as interest arising from government bonds
- β_i (the *beta*) is the sensitivity of the expected excess asset returns to the expected excess market returns
- $E(R_m)$ is the expected return of the market

- $E(R_m) - R_f$ is sometimes known as the *market premium* or *risk premium* (the difference between the expected market rate of return and the risk-free rate of return).
- The asset/portfolio beta,

$$\beta_i = \frac{\mathrm{Cov}(R_i, R_m)}{\mathrm{Var}(R_m)}$$

Restated, in terms of risk premium, we find that:

$$E(R_i) - R_f = \beta_i (E(R_m) - R_f)$$

which states that the *individual risk premium* equals the *market premium* times β.

(b) Asset pricing

Once the expected/required rate of return, $E(R_i)$, is calculated using CAPM, we can compare this required rate of return to the asset's estimated rate of return over a specific investment horizon to determine whether it would be an appropriate investment(Weaver, Western, 2009). To make this comparison, an analyst needs an independent estimate of the return outlook for the security based on either fundamental or technical analysis techniques, including P/E among others.

In theory, therefore, an asset is correctly priced when its estimated price is the same as the required rates of return calculated using the CAPM. If the estimate price is higher than the CAPM valuation, then the asset is undervalued (and overvalued when the estimated price is below the CAPM valuation).

(c) Asset-specific required return

The CAPM returns the asset-appropriate required return or discount rate. This is the rate at which future cash flows produced by the asset should be discounted given that asset's relative riskiness (Van Horne, 2005). Betas exceeding one signify more than average "riskiness"; betas below one indicate lower than average. Thus, a more risky stock will have a higher beta and will be discounted at a higher rate; less sensitive stocks will have lower betas and be discounted

at a lower rate. Given the accepted concave utility function, the CAPM is consistent with intuition—investors (should) require a higher return for holding a more risky asset.

Since beta reflects asset-specific sensitivity to non-diversifiable market risk, the market as a whole, by definition, has a beta of one(Weaver, Western, 2009). Stock market indices are frequently used as local proxies for the market—and in that case (by definition) have a beta of one. An investor in a large, diversified portfolio (such as a mutual fund), therefore, expects performance in line with the market.

(d) Risk and diversification

The risk of a portfolio comprises systematic risk, also known as undiversifiable risk, and unsystematic risk which is also known as idiosyncratic risk or diversifiable risk. Systematic risk refers to the risk common to all securities, that is, the market risk (Van Horne, 2005). Unsystematic risk is the risk associated with individual assets. Unsystematic risk can be diversified away to smaller levels by including a greater number of assets in the portfolio (specific risks "average out"). The same is not possible for systematic risk within one market. Depending on the market, a portfolio of approximately 30-40 securities in developed markets such as UK or US will render the portfolio sufficiently diversified such that risk exposure is limited to systematic risk only. In developing markets a larger number is required, due to the higher asset volatilities.

A rational investor should not take on any diversifiable risk, as only non-diversifiable risks are rewarded within the scope of this model(Weaver, Western, 2009). Therefore, the required return on an asset, that is, the return that compensates for risk taken, must be linked to its riskiness in a portfolio context which is its contribution to overall portfolio riskiness as opposed to its "stand alone riskiness." In the CAPM context, portfolio risk is represented by higher variance hence less predictability. In other words the beta of the portfolio is the defining factor in rewarding the systematic exposure taken by an investor.

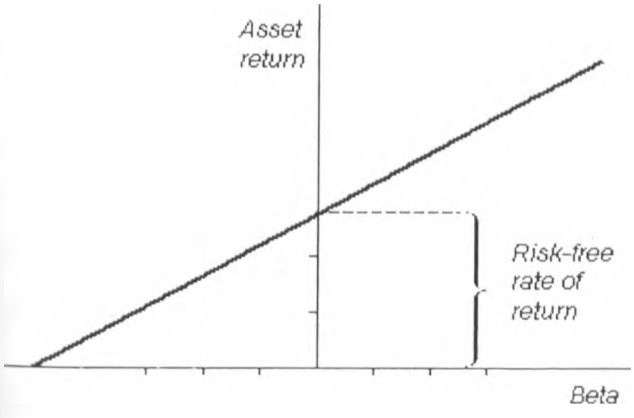
(e) Security market line

The SML essentially graphs the results from the capital asset pricing model (CAPM) formula. The *x*-axis represents the risk (beta), and the *y*-axis represents the expected return. The market risk premium is determined from the slope of the SML(Fischer, Jordan, 2009).

The relationship between β and required return is plotted on the *securities market line* (SML) which shows expected return as a function of β. The intercept is the nominal risk-free rate available for the market, while the slope is the market premium, $E(R_m) - R_f$. The securities market line can be regarded as representing a single-factor model of the asset price, where Beta is exposure to changes in value of the Market. The equation of the SML is thus:

$$SML: E(R_i) = R_f + \beta_i (E(R_m) - R_f)$$

It is a useful tool in determining if an asset being considered for a portfolio offers a reasonable expected return for risk. Individual securities are plotted on the SML graph. If the security's risk versus expected return is plotted above the SML, it is undervalued since the investor can expect a greater return for the inherent risk. And a security plotted below the SML is overvalued since the investor would be accepting less return for the amount of risk assumed (Van Horne, 2009).



The Security Market Line, describes a relation between the beta and the asset's/portfolio's expected rate of return.

Adopted from J.C. Van Horne's Financial Management Policy

CAPM assumes that the risk-return profile of a portfolio can be optimized—an optimal portfolio displays the lowest possible level of risk for its level of return(Weaver, Western, 2009). Additionally, since each additional asset introduced into a portfolio further diversifies the portfolio, the optimal portfolio must comprise every asset, assuming no trading costs with each asset value-weighted to achieve the above (assuming that any asset is infinitely divisible. All such optimal portfolios, that is, one for each level of return, comprise the efficient frontier. Because the unsystematic risk is diversifiable, the total risk of a portfolio can be viewed as beta.

(f) The market portfolio

An investor might choose to invest a proportion of his or her wealth in a portfolio of risky assets with the remainder in cash—earning interest at the risk free rate or indeed may borrow money to fund his or her purchase of risky assets in which case there is a negative cash weighting (Van Horne, 2005). Here, the ratio of risky assets to risk free asset does not determine overall return—this relationship is clearly linear. It is thus possible to achieve a particular return in one of two ways: by investing all of one's wealth in a risky portfolio, or by investing a proportion in a risky portfolio and the remainder in cash which is either borrowed or invested. For a given level of return, however, only one of these portfolios will be optimal in the sense of lowest risk. Since the risk free asset is, by definition, uncorrelated with any other asset, option 2 will generally have the lower variance and hence be the more efficient of the two.

This relationship also holds for portfolios along the efficient frontier: a higher return portfolio plus cash is more efficient than a lower return portfolio alone for that lower level of return. For a given risk free rate, there is only one optimal portfolio which can be combined with cash to achieve the lowest level of risk for any possible return(Weaver, Western, 2009). This is the market portfolio.

(g) Portfolio Betas

Beta is a risk measure that arises from the relationship between the return on a stock and the return on the market(Elton E.J., Gruber M.J. 1995). One of the earliest attempts to relate a the beta of a stock to the firm's fundamental variables such as dividend pay outs, asset growth,

liquidity, asset growth, earning variability, accounting beta and leverage was made by Beaver, Kettler and Scholes(1970). The results of their analyses were mixed with dividend pay out, liquidity, and asset size relating negatively with beta. Asset growth, leverage, earnings variability, and accounting beta however related positively with beta.

Diversification decreases variability from unique risk but from market risk. The beta of a portfolio is just an average of the betas of the securities in the portfolios weighted by the investment in each security (Brealy R.A., Merys S.C., and Marcus J.A., 2007). In order to estimate single-index betas, analysts could be asked to provide subjective estimates of betas foe securities of portfolios (Elton E.J., Gruber M.J. 1995). On the hand, estimates of future betas could be arrived at by beta from past data and using this historical beta to estimate the future beta.

Blume and Levi (1975) computed betas using time series regression analysis on non-overlapping data seven-year periods and concluded that the larger the portfolio the more accurate the estimate will be. The rationale of their conclusion was the fact that portfolio betas are measured with less errors and portfolio betas change less than betas on securities so that historical betas on portfolios are better predictors of future betas than are historical betas on securities.

3.3 CRITICAL REVIEW

3.3.1 MODERN PORTFOLIO THEORY

Modern Portfolio Theory is based on a number of assumptions. Mathematically one would expect any conclusions to be drawn from the model to be correct as long as the assumptions are correct (Kent Daniel et al, 2001). In science, basic theories are developed in order to understand basic principles As long as the fundamental pieces fit, equations can be manipulated to provide new insights. This is why now that quantum mechanics and relativity are fairly well understood and a large proportion of scientific discovery is purely mathematical. As long as the theory is correct one can make new discoveries by putting the theory into a mathematical model and

giving it all a good shake. Physicists have found hundreds of subatomic particles that were originally predicted and described in complete detail by mathematics.

One of the key assumptions of MPT is that Asset returns are (jointly) normally distributed random variables (Mandelbrot, B., Hudson, R. L. 2004). In fact, it is frequently observed that returns in equity and other markets are not normally distributed. Large swings (3 to 6 standard deviations from the mean) occur in the market far more frequently than the normal distribution assumption would predict. While the model can also be justified by assuming any return distribution which is jointly elliptical(Owen *et al,* 1983), all the joint elliptical distributions are symmetrical whereas asset returns empirically are not.

Correlations between assets are also assumed to be fixed and constant forever. Under MPT (Chamberlain, G. 1983). Correlations depend on systemic relationships between the underlying assets, and change when these relationships change. Examples include one country declaring war on another, or a general market crash. During times of financial crisis all assets tend to become positively correlated, because they all move (down) together. In other words, MPT breaks down precisely when investors are most in need of protection from risk.

All investors aim to maximize economic utility (in other words, to make as much money as possible, regardless of any other considerations) (Merton, R., 1972). This is a key assumption of the efficient market hypothesis, upon which MPT relies. Another MPT assumption that All investors have access to the same information at the same time. This also comes from the efficient market hypothesis. In fact, real markets contain information asymmetry, insider trading, and those who are simply better informed than others.

All investors are rational and risk-averse (Shleifer, 2000). This is another assumption of the efficient market hypothesis, but it is known from behavioral economics that market participants are not rational. It does not allow for "herd behavior" or investors who will accept lower returns for higher risk. Casino gamblers clearly pay for risk, and it is possible that some stock traders will pay for risk as well.

Investors have an accurate conception of possible returns, i.e., the probability beliefs of investors match the true distribution of returns. A different possibility is that investors'

expectations are biased, causing market prices to be informationally inefficient. This possibility is studied in the field of behavioral finance, which uses psychological assumptions to provide alternatives to the MPT such as the overconfidence-based asset pricing model of (Kent Daniel et al, 2001).

Other MPT assumptions include the fact that there are no taxes or transaction costs, all investors are price takers, and that any investor can lend and borrow an unlimited amount at the risk free rate of interest. Real financial products are subject both to taxes and transaction costs (such as broker fees), and taking these into account will alter the composition of the optimum portfolio. In reality, sufficiently large sales or purchases of individual assets can shift market prices for that asset and others (via cross-elasticity of demand.) An investor may not even be able to assemble the theoretically optimal portfolio if the market moves too much while they are buying the required securities. . In reality, every investor has a credit limit. All securities can be divided into parcels of any size. In reality, fractional shares usually cannot be bought or sold, and some assets have minimum orders sizes. These assumptions can be relaxed with more complicated versions of the model (Hirshleifer, Subrahmanyam, 2001).

Other criticisms on the MPT include the charge that MPT does not really model the market ((Shleifer, 2000). The risk, return, and correlation measures used by MPT are based on expected values, which means that they are mathematical statements about the future. The expected value of returns is explicit in the above equations, and implicit in the definitions of variance and covariance. In practice investors must substitute predictions based on historical measurements of asset return and volatility for these values in the equations. Very often such expected values fail to take account of new circumstances which did not exist when the historical data were generated.

More fundamentally, investors are stuck with estimating key parameters from past market data because MPT attempts to model risk in terms of the likelihood of losses, but says nothing about why those losses might occur. The risk measurements used are probabilistic in nature, not structural. This is a major difference as compared to many engineering approaches to risk management.

Essentially, the mathematics of MPT view the markets as a collection of dice. By examining past market data we can develop hypotheses about how the dice are weighted, but this isn't helpful if the markets are actually dependent upon a much bigger and more complicated chaotic system -- the world. For this reason, accurate structural models of real financial markets are unlikely to be forthcoming because they would essentially be structural models of the entire world. Nonetheless there is growing awareness of the concept of systemic risk in financial markets, which should lead to more sophisticated market models.

In conclusion, the two major limitations of MPT are its assumptions that variance of portfolio returns is the correct measure of investment risk, and the investment returns of all securities and portfolios can be adequately represented by a joint elliptical distribution, such as the normal distribution. There are two key reasons why standard deviation cannot accurately represent risk. One is because of non-normal distributions. Financial asset returns do not follow a normal distribution. Usually, the distributions are asymmetric, and upside deviation therefore differs from downside deviation, making the use of standard deviation inherently inaccurate.

Secondly, even if financial returns were perfectly symmetrical, standard deviation would still fail to describe human risk. Remember that risk is relative to a personal benchmark, or minimal acceptable return. Since mean and MAR (Minimum Acceptable Returns)are not the same number, the downside risk (outcomes below the MAR) cannot be symmetrical to the upside (returns above the MAR). Furthermore, using the elliptical distribution to model the pattern of investment returns makes investment results with more upside than downside returns appear more risky than arguably they really are, and the opposite for returns with a predominance of downside returns. The result is that using traditional MPT techniques for measuring investment portfolio construction and evaluation frequently distorts investment reality.

3.3.2 CAPITAL ASSET PRICING MODEL

CAPM assumes that either asset returns are (jointly) normally distributed random variables or that investors employ a quadratic form of utility. It is however frequently observed that returns in equity and other markets are not normally distributed. As a result, large swings (3 to 6

standard deviations from the mean) occur in the market more frequently than the normal distribution assumption would expect (Black et al, 1972).

The model assumes that the variance of returns is an adequate measurement of risk (Fama E.F., 1968). This might be justified under the assumption of normally distributed returns, but for general return distributions other risk measures (like coherent risk measures) will likely reflect the investors' preferences more adequately. Indeed risk in financial investments is not variance in itself, rather it is the probability of losing: it is asymmetric in nature. The model assumes that all investors have access to the same information and agree about the risk and expected return of all assets (homogeneous expectations assumption) (Black et al, 1972).

The model assumes that the probability beliefs of investors match the true distribution of returns. A different possibility is that investors' expectations are biased, causing market prices to be informationally inefficient. This possibility is studied in the field of behavioral finance, which uses psychological assumptions to provide alternatives to the CAPM such as the overconfidence-based asset pricing model of (Kent Daniel et al, 2001).

The model does not appear to adequately explain the variation in stock returns. Empirical studies show that low beta stocks may offer higher returns than the model would predict. Some data to this effect was presented as early as a 1969 conference in Buffalo, New York in a paper by Fischer Black, Michael Jensen, and Myron Scholes. Either that fact is itself rational (which saves the efficient-market hypothesis but makes CAPM wrong), or it is irrational (which saves CAPM, but makes the EMH wrong – indeed, this possibility makes volatility arbitrage a strategy for reliably beating the market) (Black et al, 1972).

The model assumes that given a certain expected return investors will prefer lower risk (lower variance) to higher risk and conversely given a certain level of risk will prefer higher returns to lower ones. It does not allow for investors who will accept lower returns for higher risk. Casino gamblers clearly pay for risk, and it is possible that some stock traders will pay for risk as wel (French Craig, 2002)

The market portfolio should in theory include all types of assets that are held by anyone as an investment. These include works of art, real estate, and human capital (Roll R., 1977) In

practice, such a market portfolio is unobservable and people usually substitute a stock index as a proxy for the true market portfolio. Unfortunately, it has been shown that this substitution is not innocuous and can lead to false inferences as to the validity of the CAPM, and it has been said that due to the inobservability of the true market portfolio, the CAPM might not be empirically testable. This was presented in greater depth in a paper by Richard Roll in 1977, and is generally referred to as Roll's critique.

The model assumes just two dates, so that there is no opportunity to consume and rebalance portfolios repeatedly over time. The basic insights of the model are extended and generalized in the intertemporal CAPM (ICAPM) of Robert Merton, and the consumption CAPM (CCAPM) of Douglas Breeden and Mark Rubinstein(Merton, R., 1972).

When Markowitz and Sharpe *et al* needed a definition of risk, they chose to define risk as volatility, the greater the volatility of the portfolio, measured either in terms of standard deviation or beta, the greater the risk. How did these researchers know that volatility was a good measure of risk? They did not, nor did they do any research to find out. The observation was made that the share market, which is generally thought to be more risky than cash investments, had the highest volatility. The principle was adopted generally without further evidence that volatility was a good way to measure risk.

Economists find this definition of risk compelling, because it is based on an assumption that makes perfect logical sense, that investors *should* be risk averse, and that in today's well informed, sophisticated markets everyone acts perfectly rationally and takes no risk that is not justified by a bounty of evidence in support.

Investors are very concerned by downside volatility, but how many object when their portfolio moves up? Volatility is a measure that regards upside movement as equally bad as movement to the downside. What about inflation and the terrible toll it extracts on non-growth assets? Finally, speculative stocks which are extremely volatile do not fit into this mould as they certainly do not give superior returns, as a diversified group or otherwise. Right from the start this definition of risk seemed unrealistic.

Unrealistic or not, an entire generation of investors has grown up with the idea that volatility is risk. Services that rate managed funds examine volatility as a central concern, and "risk adjusted" historic returns are frequently a major factor in determining how many stars a manager is given by the rating services.

There are many problems with the whole concept. For starters there is no permanent correlation between risk (when defined as volatility) and return. High volatility does not give better results, nor does lower volatility give lesser results.

In 1977, over a decade before Markowitz and Sharpe received their Nobel Prizes for their work on portfolio theory, a paper appeared reviewing the research on risk (J. Michael Murphy, "Efficient Markets, Index Funds, Illusion, and Reality", *Journal of Portfolio Management* (Fall 1977). Some of the conclusions were startling, at least for EMH believers. Murphy cited four studies that found "realized returns appear to be higher than expected low low-risk securities and lower than expected for high-risk securities ... or that the [risk-reward] relationship was far weaker than expected." The author continued on: "Other important studies have concluded that there is not necessarily any *stable* relationship between risk and return; that there often may be virtually no relationship between return achieved and risk taken, and that high volatility unit trusts were not compensated by greater returns".

Another paper (Haugen and Heins, "Risk and the Rate of Return on Financial Assets: Some Old Wine in New Bottles," *Journal of Financial and Quantitative Analysis* (December 1975), concluded: "The results of our empirical effort do not support the conventional hypothesis that risk - systematic or otherwise - generates a special reward." These papers were published in the mid to late 70s, just as EMH and MPT were really taking off and "revolutionizing" the way Wall Street invested money.

The total absence of a correlation between volatility and return for individual stocks is not the only thing that troubles this method and its exponents. Even more fundamental is the failure of volatility measures to remain constant over time. Any options trader will tell you immediately that volatility is not the same from day to day, nor hour to hour or even year to year. Volatility simply does not stay the same for any period of time and varies drastically from one time period

to another. Stocks do not have a fixed volatility and hence it is absolutely impossible to use that factor to make meaningful changes to a portfolio unless you know what volatility is going to be; and we are no closer to finding a way to predict volatility than we are to being able to predict the general movement of prices.

Beta, as defined by Sharpe, Lintner and Mossin were shown to have no predictive power. The beta defined for one period differs drastically to that in the next and there is no way of using beta to predict future volatility.

The Capital Asset Pricing Model is based entirely on beta. Without a reliable beta you can't have CAPM any more than a value investor can buy stocks without knowing anything about assets or earnings. Somehow all this managed to be ignored until Eugene Fama, one of the original researchers who in 1973 had been right at the centre of the development of the Efficient Market Hypothesis, put out a new paper on risk and return in 1992. (Fama and French, "The Cross-Section of Expected Stock Returns" *Journal of Finance* 67 (1992), pp 427-465). Fama and French examined 9,500 stocks between 1963 and 1990, concluding that a stock's risk, measured by beta, was not a reliable predictor of performance. Fama stated "beta as the sole variable in explaining returns on stocks ... is dead. ... What we are saying is that over the last 50 years, knowing the volatility of an equity doesn't tell you much about the stock's return."

This was like the Pope announcing that there is no God, anyone who knows what a central role Fama's early 1970s work on EMH and CAPM played would appreciate that this was an astounding development. As the *Chicago Tribune* put it: "Some of its best-known adherents have now become detractors."

Barr Rosenberg, a well respected researcher proposed a more sophisticated multifactor beta, including a large number of other inputs besides volatility to measure risk. These betas, called "Barr's Bionic Betas" proved as worthless as previous definitions in portfolio construction. Other betas were examined but none proved to have any usefulness at all for anything besides providing work for market statisticians.

If not volatility, then what ? "What investors really get paid for is holding dogs." said Fama's coworker French. Their research found that stocks with lower price to earnings ratios and price

to book ratios, as well as smaller capitalization companies provided the highest returns over time. Stocks are more positively related to these measurements than to beta or other similar risk criteria.

Fama's words "beta is dead" reverberated around the world. As one finance professor put it in discussing the Fama and French findings: Modern finance today resembles a Meso-American religion, one in which the high priest not only sacrifices the followers - but even the church itself. The field has been so indoctrinated and dogmatized that only those who promoted the leading model from the start are allowed to destroy it.

Other measures were developed do adjust returns by volatility to devise "risk adjusted" returns. One can return 40% over a few years but if he/she does this with sufficiently high volatility then someone who invested in treasury bills would have better risk adjusted returns (Van Horne, 2005). Again volatility, in its usual definition, is no different for upside or downside movements. If one achieved this with results ranging between +1% and +100% in any given year, but with no down years at all, then on the basis of that track record the strategy was obviously a risky one. Many contrarian and value investors whose track records include very little downside volatility but tend to make a lot of money when markets bounce have very poor "risk adjusted" returns as a result of this thinking.

Beta gives the appearance of a highly sophisticated mathematical formula but in reality it is data mining, looking at history you can find a number of factors that seem to be correlated, but these correlations are more often than not sheer coincidence(Weaver, Western, 2009). This is very bad science.

CHAPTER FOUR

4.0 DATA ANALYSIS AND RESULTS

4.1 INTRODUCTION

This chapter presents the research methodology adopted in this study. The chapter highlights the research design, the population and sampling technique and sample size, as well as the data collection and analysis techniques.

4.2 RESEARCH DESIGN

The research design is the arrangement of conditions for collection and analysis of data in a manner that aims to combine relevance to the research purpose with economy in the procedure (Orodho, 2004). The function of research design is to provide for the collection of relevant evidence with minimal expenditure of effort, time and money. In order to compare the risk exposures in the key sectors of NSE's market segments, a non-experimental descriptive case study (diagnostic) research design study methodology will be used to measure the impact of risks on the stock prices and dividends of firms listed at the NSE. Descriptive designs are designed to gain more information about a particular characteristic within a particular field of study. A descriptive study may be used to, develop theory, identify problems with current practice, justify current practice, make judgments or identify what others in similar situations may be doing.

Event studies are a principal research tool in testing market efficiency (Dimson and Mussavian, 1988), and have been successfully used to examine the behaviour of firm's stock prices around corporate events over the past several decades (Kothari and Warner, 2004). Similar methodology has been used to test the information content of corporate announcements made by firms quoted on the NSE. These include a study carried out by Chirchir (2002) to determine the information content conveyed by the release of commercial paper, and a study by Ng'ang'a (2003) to determine the information content of annual financial reports and a study carried by Owalla Beldina (2005) to determine the effect of rights issue announcement on the issuing firm's price.

The study compared the risk exposures in the key sectors of NSE's MIMS. This was done by determining the betas using the least square method of regression analysis. In addition to the betas, the standard deviations across the sectors shall also be compared. The stock returns were determined for individual companies and then a portfolio is formed for each sector. Then the market return was also determined using the NSE index.

4.3 POPULATION

The population targeted was all the companies quoted at the Nairobi Stock Exchange (NSE) .The NSE was ideal for carrying out the study based on the availability, reliability and accessibility of the data used. There are currently 56 companies quoted at the Nairobi Stock Exchange (Appendix 2). The researcher however concentrated on companies which have been actively trading during the duration years January 2001 to December 2005.

4.4 SAMPLING FRAME

The sampling frame adopted in the study was obtained from the NSE list of quoted companies, and comprised of all sectors at the MIMS market segment with individual firms meeting the study's criteria as listed below:-

1. The firm is one of the companies listed on the NSE during the period 1954-2005
2. The stock dividend announcement made by the firm has been issued through the NSE during the period 1954 to 2005.
3. The day of the dividend announcement is recorded at the NSE.
4. The firm's daily return data (opening and closing stock prices) are available from the NSE daily trade sheets or daily newspapers for both the event and estimation windows.
5. The firm's declared dividend is available either at the Nairobi Stock Exchange or at the Capital Markets Authority as required by regulatory procedures.

4.5 SAMPLING TECHNIQUE

The sampling technique for the four sub-populations in the four sectors of MIMS namely, Agricultural, Industrial and Allied, Commercial and Services, and Finance and Investments was stratified random sampling . In order to zero in on the companies, the sampling technique to be

used was the convenient non-probability technique. This technique was chosen, as it enabled the researcher to ensure that only the firms that met the study's objectives were selected.

4.6 SAMPLE SIZE

The sample studied was made up of all the sectors in the MIMS market segment. The sample size was made of three companies from each of the sectors Agricultural, Industrial and Allied, Commercial and Services, and Finance and Investments.

The researcher used a combination of a stratified random sampling and non-probability technique to select the firms whose shares have been actively traded at the NSE as shown in the table below. The sample size was 8 out of 39 firms, a 21 percent representation of the population.

Table 3.1 Sample design

CATEGORY	POPULATION	SAMPLE
1. AGRICULTURAL	4	2
2. COMMERCIAL AND SERVICES	8	2
3. FINANCE AND INVESTMENTS	11	2
4. INDUSTRIAL AND ALLIED	16	2
TOTAL	39	8

Adopted from Nairobi Stock Exchange

According to Mugenda and Mugenda (1999) a representative sample in a descriptive survey is that which is 10% of the population.

4.7 DATA COLLECTION

Secondary data was used to collect information for the study, and this data were obtained from the Daily price lists and the Corporate Announcements Bulletin, both available to the public from the NSE library. A data collection design was used to collect the following data for each firm: the dividend paid by the firm at the end of its financial quarter; the firm's daily stock prices for the entire five(5) years and the related NSE 20 Share Indices for the same period.

The study relied on secondary data for quoted stocks from the NSE. The data included share prices, dividends paid and shares traded. Price adjustments were made where necessary for such items as stock dividends and bonus issues. Where dividends were paid annually or semi – annually these were divided by 4 or 2 respectively to correspond with each quarter. These were analysed on quarterly basis. This information was used in calculating returns and determining the stock betas.

4.8 PERIOD OF THE STUDY

The study covered a period of five years in the computation of the segment returns, standard deviations and betas. The period so covered was from January 2001 to December 2005.

4.9 VARIABLES OF THE STUDY

The variables employed by the study included stock returns, market index returns, and portfolio returns. These returns were used to determine the asset betas as well as segment and sector betas which were then compared to see whether they were significantly different using the student t test, correlation analysis and chi-square analysis.

4.10 RESEARCH PROCEDURES

The descriptive event study methodology was used to examine the effect of risks in the different sectors of MIMS. The method involved measuring abnormal trading during the event window using the prior period (estimation window) comparison. The estimation window is usually larger than the specific period of interest in order to permit examination of periods surrounding the event (Mackinlay, 1997).

An event window method was used, similar to a study carried out by Muradoglu and Aydogan (1999) on the Istanbul Stock Exchange, which is also an emerging market with thin trading characteristics. The event period comprising three monthly sub-periods: a pre-event period of 1 day (t-1); an event period of 1 day (dividend announcement date t0): and a post-event period of 1 day(t+1). The longer event window shall enable the study to observe the possible existence of stock price changes after the event, as well as price recovery before the event as observed by (Maradoglu and Aydogan, 1999).

The data collection design/instrument was based on the Market Model, which is the most popular model as it assumes a stable linear relationship between the market and security return (Mackinlay, 1977). The model used in carrying out a descriptive event study to test the impact of an event is of high importance as it determines the type of data to be collected (Ng'ang'a, 2003).

The data collection instrument used to collect the stock prices and NSE indices over the 24 quarters in five(5) years for each firm. This pre-event window was similar to a study carried out by the Kabir and Roosenboom (2002) on Dutch firms listed on the Amsterdam Exchange. The average returns were then calculated using the Single Market Model parameters, as well as the NSE market indices collected over the 5 year event period.

The instrument will then be used to collect the closing and opening stock prices for each quarter over the 5 years and together with the quarterly dividends the actual returns were then calculated.

The two portfolio analysis techniques of MPT and CAPM were used to predict annual subsequent returns for the same portfolio for five year from 2001 to 2005. The returns were the pretax EPS figures to be obtained from the financial statements of the companies selected in the portfolio. The average portfolio return were thus be calculated.

In order to ensure uniformity in the duration under consideration, companies which use 31st March as their end of accounting periods were purposively selected in the portfolio.

The average annual NSE 20 share index was calculated from the daily indices recorded during the days of trading in the year under review.

4.11 DATA ANALYSIS

Data were analyzed using descriptive statistics with the help of Microsoft Excel and Statistical Package for Social Sciences (SPSS). Descriptive statistics included the use of percentages and frequencies so as to achieve the set objectives. The descriptive analytical technique has been exclusively applied in selected studies in the past like Steel and Webster (1992). Descriptive statistics involves examining, categorizing and tabulating data to address the objectives of the study. Also undertaken was pattern matching and explanation building based on the data collected. The analysis of the returns will then be done for the sectors/segments (Agricultural, Commercial, Financial and Industrial) on quarterly basis. Secondary data on the subject will be analyzed and interpretations made Data will be interpreted; inferences made and presented descriptively using charts, tables and percentages.

4.11.1 The Single-Index Market Model (SMM)

The Single Index Market Model was used to analyze stock prices, dividends and traded volumes. This is the most popular model as it assumes a stable linear relationship between the market and security return (Mackinlay, 1977).

The actual and observed stock earnings were used to estimated as annual rates of return for both the MPT and CAPM portfolio analysis models using the holding period formula as follows;

$$R_{it} = \frac{P_1 - P_0 + D}{P_0}$$

Where R_{it} = return on the stock i for the period t.

P_1 = market price of the stock at end of the quarter.

P_0 = market price of the stock at the beginning of the quarter.

D = cash dividend paid out in the quarter.

The SMM Observed returns were used as a standard in order to measure the accuracy of the Modern Portfolio Theory(MPT) and the Capital Asset Pricing Model(CAPM).

4.11.2 The Modern Portfolio Theory

The analysis of the returns was then done for the sectors/segments (Agricultural, Commercial, Financial and Industrial) on annual basis using the MPT formula. Each of the said sectors then formed a portfolio of the returns where the determination of the said returns using the formula;

$$Rp = \sum RiWi$$

Where Rp = Return of the portfolio

Ri = Return of each firm in the segment

Wi = weight/ capitalisation at the end of the year.

This was the price multiplied by the average volume of the shares traded during the year to indicate the weighting factors.

Portfolio return variance:

$$\sigma_p^2 = \sum_i w_i^2 \sigma_i^2 + \sum_i \sum_{j \neq i} w_i w_j \sigma_i \sigma_j \rho_{ij}$$

where ρ_{ij} is the correlation coefficient between the returns on assets i and j. Alternatively the expression can be written as:

$$\sigma_p^2 = \sum_i \sum_j w_i w_j \sigma_i \sigma_j \rho_{ij}$$

where $\rho_{ij} = 1$ for $i=j$.

Portfolio return volatility (standard deviation):

$$\sigma_p = \sqrt{\sigma_p^2}$$

4.11.3 The Capital Asset Pricing Model

The CAPM formula was then used to calculate expected returns of the portfolio made up of the three firm stocks from the main investments segments of Agriculturals, Industrial and Allied, Finance and Investments and Commercial and Services

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

where:

- $E(R_i)$ is the expected return on the capital asset
- R_f is the risk-free rate of interest such as interest arising from government bonds
- β_i (the *beta*) is the sensitivity of the expected excess asset returns to the expected excess market returns
- $E(R_m)$ is the expected return of the market
- $E(R_m) - R_f$ is sometimes known as the *market premium* or *risk premium* (the difference between the expected market rate of return and the risk-free rate of return).

The portfolio beta for each market segment will be calculated using the formula below:

The beta of an individual asset is:

$$\beta_i = \frac{\mathrm{Cov}(R_i, R_m)}{\mathrm{Var}(R_m)},$$

If a given portfolio has weights w_p. The portfolio beta is:

$$\beta_p = \frac{Cov(R_p, R_m)}{Var(R_m)} = \frac{Cov\left(\left(\sum_{i-1}^{n} w_i R_p\right), R_m\right)}{Var(R_m)}$$

$$= \frac{\sum_{i-1}^{n} w_i Cov(R_i, R_m)}{Var(R_m)} = \sum_{i-1}^{n} w_i \beta_i$$

The beta of the portfolio was the weighted average of the individual asset betas where the weights are the portfolio weights obtained from the volumes of traded stocks in each sector/portfolio. (WWWFinance). So the researcher first calculated each stock's beta then sector's/portfolio's beta using the formula given above.

The expected annual market rate of return will be calculated using the Single Index Market Model as follows:

$$R_m = \frac{I_1 - I_0}{I_0}$$

Where I_1 = Market Index at the end of the quarter

I_0 =Market index at the beginning of the quarter.

The risk-free rate was estimated using the average annual 91 –day treasury bill rate for the year under consideration in the study analysis.

4.12 COMPARISON ANALYSIS OF MPT AND CAPM RETURNS

4.12.1 Overall SMM Observed, MPT and CAPM Returns

The stock prices, share traded volumes, dividends, the 91-day treasury bill rates and the 20-NSE index were used to calculate the observed, MPT and CAPM returns for the years 2001-2005. The study found that there was disparities in the portfolio returns based on the two portfolio analysis techniques of MPT and CAPM the historical observed returns. The observed returns of the portfolio of eight stocks composed of agricultural, commercial and services, financial and industrial and allied market segments recorded an average of 13.25 percent for the entire five duration. The overall MPT five year average return rate was 49.7125 with CAPM reporting only 4.48 percent.

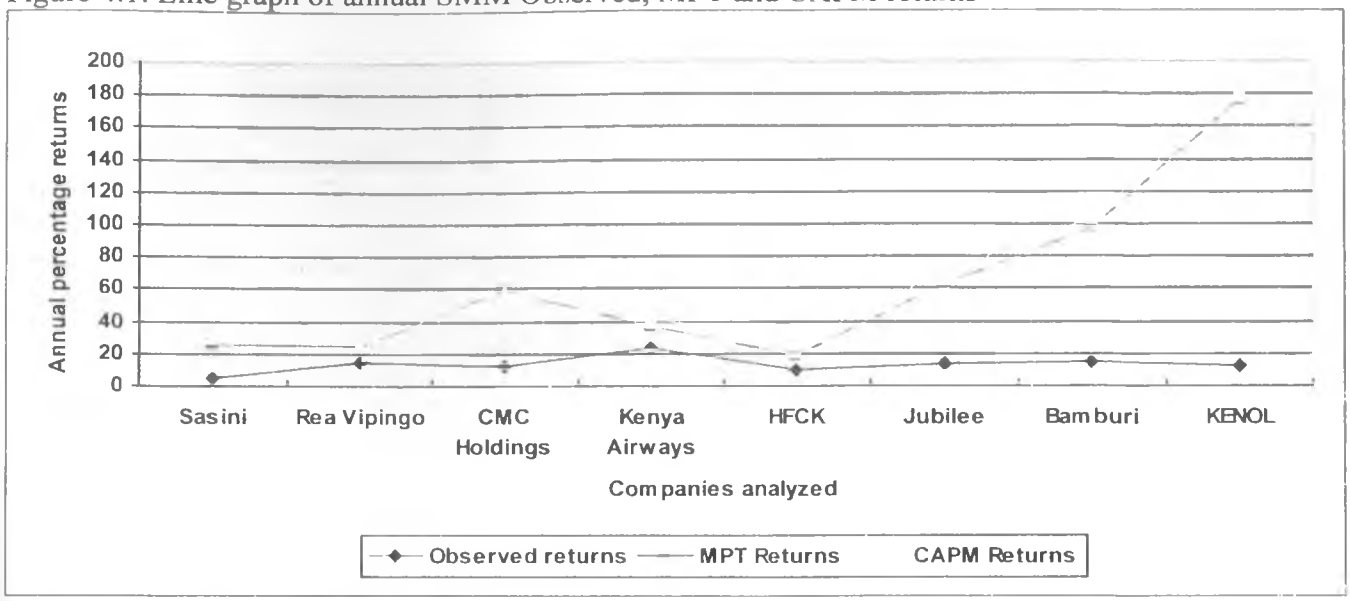
Table 4.1: Overall Individual Stock and Portfolio Observed, MPT and CAPM Returns

Serial Number	Company	SMM Observed Returns	MPT Returns	CAPM Returns
1	SASINI	5.12	21.32	2.78
2	REA VIPINGO	14.53	10.74	1.2
3	CMC	12.62	46.9	-1.18
4	KQ	23.61	12.92	5.61
5	HFCK	9.63	8.83	7.04
6	Jubilee	13.38	50.06	7.02
7	Bamburi	14.86	82.32	7.04
8	KENOL	12.24	164.61	6.33
	AVERAGE	13.2488	49.7125	4.48
	STANDARD DEVIATION	5.239892	52.94576	3.160972

Source: Researcher's analysis, 2010.

The researcher attributed the enhanced MPT returns to the impact of traded volume weighting factors. The weighting exaggerated the positive return rates. In the CAPM technique the beta associated with each stock moderated the exaggerations noted in the MPT technique. The researcher noted that the CAPM technique in fact downgraded the overall returns to below the observed return rates. The line graph in figure 4.1 below graphically depicts the variation in the overall return rates for the eight stocks using the three methods.

Figure 4.1: Line graph of annual SMM Observed, MPT and CAPM returns

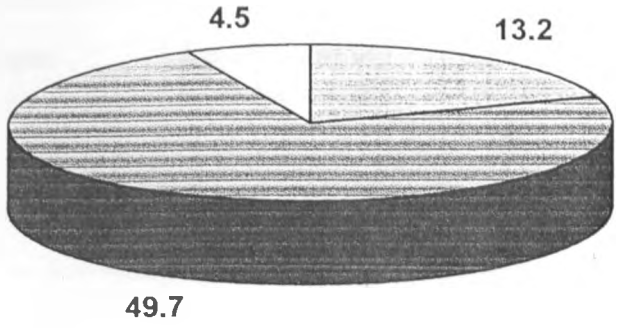


Source: Researcher's analysis, 2010.

In the MPT portfolio analysis technique, only the prices and volumes of traded shares are considered. While the CAPM technique considers the overall market index returns as well as the risk free rate (in this case the 91-day treasury bill rate for the quarter), the observed returns used prices at the beginning and at the end as swell as the quarter dividend.

These considerations explains the differences in the return rates using the three approaches with records of 11.6, 76.8 and 4.7 percent respectively using observed, MPT and CAPM techniques respectively. These are shown in the pie chart in figure 4.2 overleaf.

Figure 4.2: Overall Percentage Portfolio SMM Observed, MPT and CAPM returns



Source: Researcher's analysis, 2010.

4.12.2 Correlation Analysis of MPT and CAPM Returns

The returns obtained from the, Modern Portfolio Theory and Capital Asset Pricing Model were subjected to a bivariate correlation (as independent variables) using Karl Pearson's correlation co-efficient with the Single Market Model returns being the independent variable and the results were mixed. The analysis indicated that there was a negatively weak correlation co-efficient of -0.059 and between the observed SMM returns and the MPT returns with a significance p-value of 0.890. The correlation between SMM observed returns and the CAPM returns however positively weak at 0.157 with a significance measure of 0.710.

The import of these values indicates that both MPT and CAPM portfolio analysis techniques are relatively weak in predicting observed returns for a given portfolio of stocks. CAPM however is better portfolio analysis model compared to because the co-efficient of correlation between its returns and the SMM returns is positive so that the returns are changing in the same direction.

The null hypothesis was therefore rejected and the alternative hypothesis accepted.

Table 4.2: Correlation analysis of MPT and CAPM returns

Serial Number	Technique	Co-efficient of Correlation (r)	Co-efficient of Determination (r^2)	P-value
1	Modern Portfolio Theory	-0.059	0.348	0.890
2	Capital Asset Pricing Model	0.157	2.46	0.710

Source: Researcher's analysis, 2010.

The results of correlation analysis were not significant statistically at 0.05 and 0.01 significance levels for both the MPT and CAPM returns since their p-values were higher at 0.890 and 0.710 respectively. The co-efficient of determination which is the square of the percentage co-efficient of correlation determines the extent to which the independent variable determines the dependent variable.

The calculated co-efficient of determination were 0.348 percent and 2.46 percent for the MPT and CAPM returns respectively indicating that both methods contribute negligently towards the actual observed historical returns. The CAPM returns however contributed a higher percentage value of the observed returns compared to the MPT returns.

4.12.3 Regression Analysis of MPT and CAPM returns

The simple linear regression model used to relate the MPT and CAPM returns to the SMM Observed returns was as follows:

$$Y_i = \alpha + \beta x_i + \varepsilon_i.$$

where

x_i, $i = 1, ..., n$ are known,

α = the y-intercept

β =The co-efficient of the independent variable x in this case the MPT and CAPM returns.

ε_i= are independent normally distributed random errors

Table 4.3: Regression analysis on the MPT and CAPM returns

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	12.397	4.104		3.020	.029	1.846	22.947
	MPT	-.011	.045	-.114	-.249	.813	-.128	.105
	CAPM	.316	.761	.191	.415	.695	-1.640	2.272

a Dependent Variable: SMM

The analyzed data gave the following least squares regression equations:

Y= -0.011 -0.114x for the MPT returns and Y=0.316 + 0.191x for the CAPM returns.

4.12.3 Z-Test for Normality

Table 4.4: Standardized Variate (z-score) Test Results

	SMM Observed returns	MPT returns	CAPM returns
AVERAGE	13.2488	49.7125	4.48
STANDARD DEVIATION	5.239892	52.94576	3.160972

The Z-test for a normal distribution is calculated using the following formula:

$$Z = \frac{M - \mu}{SE}$$

Where M = Sample mean value

μ = Population mean (as in the hypothesis but in this case the SMM Observed returns)

SE = Standard Error = s/(n)^1/2

The standard errors for the MPT and CAPM returns based on a sample of eight (8) company stocks were calculated as follows:

MPT: SE = 52.95/(8)^1/2=18.71

CAPM: SE = 3.16/(8)^1/2=1.12

The calculated z-values for the MPT and CAPM returns using the SMM Observed returns as the population mean were as follows:

$$\text{MPT: } Z = \frac{49.71-13.25}{18.71} = 1.95$$

$$\text{CAPM: } Z = \frac{4.48-13.25}{1.12} = -7.83$$

At 5 percent level of significance, the z-score from the statistical tables, lies between +1.96 and -1.96. Since the calculated z-score for the MPT returns is 1.95, the Null Hypothesis that the MPT returns are equal to the SMM observed returns cannot be rejected. However, since the calculated z-score for the CAPM returns is -7.83 and is beyond the -1.96 boundary the Null Hypothesis that CAPM returns are equal to the SMM observed returns is rejected.

At the 1 percent significance level, since the acceptance region lies between -2.58 and +2.58, the same results and interpretations are found.

4.12.4 T-test of MPT and CAPM returns

The overall returns from the three portfolio analysis techniques of Single Market Model, Modern Portfolio Theory and the Capital Asset Pricing model were subjected to statistical t-test because the eight stock sample was smaller than the 30 threshold recommended for large samples (Mongomery D.C, Runger G.C., 1994) and the results were found to be as in table 4.3 below.

Table 4.5: One Sample T-test on SMM Observed, MPT and CAPM returns

	Test Value = 0.05					
	t-value	Degrees of Freedom	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
SMM	7.125	7	.000	13.1987	8.8181	17.5794
MPT	2.653	7	.033	49.6625	5.3987	93.9263
CAPM	3.964	7	.005	4.4300	1.7874	7.0726

Source: Researcher's analysis, 2010.

In testing the null hypothesis that the mean returns from the MPT and CAPM formulae is equal to a specified value μ_0, in this case the mean return of the SMM observed returns the researcher used the statistic

$$t = \frac{\bar{x} - \mu_0}{\frac{s}{\sqrt{n}}}$$

where s is the MPT or CAPM standard deviation and n is the sample size. The degrees of freedom used in this test is $n - 1$.

Hence, $t_{0.05,7} = 7.125$ for the SMM observed returns, $t_{0.05,7} = 2.653$ for the MPT returns and $0.05,7 = 3.964$ for the CAPM returns.

The statistical two-tailed table t-statistic however was $t_{0.05,7} = 2.365$. Now since the t-values calculated using both the MPT and CAPM mean returns were greater than the tabulated t-value, the mean returns from both MPT and CAPM techniques are larger than the two-tailed table t-value at the 0.05 level of significance the hypothesis that the MPT and CAPM returns represent the actual SMM observed returns was rejected at the 0.05 level of significance (Lucey T., 2002).

However, the MPT returns was more representative of the observed returns since the calculated t-value from the CAPM returns was larger than the same calculated value from the MPT returns at 3.964 and 2.653 respectively.

4.12.5 Chi-Square Analysis of MPT and CAPM Returns

The MPT and CAPM returns were subjected to a chi-square analysis with the SMM Observed returns as the observed returns and the returns were as shown in Table 4.5 below. The calculated chi-square values were 26.75 and 17.16 for the MPT and CAPM returns respectively.

The value of the test-statistic was calculated using the formula overleaf:

$$X^2 = \sum_{i}^{n} \frac{(O_i - E_i)^2}{E_i}$$

Where

X^2 = Pearson's cumulative test statistic, which asymptotically approaches a χ^2 distribution.

O_i = an observed frequency;

E_i = an expected (theoretical) frequency, asserted by the null hypothesis;

n = the number of cells in the table (Chernoff and Lehmann, 1954).

Table 4.4: Chi-square test analysis for the SMM Observed, MPT and CAPM returns

COMPANY	SMM Returns (O)	MPT Returns (E1)	CAPM Returns (E2)	O-E1	O-E2	(O-E1)^2	(O-E2)^2	(O-E1)^2/E1	(O-E2)^2/E2
SASINI	5.12	21.32	2.78	16.2	-2.34	262.44	5.4756	12.30956848	1.969640288
REA VIPINGO	14.53	10.74	1.2	-3.79	-13.33	14.3641	177.689	1.337439479	148.0740833
CMC	12.62	46.9	-1.18	34.28	-13.8	1175.12	190.44	25.05582942	-161.389831
KQ	23.61	12.92	5.61	-10.69	-18	114.276	324	8.844899381	57.7540107
HFCK	9.63	8.83	7.04	-0.8	-2.59	0.64	6.7081	0.072480181	0.952855114
Jubilee	13.38	50.06	7.02	36.68	-6.36	1345.42	40.4496	26.87619656	5.762051282
Bamburi	14.86	82.32	7.04	67.46	-7.82	4550.85	61.1524	55.28245384	8.686420455
KENOL	12.24	164.61	6.33	152.37	-5.91	23216.6	34.9281	141.0401367	5.517867299
TOTALS	13.2488	49.7125	4.48	36.4638	8.7688	1329.61	76.891	26.74589015	17.16316441

Source: Researcher's analysis, 2010.

The statistical table chi-square value for (8-1)(2-1) degrees of freedom at the 0.05 significance level was 14.07. As the calculated values were greater than the table chi-square values at were 26.75 and 17.16 for the MPT and CAPM returns respectively, the calculated returns are rejected as representative of the actual observed returns. The CAPM chi-square value at 17.16 is less than the MPT value of 26.75 so that the CAPM were found to be better estimates of the actual observed returns.

The null hypothesis was therefore rejected and the alternative hypothesis accepted.

5.0 CHAPTER FIVE

5.1 CONCLUSIONS AND RECOMMENDATIONS

5.1 CONCLUSIONS

The overall mean returns from the Modern Portfolio Theory and Capital Asset Pricing Model models were 49.7125 and 13.2488 percent respectively. When compared to the historical Single Market Model returns of 4.48 percent it is clear that there is a great disparity.

The Modern Portfolio Theory appears to exaggerate the positive returns when the weighting factors of the volume of shares traded are factored in. The fact that the MPT uses only the stock prices as an estimation of future stock returns is a bit unrealistic because investors buy shares primarily in order to earn dividends. This is especially true for the serious long term investors whose investment horizon is in the range of one to ten years. Of course, investors would not mind share appreciation and therefore capital gains when stock prices appreciate in value. Capital gains as an investment objective is the preserve of speculative investors. Usually stock markets do not consider such retail and pedestrian traders serious investors.
But this should not override the dividend investment objective.

The research found that the co-efficient of correlation between the MPT returns and the SMM Observed returns was very weak and negative at -0.059 indicating that there is a negligible relationship between the two return estimates. This can be attributed to over-emphasis on stock price changes as an indication of future returns.

The Capital Asset Pricing Model incorporates more evaluation parameters such as the risk free rate, in this case the 91-day treasury bill rate, and the entire market returns, as represented by the Nairobi Stock Exchange 20 Share Index. These more variables improved the validity of the CAPM model as a predictor of future returns compared to the MPT since its co-efficient of correlation was and positive greater at 0.157.

Although the Capital Asset Pricing Model used more parameters in estimating future returns for the analyzed portfolio, it still fell victim to the same predicament faced by the MPT model

by not incorporating dividends in its valuation process. That is why its returns at 13 percent were an improvement from the 49 percent of MPT but were still way beyond the observed SMM returns of 5 percent.

At 5 percent level of significance, the z-score from the statistical tables, lies between =1.96 and -1.96. Since the calculated z-score for the MPT returns is 1.95, the Null Hypothesis that the MPT returns are equal to the SMM observed returns cannot be rejected. However, since the calculated z-score for the CAPM returns is -7.83 and is beyond the -1.96 boundary the Null Hypothesis that CAPM returns are equal to the SMM observed returns is rejected. At the 1 percent significance level, since the acceptance region lies between -2.58 and +2.58, the same results and interpretations are found.

The study conclusion was that the hypothesis that the MPT and CAPM returns represent the actual SMM observed returns was rejected at the 0.05 level of significance. This was because the calculated t-values for MPT and CAPM returns were greater than the table t-value of $t_{0.05,7}=2.365$ at 3.964 and 2.653 respectively. However, the MPT returns was more representative of the observed returns since the calculated t-value from the CAPM returns was larger than the same calculated value from the MPT returns

To confirm the statistical significance of the difference between the SMM observed returns and the MPT and CAPM returns, a chi-square statistical test was done. The conclusion was that the table chi-square value at 14.07 was less than the calculated MPT and CAPM return values at 26.75 and 17.16 respectively. The MPT and CAPM calculated returns were rejected as representative of the actual observed returns. The CAPM chi-square value at 17.16 was found to be less than the MPT value of 26.75 so that the CAPM returns were found to be better estimates of the actual observed returns.

5.2 RECOMMENDATIONS

5.2.1 Modern Portfolio Theory

On the MPT model, the study recommended that the weighting factors in the form of traded volumes of stocks can be adjusted so that they do not magnify positive changes in the prices of shares. A trend analysis such as decomposition and cyclical variations could be incorporated so that the weighting factors are more accurate.

The weighted mean concept of the MPT model could be improved by introducing geometric means instead of arithmetic mean used at the moment.

The MPT assumptions included the fact that there were no taxes or transaction costs, all investors were price takers, and that any investor could lend and borrow an unlimited amount at the risk free rate of interest. Real financial products are subject both to taxes and transaction costs (such as broker fees), and taking these into account will alter the composition of the optimum portfolio. In reality, sufficiently large sales or purchases of individual assets can shift market prices for that asset and others (via cross-elasticity of demand.) An investor may not even be able to assemble the theoretically optimal portfolio if the market moves too much while they are buying the required securities. . In reality, every investor has a credit limit. All securities can be divided into parcels of any size. In reality, fractional shares usually cannot be bought or sold, and some assets have minimum orders sizes.

The study therefore recommended that the MPT models adjusts its recommendations so that they are more realistic of the capital markets in the real world. Although, removing some of the assumptions would complicate the MPT calculations, the study recommended that this was justified given the study findings which revealed that the MPT returns were not accurate estimating portfolio returns.

5.2.2 Capital Asset Pricing Model

The use of the 91-one day treasury bill rate as the risk free rate used in the CAPM model could further be improved through globalization into an international standard such as the European Union rate, the United States of America treasury bill rate of even a rate from the International

Monetary Fund. This will have the impact of globalizing the research findings and anchor the results on a larger and stable economic basis.

The CAPM model assumes that the variance of returns is an adequate measurement of risk . This might be justified under the assumption of normally distributed returns, but for general return distributions other risk measures (like coherent risk measures) will likely reflect the investors' preferences more adequately. Indeed risk in financial investments is not variance in itself, rather it is the probability of losing: it is asymmetric in nature. The model assumes that all investors have access to the same information and agree about the risk and expected return of all assets.

The study therefore recommended that a more concise risk measurement which include fundamentals such as Earnings Per Share, Industry issues and the macro-economic outlook be adopted under CAPM calculations

The Capital Asset Pricing Model is based entirely on beta. Without a reliable beta one cannot have CAPM any more than a value investor can buy stocks without knowing anything about assets or earnings. The study therefore proposed that a more sophisticated multifactor beta which includes a large number of other inputs besides volatility be used to measure risk.

5.3 SUGGESTIONS FOR FURTHER STUDY

5.3.1 Modern Portfolio Theory

The study noted that recent advances in portfolio and financial theory, coupled with today's increased electronic computing power, have resulted in expanded risk/return paradigm known as Post-Modern Portfolio Theory, or PMPT. Thus, MPT becomes nothing more than a (symmetrical) special case of PMPT.

In 1987 The Pension Research Institute at San Francisco State University developed the practical mathematical algorithms of PMPT that are in use today. These methods provide a framework that recognizes investors' preferences for upside over downside volatility. At the

same time, a more robust model for the pattern of investment returns, the three-parameter lognormal distribution, was introduced.

Downside risk (DR) was measured by target semi-deviation (the square root of target semivariance) and is termed downside deviation. It is expressed in percentages and therefore allows for rankings in the same way as standard deviation.

An intuitive way to view downside risk is the annualized standard deviation of returns below the target. Another is the square root of the probability-weighted squared below-target returns. The squaring of the below-target returns has the effect of penalizing failures at an exponential rate. This is consistent with observations made on the behavior of individual decision-making under

$$d = \sqrt{\int_{-\infty}^{t} (t - r)^2 f(r)\, dr}$$

where

d = downside deviation (commonly known as 'downside risk'),

t = the annual target return, originally termed the minimum acceptable return, or MAR.

r = the random variable representing the return for the distribution of annual returns $f(r)$,

$f(r)$ = the three-parameter lognormal distribution

The Sortino ratio measures returns adjusted for the target and downside risk. It is defined as:

$$\frac{r - t}{d}$$

where

r = the annualized rate of return,

t = the target return,

d = downside risk.

5.3.2 Capital Asset Pricing Model

These criticisms against CAPM have inspired scholars to come up with new CAPM versions such as the Consumption CAPM and Black's CAPM have been designed in order to improve the capital assets pricing model(Weaver, Western, 2009). The consumption-based capital asset pricing model (CCAPM) is used in finance and economics as an expansion of the capital asset pricing model (CAPM). The CCAPM factors in consumption as a means of understanding and calculating an expected return on investment.

The CCAPM implies that the expected risk premium on a risky asset, defined as the expected return on a risky asset less the risk free return, is proportional to the covariance of its return and consumption in the period of the return. The consumption beta is included and the expected return is calculated as follows:

r= rf + B(rm - rf)

r = expected return on security or portfolio rf = risk free rate B = consumption beta (of individual company or weighted average of portfolio), and rm = return from the market

The derivation of the CAPM measure assumes that all individuals hold the same portfolio and that this portfolio must be the market portfolio. The most general version of the CAPM requires only that individuals hold mean variance efficient portfolios. In Black's CAPM, each individual can hold a different portfolio of risky assets (Fischer, Jordan, 2009). The market portfolio, which is just a weighted sum of the individuals portfolios, will itself be on the efficient frontier and hence will be an efficient portfolio. This more general version of the CAPM also relaxes the assumption that individuals can borrow and lend at the riskless rate. In fact, it treats all assets as risky. Rather than relying on the existence of a riskless asset, all that is required is the existence of an asset whose returns are uncorrelated with those of the market portfolio (a zero-beta portfolio). The final equation for this model is:

$$E[r_i] = E[r_z] + \beta E[r_m - r_z]$$

where $E[r_z]$ is the expected return of the zero-beta portfolio and the other variables are as previously defined. This version of the CAPM is known as the Black CAPM and was derived by Fischer Black.

The researcher hopes, God willing, to pursue these more sophisticated portfolio investment analysis techniques at higher levels of studies and research.

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APPENDIX 1: LETTER OF INTRODUCTION

TO WHOM IT MAY CONCERN:

Dear Sir/Madam,

RE: RESEARCH INFORMATION

I am a postgraduate student at the School of Mathematics, University of Nairobi pursuing my Post Graduate Diploma in Actuarial Science course. As part of the course requirements, I am undertaking a research project a Technical Return-Risk Portfolio Analysis in a Segmented Market at the NSE for the period 2000 to 2005.

To fulfill information requirements for the study, I intend to collect secondary data from your institution. The information being requested is purely for academic purposes and will be treated in strict confidence, and will not be used for any purposes other than for my research.

I would really appreciate if you would allow me to access all the relevant information for the research project. Any additional information you might consider useful for the study is most welcome.

Thank you.

Cherutich Peter Kipkoech

Student
Post Graduate Diploma in Actuarial Science

Prof. Patrick Weke

Supervisor
School of Mathematics
University of Nairobi

APPENDIX 2: COMPANIES LISTED AT NSE

MAIN INVESTMENT MARKET SEGMENT

1.AGRICULTURAL

Unilever Tea Kenya Limited

Rea Vipingo Limited

Sasini Tea and Coffee Limited

Kakuzi Limited

2.COMMERCIAL AND SERVICES

TPS Serena

Car and General Limited

Hutchings Biewer Limited

CMC Holdings

Kenya Airways

Uchumi Supermarkets Limited

Marshalls EA Limited

Nation Media Group

3. FINANCE AND INVESTMENTS

National Industrial Credit Bank Limited

Pan African Insurance Holdings Limited

Housing Finance Limited

Barclays Bank of Kenya Limited

CFC Bank Limited

Standard Chartered Bank Limited

Diamond Trust Bank of Kenya

ICDC Investment Company Limited

Jubilee Insurance Company Limited

National Bank of Kenya Limited

Kenya Commercial Bank Limited

4. INDUSTRIAL AND ALLIED

Athi River Mining

BOC Kenya Limited

Bamburi Cement Limited

British American Tobacco (K) Limited

Crown –Berger (K) Limited

Olympia Capital Holdings

EA Breweries Limited

EA Cables Limited

Carbacid Investments Limited

EA Portland Cement Company Limited

Sameer Group

Unga Group Limited

Mumias Sugar Company

Kenya Power and Lighting Company Limited

Kenya Oils Limited

Total (K) Limited

ALTERNATIVE INVESTMENTS MARKET SEGMENT

A Baumann & Company Limited

City Trust

Standard Group Limited

Eagads Limited

Express Kenya Limited

Williamson Tea Kenya Limited

Kapchorua Tea Company Limited

Kenya Orchads

Limuru Tea

APPENDIX 3:SMM OBSERVED RETURNS

		AGRICULTURAL						COMMERCIAL AND SERVICES					
		SASINI			REA VIPINGO			CMC Holdings			Kenya Airways		
YEAR	QUARTER	PRICE	DIVIDENDS	OBSERVED RETURN:	PRICE	DIVIDENDS	OBSERVED RETU	PRICE	DIVIDENDS	OBSERVED R	PRICE	DIVIDEND!	OBSERVED RETUF
2001	1stquarter	33.00			3.30			11.75			7.55		
	2ndquarter	26.75	6	-0.76	2.70	0.25	-10.61	8.80	0.75	-18.72	8.80	2	43.05
	3rdquarter	19.60		-26.73	2.90		7.41	8.10		-7.95	6.60		-25.00
	4th quarter	15.9		-18.88	2.90		0.00	9.00		11.11	7.30		10.61
2002	1stquarter	15		-5.66	2.90		0.00	8.00		-11.11	7.30		0.00
	2ndquarter	15	2	13.33	3.00	0.25	12.07	11.80	0.75	56.88	7.25	2.5	33 56
	3rdquarter	13.2		-12.00	2.55		-15.00	17.25		46.19	6.20		-14.48
	4th quarter	13.6		3.03	2.60		1.96	21.00		21.74	6.85		10.48
2003	1stquarter	17		25.00	3.50		34.62	25.00		19.05	5.90		-13.87
	2ndquarter	21.5	2.5	41.18	5.00	0.80	65.71	44.75	0.8	82.20	6.50	1.5	35.59
	3rdquarter	17.3		-19.53	5.15		3.00	68.00		51.96	9.10		40.00
	4th quarter	20		15.61	6.10		18.45	72.00		5.88	8.50		-6.59
2004	1stquarter	17.35		-13.25	9.00		47.54	53.00		-26.39	9.60		12.94
	2ndquarter	19.55	6	47.26	9.10	0.60	7.78	51.00	0.75	-2.36	13.00	2	56.25
	3rdquarter	20.25		3.58	9.50		4.40	55.00		7.84	14.00		7.69
	4th quarter	26.25		29.63	10.00		5.26	60.00		9.09	16.90		20.71
2005	1stquarter	30.25		15.24	12 05		20.50	49.00		-18.33	24.00		42.01
	2ndquarter	33.75	3	21.49	19.70	0.50	67.63	51.00	0.8	5.71	58.50	2.5	154.17
	3rdquarter	33.00		-2.22	20.50		4.06	47.25		-7.35	84.50		44.44
	4th quarter	26.75		-18.94	20.75		1.22	54.00		14.29	82.00		-2.96
		21.75		5.12	7.89	0.48	14.53	37.58	0.77	12.62	20.15	2.10	23.61

APPENDIX 3: SMM OBSERVED RETURNS (CONTINUED)

Housing Finance			Jubilee Insurance			Bamburi Cement			Kenya Oil		
PRICE	DIVIDI	OBSERVEI	PRICE	DIVIDEI	OBSERVED	PRICE	DIVIDI	OBSERVEI	PRICE	DIVIDE	OBSERVED RETURNS
5.35			16.90			28.00			93 00		
5.00	0.38	0.56	15.10	1 75	-0.30	28.00	0.5	1.79	73.50	2.5	-18.28
4 00		-20.00	14.75		-2.32	23.00		-17.86	68.50		-6.80
4.00		0.00	15.50		5.08	29.00		26.09	73.50		7.30
3.10		-22.50	15.25		-1.61	16.00		-44.83	82.00		11.56
3.70	0.4	32.26	15.70	1.75	14.43	17.25	0.75	12.50	73.00	3	-7.32
3.00		-18 92	15.50		-1.27	22.00		27.54	81.00		10.96
5.20		73.33	15.50		0.00	22.00		0.00	82.00		1.23
7.00		34.62	25.50		64.52	54.00		145.45	123.00		50 00
10.95	0.35	61.43	30.00	1.75	24.51	80.00	1.5	50.93	200.00	3.5	65.45
12.00		9.59	62.50		108.33	102.00		27.50	272.00		36.00
13.00		8.33	51.50		-17 60	105.00		2.94	329.00		20.96
12.10		-6.92	60.00		16.50	99.50		-5.24	350.00		6.38
9.90	0.4	-14.88	53.00	2.5	-7.50	79.50	6.8	-13.27	420.00	2.5	20.71
9.20		-7.07	55.00		3.77	85 50		7.55	50.50		-87.98
8.50		-7.61	58.00		5.45	95.00		11.11	63.00		24.75
9.45		11.18	62.50		7.76	97.00		2.11	64.50		2.38
12.70	0.45	39.15	70.50	2.5	16.80	120.00	7.8	31.75	110.00	2	73.64
12 20		-3.94	71.00		0.71	136.00		13.33	126 00		14.55
13.95		14.34	83.00		16.90	140.00		2.94	135.00		7.14
8.37	0.40	9.63	41.57	2.05	13.38	71.09	3.47	14.86	146.13	2.70	12.24

APPENDIX 4: MODERN PORTFOLIO THEORY RETURN-RISK CALCULATIONS

YEAR		AGRICULTURAL						COMMERCIAL AND SERVICES					
		SASINI			Rea Vipingo			CMC Holdings			Kenya Airways		
		VOLUME	PRICE	WEIGHTED P	VOLUME	PRICE	WEIGHTED P	VOLUME	PRICE	WEIGHTED P	VOLUME	PRICE	WEIGHTED P
2001	1stquarter	604,347	33.00	19943451.00	159,000.00	3.30	524,700.00	606,989.00	11.75	7,132,120.75	2,654,289.00	7.55	20,039,881.95
	2ndquarter	516,925.00	26.75	13827743.75	174,000.00	2.70	469,800.00	213,660.00	8.80	1,880,208.00	3,000,501.00	8.80	26,404,408.80
	3rdquarter	646,157.00	19.60	12664677.20	168,000.00	2.90	487,200.00	196,600.00	8.10	1,592,460.00	4,016,055.00	6.60	26,505,963.00
	4th quarter	760,185.00	15.9	12086941.50	180,000.00	2.90	522,000.00	218,516.00	9.00	1,966,644.00	3,877,570.00	7.30	28,306,261.00
2002	1stquarter	684,166.00	15	10262490.00	156,000.00	2 90	452,400.00	509,870.00	8.00	4,078,960.00	4,662,316.00	7.30	34,034,906.80
	2ndquarter	760,185.00	15	11402775.00	210,000.00	3.00	630,000.00	1,019,742.00	11.80	12,032,955.60	6,001,001.00	7.25	43,507,257.25
	3rdquarter	659,460.00	13.2	8704872.00	279,000.00	2.55	711,450.00	1,675,290.00	17.25	28,898,752.50	6,462,617.00	6.20	40,068,225.40
	4th quarter	722,175.00	13.6	9821580.00	309,000.00	2.60	803,400.00	1,990,924.00	21.00	41,809,404.00	7,916,706.00	6.85	54,229,436.10
2003	1stquarter	779,189	17	13246213.00	339,000.00	3.50	1,186,500.00	2,573,633.00	25.00	64,340,825.00	11,078,772.00	5.90	65,364,754.80
	2ndquarter	997,742	21.5	21451453.00	522,000.00	5.00	2,610,000.00	2,476,515.00	44.75	110,824,046.25	29,312,583.00	6.50	190,531,789.50
	3rdquarter	1,187,789	17.3	20548749.70	540,000.00	5.15	2,781,000.00	2,670,752.00	68.00	181,611,136.00	39,006,508.00	9.10	354,959,222.80
	4th quarter	1,301,817	20	26036340.00	570,000.00	6.10	3,477,000.00	2,816,429.00	72.00	202,782,888.00	37,852,470.00	8 50	321,745,995.00
2004	1stquarter	1,216,296	17.35	21102735.60	600,000.00	9.00	5,400,000.00	2,330,838.00	53.00	123,534,414.00	1,042,060.00	9.60	10,003,776.00
	2ndquarter	1,016,747	19.55	19877403.85	723,000.00	9.10	6,579,300.00	2,427,956.00	51.00	123,825,756.00	4,016,055.00	13.00	52,208,715.00
	3rdquarter	1,330,324	20.25	26939061.00	1,275,000.00	9.50	12,112,500.00	3,006,508.00	55.00	165,357,940.00	3,877,570.00	14.00	54,285,980.00
	4th quarter	1,016,747	26.25	26689608.75	1,245,000.00	10.00	12,450,000.00	3,785,247.00	60.00	227,114,820.00	4,662,316.00	16.90	78,793,140.40
2005	1stquarter	744,981	30.25	22535675.25	800,500.00	12.05	9,646,025.00	2,456,000.00	49.00	120,344,000.00	6,001,001.00	24.00	144,024,024.00
	2ndquarter	760,185.00	33.75	25656243.75	901,470.00	19.70	17,758,959.00	2,786,320.00	51.00	142,102,320.00	2,001,520.00	58.50	117,088,920.00
	3rdquarter	684,166.00	33.00	22577478.00	987,500.00	20.50	20,243,750.00	2,789,500.00	47.25	131,803,875.00	3,554,000.00	84.50	300,313,000.00
	4th quarter	760,185.00	26.75	20334948.75	1,005,000.00	20.75	20,853,750.00	3,005,500.00	54.00	162,297,000.00	5,456,000.00	82.00	447,392,000.00
	TOTALS	17,149,768	435	365,710,441	11,143,470	153	119,699,734	39,556,789	726	1,855,330,525	186,451,910	390	2,409,807,658
	EXPECTED RETURNS			21.32			10.74	258203.58		46.90	256926.98		12.92

APPENDIX 4: MODERN PORTFOLIO THEORY RETURN-RISK CALCULATIONS (CONTINUED)

Housing Finance			Jubilee Insurance			Bamburi Cement			Kenya Oil		
VOLUME	PRICI	WEIGHTED I	VOLUME	PRICE	WEIGHTED PI	VOLUME	PRICE	WEIGHTED PRI	VOLUME	PRICE	WEIGHTED PR
586,500.00	5.35	3,137,775.00	556,200.00	16.90	9,399,780.00	9,708,664.00	28.00	271,842,592.00	547,184.00	93.00	50,888,112.00
460,000.00	5.00	2,300,000.00	531,000.00	15.10	8,018,100.00	10,525,838.00	28.00	294,723,464.00	740,851.00	73.50	54,452,548.50
437,000.00	4.00	1,748,000.00	558,000.00	14.75	8,230,500.00	5,898,099.00	23.00	135,656,277.00	690,453.00	68.50	47,296,030.50
598,000.00	4.00	2,392,000.00	569,000.00	15.50	8,819,500.00	15,335,056.00	29.00	444,716,624.00	745,891.00	73.50	54,822,988.50
805,000.00	3.10	2,495,500.00	505,132.00	15.25	7,703,263.00	7,600,000.00	16.00	121,600,000.00	1,078,518.00	82.00	88,438,476.00
1,196,000.00	3.70	4,425,200.00	918,000.00	15.70	14,412,600.00	9,900,000.00	17.25	170,775,000.00	1,270,031.00	73.00	92,712,263.00
1,420,250.00	3.00	4,260,750.00	104,400.00	15.50	1,618,200.00	18,500,000.00	22.00	407,000,000.00	2,015,922.00	81.00	163,289,682.00
1,380,000.00	5.20	7,176,000.00	223,200.00	15.50	3,459,600.00	45,369,991.00	22.00	998,139,802.00	2,741,654.00	82.00	224,815,628.00
1,092,500.00	7.00	7,647,500.00	1,800,000.00	25.50	45,900,000.00	35,933,033.00	54.00	1,940,383,782.00	3,830,253.00	123.00	471,121,119.00
1,058,000.00	10.95	11,585,100.00	2,160,000.00	30.00	64,800,000.00	29,036,794.00	80.00	2,322,943,520.00	3,527,864.00	200.00	705,572,800.00
1,000,500.00	12.00	12,006,000.00	1,908,000.00	62.50	119,250,000.00	31,033,074.00	102.00	3,165,373,548.00	4,233,437.00	272 00	1,151,494,864.00
1,092,500.00	13 00	14,202,500.00	1,980,000.00	51.50	101,970,000.00	34,481,193.00	105.00	3,620,525,265.00	5,090,204.00	329.00	1,674,677,116.00
1,454,750.00	12.10	17,602,475.00	2,088,000.00	60.00	125,280,000.00	35,207,050.00	99.50	3,503,101,475.00	6,501,350.00	350.00	2,275,472,500.00
1,414,500.00	9.90	14,003,550.00	2,268,000.00	53.00	120,204,000.00	44,281,032.00	79.50	3,520,342,044.00	11,591,554.00	420.00	4,868,452,680.00
1,604,250.00	9.20	14,759,100.00	2,502,000.00	55.00	137,610,000.00	48,900,500.00	85.50	4,180,992,750.00	12,700,311 00	50.50	641,365,705.50
805,000.00	8.50	6,842,500.00	2,532,000.00	58.00	146,856,000.00	50,814,299.00	95.00	4,827,358,405.00	13,607,476.00	63.00	857,270,988.00
1,196,000.00	9.45	11,302,200.00	2,988,000.00	62.50	186,750,000.00	45,369,991.00	97.00	4,400,889,127.00	11,500,745.00	64.50	741,798,052.50
1,420,250.00	12.70	18,037,175.00	505,132.00	70.50	35,611,806.00	35,933,033.00	120.00	4,311,963,960.00	4,500,700.00	110.00	495,077,000.00
1,380,000.00	12.20	16,836,000.00	918,000.00	71.00	65,178,000.00	29,036,794.00	136.00	3,949,003,984.00	4,814,789.00	126.00	606,663,414.00
1,454,750.00	13.95	20,293,762.50	2,160,000.00	83.00	179,280,000.00	36,450,000.00	140.00	5,103,000,000.00	5,600,400.00	135.00	756,054,000.00
21,855,750	164	193,053,088	27,774,064	807	1,390,351,349	579,314,441	1,379	47,690,331,619	97,329,587	2,870	16,021,735,968
		8.83	169044.82		50.06	#DIV/0!		82.32	70592.63		164.61

APPENDIX 5: CAPM RETURN-RISK CALCULATIONS

YEAR		TREASU I0		Rm=(I1-I0)/I0	Sasini	Rea Vipingc	CMC	KQ	HFCK	Jubilee	Bamburi	KENOL
2001	1stquarter	14.418	1,905.86	-3.952546357	-2.00	-8.062037577	-17.21112078	8.90977538	14.4078962	14.33533254	14 4078962	11 67031738
	2ndquarter	12.433	1830.53	-9.774218396	-7.42	-14.74197315	-25.80183413	5.774387636	12.420786	12.33306752	12.42078603	9.111466345
	3rdquarter	12.141	1,651.61	-15 04047566	-12.16	-21.12097176	-34.65816208	3.990906339	12.1260502	12.01868336	12.12605019	8.075466686
	4th quarter	10.854	1,403.20	-3.339509692	-1.83	-6.51459781	-13.58339144	6.598218054	10.8461936	10.79012921	10.84619357	8.731076755
2002	1stquarter	10.045	1,356.34	-13.01517319	-10.57	-18.17373393	-29.65839198	3 130637672	10.0323169	9.941229221	10.0323169	6.595889896
	2ndquarter	7.498	1,179.81	-7.65377476	-6.05	-11.04322677	-18.58926516	2.954891856	7.48966652	7.429817014	7.489666524	5.231749049
	3rdquarter	7.265	1,089.51	-5.251902231	-3.92	-8.05193326	-14.28572608	3.511932035	7.2581157	7.20867394	7.258115704	5.392846933
	4th quarter	8.419	1,032.29	34.16578675	31.44	39.92534294	52.74801514	16.13891654	8 43316073	8.53486054	8.433160733	12.26994689
2003	1stquarter	5.796	1,384.98	16.85656111	15.68	19.33080862	24.83929987	9.112398642	5.80208331	5.845772525	5.802083309	7.450328125
	2ndquarter	1.537	1,618.44	19.21603519	17.34	23.17083537	31.97552527	6.837881913	1.54672347	1.616555658	1.546723469	4.181253294
	3rdquarter	0.849	1,929.44	23.73849407	21.31	28.85887389	40.25852863	7 712185902	0.86158922	0 952002723	0.861589222	4.272581628
	4th quarter	1 405	2,387.46	14.74370251	13.33	17.72757026	24.37064428	5.404476561	1.41233629	1.465024161	1.412336286	3.400069735
2004	1stquarter	1.623	2,739.46	-0.661809262	-0.42	-1.172921094	-2.31082465	0.937922791	1.62174335	1.612718358	1.621743355	1.281261079
	2ndquarter	1.717	2,721.33	-3.184472298	-2.66	-4.280931652	-6.7220119	0.247342546	1.71430419	1.694943375	1.71430419	0.983886788
	3rdquarter	2.906	2,634 67	1.367154141	1.53	1.022914322	0.256522919	2.444592458	2.90515363	2.899075194	2.905153635	2.675834825
	4th quarter	8.291	2,670.69	10.68263258	10.43	11.21764079	12.40874556	9.008107112	8.2923154	8.301762347	8.292315398	8.648716485
2005	1stquarter	8.62	2,955.99	6.209425607	6.47	5.670180115	4.46964175	7.897213374	8.61867418	8.609152415	8.618674184	8.259450388
	2ndquarter	8.462	3,139.54	28.65483478	26.51	33.17197193	43.22860943	14.51661958	8.47310606	8.552867757	8.473106059	11.4822423
	3rdquarter	8.488	4,039.17	-5.153534018	-3.71	-8.205145178	-14.99903837	4.39772244	8.48049716	8.426613097	8.480497156	6.447635757
	4th quarter	8.14	3,831 01	-43.22472403	-37.78	-54.71501279	-80.2961863	-7.261198853	8.1117494	7.908858742	8.111749402	0.457378227
	MEAN	7.045	2175.1	2.2691243	2.776	1.20068	-1.17802	5.61325	7.0427	7.02386	7.04272	6.33097
	STANDARD DEVIATION			17.74654524	2.78	1.20	-1.18	5.61	7.04	7.02	7.04	6.33