THE RISK-RETURN TRADE-OFF OF COMPANIES LISTED AT THE NAIROBI STOCK EXCHANGE

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A RESEARCH PROJECT REPORT SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF THE MASTER IN BUSINESS ADMINISTRATION, UNIVERSITY OF NAIROBI

NOVEMBER 2011

DECLARATION

I hereby declare that this Research Project is my original work and has not been submitted in any other university for any award. Where other sources of information have been used, they have been acknowledged.

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This declaration has been submitted with my approval as the university supervisor.

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DEDICATION

Special thanks to my parents, Nathan Mogunde and Josephine Kenyanya, for your love and care throughout my academic work. Thank you my brother Charles Moraro, you were always there for me when I needed you most. My brother and sisters: Bonvas, Callen and Christine, thank you for the good encouragement. I will always treasure you. God bless you all.

ACKNOWLEDGEMENT

Various people and organizations helped me to make this research a success. I hereby wish to express my sincere gratitude to them for without their material and non material support it would have been difficult to complete this project. I take this opportunity to express my sincere thanks to each of these people and organisations.

The staff of the Jomo Kenyatta Library of the University of Nairobi provided both the MBA and the Electronic Library section. Thanks to this staff who enabled me to access research reports from earlier MBA projects and scholarly publication from the wider academia.

Much of the direction on what to do at each stage of this research from the generation of the research idea, its conceptualization, drafting of the research proposal, to the analysis of samples and preparation of the report was provided by my supervisor Mrs. Kithinji Angela.

The data of analysis was obtained from the Nairobi Stock Exchange. It would not have been possible to conduct an analysis and extract out the relevant findings if the data was not available in the first place. The record from which these data was extracted was well maintained by the staff of the NSE who then availed it to me when I needed it to conduct this research.

In my literature review I have cited quite a lot of scholarly publication. Some are from earlier research findings from projects done by other MBA students. I have used scholarly papers from the wider academia. These are works without which I could not have had a scholarly insight into this research

MOGUNDE BONVENJA

ABSTRACT

CAPM is basically a linear model that relates risk and return in which beta is the coefficient of the difference between the market return and the risk-free rate. However, in this research beta is not the gradient but the independent variable, while by rearrangement of the model the difference between the, market return is the gradient. The research sought to find out whether this relationship between return and risk captured by beta is as linear as suggested by the CAPM.

To achieve this objective data were collected from the NSE for the period 4th January 2006 to 29th December 2010 which included Wednesday stock prices, Wednesday stock volumes, and the dividends. This was used to calculate the returns of stocks, the average Wednesday market returns and the betas of the companies. The values of beta and return were reduced to annual values thereby enabling every company to have five paired values of return and beta. Regression analysis was conducted on the paired values of risk and return for each company. The tests used in the regression tests were the T test and the F test.

Most of the companies did not pass the linearity test as only thirty-two out of the forty-three had their F-values greater than the critical values of F. The test for the significance of the coefficient term also revealed that thirty-eight companies did not pass this test. The results therefore testify that the relationship between return and beta of firms at the NSE is not linear based on the Wednesday return.

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CHAPTER ONE

INTRODUCTION

1.1 Background of the study

March (1994) argues that a decision-maker when making investment decision, it is assumed that he/she will choose the option that maximizes expected value if a specific choice were to be made several times. Mollen and Roth (1991) define risk as the existence of states beyond the decision maker's control that will affect the outcome of choices made. They continue to state that the degree of risk is the function of the potential loss and the probability of such loss. Investors and decision makers view risk as closely associated with the concepts of return and the variations around a return. Pandey (2005) argues that in finance risk has two parts: diversifiable (unsystematic) and non-diversifiable (systematic). Systematic risk arises due to economy-wide uncertainties and tendency of individual securities to move together with changes in the market. This type of risk cannot be eliminated by diversification and it measures the asset's sensitivity to market risk, represented by beta. The other type of risk is unsystematic risk also called specific risk. It arises due to unique uncertainties of individual securities. This risk can be mitigated by forming well-diversified portfolios. Variance or standard deviation is a measure of the risk of returns on a security.

Mullins (1982) observed that return on a security comprises of two parts: the dividend and the capital gain. The return of a portfolio is equal to the weighted average of the returns of individual securities in the portfolio with weights being equal to the proportion of investment value in each asset. Based on Markowitz's (1952) article, a risk-averse investor will prefer a portfolio with the highest expected return for a given level of risk or choose a portfolio with the lowest level of risk for a particular level of expected return. This is referred to as the risk-return trade-off, which is the balance an investor can decide on between the desire for the lowest possible risk for the highest possible returns. (Investopedia, 2011).

Investors are interested in knowing the risk involved and the return to be expected at the end of their investment period, and this is true for any rational investor who aims at maximizing return while simultaneously minimizing risk. Risk is cost of investment for which the investor expects a return. This makes it of importance for investors to know and relate risk and return in an investment market. (Markowitz, 1952).

According to Gordon et al. (2003), the link between risk and return is among the fundamental concepts in finance and very useful to investors and portfolio managers. They further posit that beta or systematic risk is the only relevant measure of risk for investors, although many researches have showed betas and returns being not related empirically in domestic and international stock markets. The close relationship between risk and return has been assumed to be linear and positive in up market periods (positive market excess returns), but a significant negative relationship in down market periods (negative market excess returns). (Gordon et al, 2003).

Following Merton's (1973) single factor risk model, the linear relation can be expressed as below:

$$R_{m,t} - R_{f,t} = \Theta_o + \lambda_m \sigma^2_{m,t} + \varepsilon_{m,t}$$

Where;

$R_{m,t}$ is the expected market return

$R_{f,t}$ is the return independent of risk

Θ_o is the intercept term

λ_m is the coefficient of market risk aversion

$\sigma^2_{m,t}$ is the variance of excess market return

$\varepsilon_{m,t}$ is the white noise error term

Merton (1973) states that the difference between the market return and risk free rate of return is the excess market return. According to Fama (1965a), in an efficient market, like the stock market, returns and risk should behave in a manner suggested by this model. This paper examines the relationship between beta and returns in the Nairobi Stock Exchange for the period from 4th January 2006 to 29th December 2010.

1.1.1 The Nairobi Stock Exchange

In Kenya, dealing in shares began in the 1920's when the country was a British colony. During this period the market was not formally organized and rules and regulations to govern it did not exist. In 1954 the NSE was formally organized and was constituted as a voluntary association of stock brokers registered under the Societies Act. Currently the listed companies are divided into ten groups namely: (i) Agricultural (ii) Commercial and Services (iii) Telecommunication and Technology (iv) Automobiles and Accessories (v) Banking (vi) Insurance (vii) Investment (viii) Manufacturing and Allied (ix) Construction and Allied (x) Energy and Petroleum (Nairobi Stock Exchange, 2011).

The NSE's main functions are summarized as; securities and stock trading, information services in the form of presentations to prospective issuers and investors, and data vending. The NSE is located in Nation Centre building, first floor, Kimathi Street, Nairobi-Kenya. (Mapsofworld.com, 2011).

1.2 Statement of the problem

Ghysels et al (2004), states that risk and return are the cornerstones of the modern finance theory. Further they posit that information about the stocks' expected returns and risks (risk measured using the standard deviation of the streams of returns on a stock) enables an investor make decisions on investment, and usually investors are risk averse. Leroi's (2009), standard asset pricing theory and the Capital Asset Pricing Model (CAPM), postulate a direct relationship between expected premium and risk. Ghysels et al. (2004) call this relation as the "first fundamental law of finance."

Merton's (1973) Intertemporal Capital Asset Pricing Model (ICAPM) hypothesizes a positive correlation between expected return on an investment and the associated risk. Within the context of risk-aversion, the Sharpe (1964) and Lintner (1965) CAPM indicate a positive, linear relationship between expected market risk and returns. Merton (1973) tested the relationship using the ICAPM model and found it to be positive and linear.

Bollerslev et al. (1988) and Harvey (1989) found a statistically significant positive relationship between expected market risk premium and conditional volatility of the market. French et al. (1987), found this relationship to be statistically insignificantly positive. Ferhan (2002), Assaf (2005), Hueng (2008) and Leroi (2009) also found a significant positive relationship between risk and return.

However, Campbell (1987), Turner et al. (1989) and Glosten et al. (1993) documented a statistically significant negative relationship. Baillie and DeGennaro (1990) found no evidence for a statistically significant relationship between the market risk premium and conditional variance or standard deviation. This led him to conclude that other measures of risk are more important than the variance of returns. Iqbal and Brook (2007) found evidence of non-linearity in the risk-return relationship, their research in Pakistan stock markets concluded that the unconditional CAPM is rejected. Iqbal et al. (2008) tested the CAPM and Fama and French (1993) tested the three factor model on the Pakistani market and concluded that there are a number of risk variables including the volume traded which determine the expected stock returns. Attiya (2008), notes that extensive empirical work has been done for developed markets on the conditional CAPM and the conditional three factor model, but very little has been done for the emerging markets.

Sharpe (1964) and Lintner (1965) argued that CAPM describes the risk-return relationship. However, many empirical studies by using the three-step approach put forward by Fama and MacBeth (1973), show that this Sharpe and Lintner CAPM is inadequate as there is not enough evidence to support a statistically significant relationship between risk and return. A similar conclusion was also reached by Fama and French (1992) and He and Ng (1994). These results had cast doubt on the CAPM. More still, Ananda et al. (2008) agree that the study of risk and return is very crucial for researchers in finance, but the theorizing and the empirical findings in this area continue to present many problems. They continue to say that problems manifest in the literature in two different ways. One is the discussion on whether the relationship is positive, negative or curvilinear (Fiegenbaum et al, 1996). Gooding et al (1996) and Wiseman and Catanach (1997), identify the second way to involve empirical anomalies that confront researchers when examining the numerous studies in this area.

Some studies were done at the University of Nairobi about risk-return relationship at the NSE, for instance Gitari (1990), found a statistically significant positive relationship between systematic risk and return, suggesting that investors are either being under or over-compensated for taking on high risks. Akwimbi (2003) found that the Arbitrage Pricing Theory (APT), which is a linear model, has been more successful in explaining expected return at the NSE, asserting that this APT holds in this emerging market. Gichana (2009) deduced that non-linear models are better than linear ones in predicting stock returns at the NSE, furthering the argument that stock returns in this market is non-linear with risk. This paper is to investigate whether the linear relationship between systematic risk and stock returns holds on the NSE given that this emerging market has over the last eight years undergone significant changes such as the introduction of Central Depository System (CDS) with positive impact on the market (Otuke, 2006), and the launching of live trading on the automated trading systems of the NSE in 2006, (Nairobi Stock Exchange 2011). Considering these changes at the NSE, then what relationship exists between risk and stock returns?

1.3 Objective of the Study

The objective of this research is to establish the relationship between beta and stock returns using Capital Asset Pricing Model at the Nairobi Stock Exchange Market for the period 4th January 2006 to 29th December 2010.

1.4 Importance of the Study

The study is meant to provide information to investors, to make right decisions about the firms in which to invest their funds, to gain maximum returns both in the short and long term.

The managers will utilize risk-return relationship information to diversify their firms' portfolio and estimate the returns expected from those investments. Managers need a good vision about the future and therefore should strategize how the firm can adapt in a changing economic environment to generate more returns and contribute to the success of the stakeholders of the business.

The Financial analysts will be able to analyze securities performance and provide a rating and recommend which investment action to be taken by clients.

The academicians will gain some knowledge about the behaviour of asset return-risk with respect to changing times at the Nairobi Stock Exchange Market.

Policy makers will assess how the micro and macro-economic factors impact on the risk and return at the NSE and be able to come up with policies meant to maximize value creation to all market participants and stakeholders.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter will discuss the uncertainty and the related types of risk-related decision making. It further explains the investment theory as being the commitment of money or capital to buy financial assets in order to make a gain. The other key theory that has been discussed is the Portfolio theory, which provides an explanation about investors' investment decisions on their wealth. It is based on the assumption that investors are risk-averse. It emphasizes that investors hold a well-diversified portfolio of assets. The main focus for investors is the expected rate of return and risk of the portfolio rather than the individual asset to the portfolio risk. The portfolio theory derives a framework for valuing risky assets and this frame-work is called the Capital Asset Pricing Model (CAPM). An alternative of CAPM model for the valuation of risky assets is the Arbitrage Pricing Theory (APT).

The Efficient Market Hypothesis (EMH) is another key finance concept which has been discussed. It has the view that stock prices reflect all available information critical for selling, buying or holding an option. According to the EMH theory, it is not possible for an investor to consistently outperform the market.

Systematic risk (beta) has been explained as a standard measure of an asset's non-diversifiable risk and it measures the sensitivity of the asset's returns. However, beta has limitations hence it is inadequate to explain stock returns. The relationship between beta and returns is further looked into. This relationship is captured by the Security Market Line (SML) and theoretically it can be said to be linear.

The chapter concludes with the empirical evidence of risk-return relationship as per the various studies conducted around the world. The risk-return relationship has been found to be positive and linear in some markets, but in other markets it is negative and linear. However, most studies have been concentrated in the developed countries whose markets

are far much developed compared to the developing countries whose markets are less developed and few studies have been done there.

2.2 Theoretical Review

2.2.1. Risk, Risk-Seekers and Risk-Averters

Uncertainty and the lack of definite knowledge about specific results of an action are the key components of risk-related decision-making. (March, 1994). The author states that the most common situations involving uncertainty are when the exact consequences of an action are unknown but their probabilities are known. According to March (1994), when making a decision, it is assumed a decision maker chooses the option that maximizes the expected value if a particular choice were to be made repeatedly. Mullen and Roth (1991) argue that risk is the existence of states that are beyond the decision maker's control and that affect the outcomes of his/her choices. Therefore the degree of risk is a function of the size of the potential loss and the probability of that loss; hence to most investors and decision makers, risk is closely associated with return, and variations around a return.

Mullen and Roth (1991) argue that risk seekers take choices that involve greater potential loss and/or a higher probability of a loss at the evaluation phase. They observed that Risk Seekers take information at face value without considering deeper details, and consequently they underestimate risk by overestimating profits and underestimating losses. Tiegen and Brun (1997) recognized that risk seekers concentrate more on the opportunities for gain or may behave on account of personality dispositions.

Risk averters are keen on details and they tend to follow closely the consequences of their decisions (Mullen and Roth, 1991) unlike to Risk Seekers. Consequently, Risk averters demand more and accurate information on probabilities, adopting worst-case scenarios. Risk averse individuals overestimate risk (in effect overestimating losses) and underestimate profits. In the earliest stages of decision making, Risk averters put risks at a higher level than risk seekers. Risk averters continually have a disposition for loss-inclination behaviours that lead to risk averse security-mindedness, (Tiegen and Brun, 1997). They also are survival-oriented as resources are threatened by depletion (Lopes, 1987 and March and Shapiro, 1992).

2.2.2 Investment Theory

Investment is the commitment of money or capital to the purchase of financial instruments or other assets for profitable returns in the form of interest, dividends, or appreciation of the value of the instrument (Sullivan et al, 2003).

Investopedia (2011) argues that Investment theory focuses on three factors linked with investment process. First, it is the decision on how to diversify a portfolio in order to minimize losses from one market while simultaneously realizing higher returns with other securities. Second is the evaluation of investments based on risk and return the focus being the expectation of maximum returns at a minimized risk. Thirdly, a good investment will factor in the amount of information available about the investment opportunity and the general market conditions within which trading is taking place, as theorized by the Efficient Market Hypothesis (EMH). The EMH is a fundamental finance concept which maintains that security prices fully reflect available information essential for selling, buying or holding an option. If asset prices are an embodiment of information on the assets, the market is regarded as efficient. (Investopedia, 2011).

2.2.3 The Portfolio Theory

According to Pandey (2005), a portfolio is a bundle of securities. He discusses that portfolio theory provides an explanation of how investors can make investment decisions about their wealth, investing in a given range of risky assets or securities. According to Fama and French (2004), the portfolio theory was founded on the assumption that all investors are risk-averse, and they will invest their money in well-diversified portfolios rather than investing in a single or a few assets, the portfolio theory, as quoted by Perold's (2004) publication agrees with the adage, "do not put all your eggs in one basket," as strategy of reducing total risk. Markowitz (1952) argues that an investor diversifies his wealth, based on the weighted average of the assets' returns and the risk involved. Perold (2004) continues to say that Markowitz (1952) idea was that due to broad economic influences, risks across securities were correlated to some degree. As a consequence, investors can eliminate some but not all risk by holding a diversified portfolio.

Diversification is an age-old activity. The wise King Solomon in the bible said, "But divide your investments among many places, for you do not know what risks might be ahead." (New Living Translation Version, Eccle.11.2). Markowitz (1999) noted that William Shakespeare wrote about diversification and variance in the play "Merchant of Venice" in which the Merchant Antonio says: "my venture is not in one bottom trusted, nor to one place: nor is my whole estate upon the fortune of this present year: therefore my merchandise makes me not sad," as cited in Markowitz (1999).

Markowitz (1999) claims that he has been referred to as the father of 'Modern Portfolio Theory' on the basis of Markowitz (1952). However, Markowitz (1999) recognises Roy (1952) as equally accorded similar honour. Markowitz's 1952 article on portfolio selection proposed that the expected return and variance of return is a criterion for portfolio selection. The article assumes that securities follow the same rules of randomness of random variables. Based on this belief, the expected return on a portfolio is a weighted average of the expected returns on individual securities, and the variance of return on the portfolio is a function of the variances of and the covariances between securities and their weights in the portfolio. Markowitz (1952) differentiated between efficient and inefficient portfolios and this led to the phrase "efficient frontier" referring to the " set of efficient mean-variance combinations," Markowitz (1952) proposed that means, variances, and covariances of securities can be determined by both techniques of statistical analysis and security analysis judgment. From these estimates the set of efficient mean-variance combinations can be derived and given to the investor to choose the desired risk-return combination. According to Markowitz (1999), Roy proposed in making choices on the basis of mean and variance of the portfolio as a whole. He proposed choosing the portfolio that maximizes returns $(E-d)/\sigma$ where d is a fixed disastrous return and σ is the standard deviation of return. Roy (1952) model for the variance of the portfolio was similar to that of Markowitz (1952) in that it included the covariances of returns among securities. The main contrasts of Markowitz and Roy analyses were: First, Markowitz analysis did not consider negative investments whereas Roy's allowed the amount invested in any security to be either positive or negative. Secondly, Markowitz allowed the investor to choose a desired portfolio from the efficient frontier but Roy suggested choice of a specific portfolio.

The portfolio theory was further advanced in 1960s and 1970s particularly in a mathematical modeling of finance and investment management. From the foundation laid down by Markowitz (1959) on the model of portfolio choice, another improvement on portfolio theory came up and it is referred to as the Capital Asset Pricing Model (CAPM). The CAPM model was introduced by Sharpe (1964) and Lintner (1965a) independently. The work of these scholars basically looked at the risk of investments and how it affects expected return. Fama and French (2004) address CAPM as a tool offering powerful intuitively pleasing predictions about how to measure risk and the relationship between expected return and risk.

The CAPM model is represented as:

$$R_a = R_f + \beta_a (R_m - R_f),$$

Where, R_a is the expected return of an asset a,

R_f is the risk free rate,

β_a is beta of the asset,

And R_m is the expected market return.

The general idea behind CAPM is that investors need to be compensated in two ways (Investopedia, 2011): by time value of money and by risk. The risk free rate compensates the investors for placing money in an investment for a given period of time. The other part of the equation determines the amount of compensation the investor needs for taking on additional risk. This is the product of a risk measure (beta) that compares the returns of the asset to the market over a period of time and the market premium ($R_m - R_f$). Perold (2004) listed out the main assumptions of CAMP as follows: (i) investors are rational and risk averse therefore evaluating their investment portfolios solely in terms of expected return and standard deviations over the same single period (ii) the capital markets are efficient, that, is investors can trade without transaction or taxation costs, they deal with securities which are highly divisible, information is freely available to all investors at the same time and there is unlimited lending and borrowing among investors at the risk free-rate of interest.(iii) investors are price takers so that they cannot influence prices

prevailing in the market (iv) investors have similar expectations in terms of expected returns and risk in the market.

The CAPM model seemed to be highly simplified (Perold, 2004) leading to other models based on the desire to overcome the limitations CAPM. The key ones are Intertemporal Capital Asset Pricing Model (ICAPM) by Merton (1973) and the Arbitrage Pricing Theory (APT) by Ross (1976). The ICAPM is a linear model looking at how investors solve lifetime consumption problems when exposed to many uncertainties. The key point with ICAPM not found in CAPM is the additional state factors making investors to hedge against changes in the future investment opportunity set.

In the Arbitrage Pricing Model, Ross (1976) argued that each security's return is determined by many factors independent of each other. In APT a number of factors (industry specific and macroeconomic factors) influence returns of a security and hence there are many factors affecting the systematic (non-diversifiable) risk of an asset. Ross (1986) and other researchers generally settled on the following macroeconomic factors they felt play key role in influencing the stock return: Gross National Product, the confidence of investors, Inflation and the shifts of the Yield Curve. The main assumptions required for the linear function between asset return and assets' betas to the various factors are; existence of perfect competition in the market, the factors causing betas should not exceed the total number of assets and investors have homogenous expectations about risk and expected return.

The main logic of APT according to Pandey (2005) is that investors always indulge in arbitrage whenever they find differences in the returns of assets with similar risk characteristics.

The main problem with APT is that it does not indicate the specific factors influencing stock returns. The potentially large number of variables implies more betas to be calculated hence making the model more complex and less usable than CAPM.

Other models which improved on CAPM are the Consumption CAPM (CCAPM) by Breeden and Rubinstein (1979), the three factor model of APT by Eugene and French

(1993-1996), the Behavioural CAPM by Shefrin and Statman (1994), and Downside risk-CAPM by Estrada (2002).

2.2.4 The Theory of Efficient Market Hypothesis

The EMH was developed by Fama (1965) and Samuelson (1965) in the 1960s from different research areas. It was first presented by Samuelson (1965) in the publication, "Proof that properly Anticipated Prices Fluctuate Randomly." He continues to say that in an informationally efficient market, price changes must be unpredictable if they fully incorporate the information and expectations of all market participants. His idea of EMH was as a result of his interest in temporal pricing models of storable commodities that are harvested and highly perishable.

Fama's (1963: 1965a; 1965b; 1970) seminal papers were statistics-based with analysis properties of stock prices, and in resolving the debate between technical analysis (the use of geometrical patterns in price and volume charts to predict future price movements of a security) and fundamental analysis (the use of accounting and economic data to determine a security's fair value). Fama (1965b) was the first to use the term 'efficient markets' and he operationalised the EMH hypothesis by summarizing it in this short sentence, "prices fully reflect all available information."

The EMH has been criticized by many scholars. Burton (2003) argued that the intellectual dominance of the efficient market revolution has been more challenged by economists who stress psychological and behavioural elements of stock-price determination and by econometricians who argue that stock returns are only up to a considerable degree, predictable. His publication laid attack on the EMH and the relationship between predictability and efficiency. He concluded that stock markets are more efficient and less predictable than many recent (at that time) academic papers propose.

Behavioural critiques of EMH are based on the preferences and behavior exhibited by market participants. Blume and Darlouf (2007), assert that investors optimize additive time-separable expected utility functions from certain parametric families e.g. constant relative risk-aversion. They say that Psychologists and experimental economists,

however, have documented some departures from this paradigm, in the form of specific behavioural biases that are ubiquitous to human decision-making under uncertainty with undesirable outcomes and effect on an individual's economic welfare. Some of these biases include: overconfidence (Fischoff and Slovic, 1990), overreaction (DeBondt and Thaler, 1985), loss aversion (Kahneman and Tversky, 1979), herding (Huberman and Regev, 2001), psychological accounting (Tversky and Kahneman, 1981), Hyperbolic discounting (Laibson, 1997), and regret (Bell, 1982). These critics of the EMH argue that investors are often irrational and do exhibit predictable and financially ruinous behavior.

Blume and Darlouf (2007) argue that the supporters of the EMH respond to the above challenges by arguing that, while behaviour biases and corresponding inefficiencies do exist every time, there is a limit to their prevalence and impact because of opposing forces dedicated to exploiting profitable opportunities.

2.2.5 Systematic Risk (Beta)

Beta of a stock is a number describing the relation between its returns to those of the financial market as a whole (Levinson, 2006). Beta is a standard measure of a security's non-diversifiable risk. The beta coefficient is the main parameter in the CAPM as it measures that part of the asset's statistical variance that cannot be eliminated by diversification given a combination of many risky assets, because of the correlation of its returns with the returns of the other assets that are in the portfolio (Pandey, 2005). Beta can be estimated for individual firms by regression analysis of a stock market index. Beta can also be referred to as financial elasticity or correlated relative volatility and it measures the sensitivity of the asset's returns.

Beta originated out of linear regression analysis, (Wikipedia, 2011). It is linked to a regression analysis of the returns of a portfolio such as a stock index (x-axis) in a specific period versus the returns of an individual asset (y-axis) in a specific year resulting in the Security Characteristics Line (SCL) mathematically modeled as:

$$R_{i,t} - R_f = \alpha_i + \beta_i (R_{m,t} - R_f) + \varepsilon_{i,t}$$

Where: $R_{i,t}$ is the total expected return of an asset i in the period t,

ted R_f is the risk free rate of interest,

α_i is the asset's alpha (abnormal return),

$\beta_i (R_{m,t} - R_f)$ is a non-diversifiable risk (or systematic risk),

$\varepsilon_{i,t}$ is a diversifiable risk

Where the slope of the SCL is the sensitivity coefficient which is called beta calculated as below:

$$\beta_i = \frac{Cov (R_{i,t}, R_{m,t})}{Var (R_{m,t})}$$

Klarman (1991), views beta as inadequate to explain stock returns. He argues that Beta measures risk dependent on market prices, instead of taking into account micro and macro-economic factors as well as not considering price levels. Further, Beta ignores the influence the investors can have on the riskness of of their holdings proxy contests, communication with management, shareholder resolutions and buying majority stock to achieve corporate control with direct access to underlying value. Beta also assumes that the upside potential and downside risk of an investment are the same. Klarman (1991) concludes that based on the above limitations of beta, in the real world the past security price volatility cannot accurately forecast future investment performance or volatility.

2.2.6 The Relationship Between Risk and Return

According to Perold (2004), beta can give a method of measuring the systematic risk. He says that if the risk of an asset as measured by beta is plotted as an independent variable and the return as a dependent variable, if the market is in equilibrium, all assets must lie on a straight-line called Securities Market Line. Perold (2004) argues that the risk-return relationship for a security is captured by the Security Market Line (SML), and the SML is part of CAPM. This line starts from the risk-free rate (the y-intercept) and extends up top

right. When the risk of an investment increases the expected return increases as well. If an investor prefers a low risk he/she will choose a stock towards the bottom left of the line while investors who can tolerate higher risk will choose an investment towards the top right of the SML.A change in the gradient of the SML is caused by the risk premium of the stocks, (Pandey, 2005).

2.3 Empirical Evidence of Risk-Return Relationship

Most researchers in finance have investigated the risk-return relationship (Gonzalo et al, 2005); owing to the fact that such a relationship and trade-off is the basic of financial economics. Merton (1973) indicated that if the investment opportunity set is constant or when rates of returns are independent and uniformly spread, there is a positive relationship between expected extra return and conditional variance. Based on the assumption that investors are risk averse, a positive relationship between expected return and risk is expected.

Bollerslev et al. (1988) and Harvey (1989) found a significant positive relationship between the expected market premium and conditional volatility of the market. Mendelson et al. (1992) used two econometric methods to improve the efficiency of the estimation of risk-return relationship. The tools were: joint pooled cross-section and time-series estimation and generalized least squares. Using these techniques, they found a highly significant relationship between average portfolio returns and systematic risk.

Ferhan (2002) investigated for the risk-return-volume relationship in the Istanbul Stock Exchange (ISE) for the period of January 2, 1992 to May 29, 1998 by using the Generalized Autoregressive Conditional Heteroskedasticity-in-Mean (GARCH-M) specification; he found that return is positively associated with risk, i.e. the estimate of the conditioned standard deviation. Changes in volume have a positive effect on returns. Hueng (2008) investigated the asymmetric risk-return relationship in a time-varying beta CAPM, using Standard and Poor's 500 index (S&P 500) daily data from November 1987 to December 2003 and found a positive risk-return relationship in the up market (positive market excess returns) and a negative relationship in the down market (negative market excess returns). This supported the argument by Pettengill et al. (1995).

To some extent it has been proved difficult from empirical view to find a positive relationship between expected risk and return. French and Stambaugh (1987), Campbell and Henstschel (1992) and Guo and Whitelaw (2003) found a positive relationship but not a significant one. Alternatively quite a number of academicians found a negative and significant relationship. Campbell (1987), Turner et al. (1989), Glosten et al. (1993) and Ludvigson (2003) document a negative and statistically significant relationship.

Other related researches by Harvey (2001) found that the sign of the empirical evidence depends on the exogenous predictor employed in conditional asset pricing models tested. Brandt and Kang (2004) found different results dependent on whether unconditional or conditional correlations are used. All these papers use the U.S data. Evidence from other countries is rare and not conclusive.

Gonzalo et al. (2005) found that by using flexible weighting schemes that allow an optimal choice of estimation of the weights on lagged squared returns that produces the necessary persistence in conditional variance and by employing a differential impact on and persistence of negative and positive shocks, their paper found a positive and significant relationship between expected market excess return and conditional variance on European equity indices. Their results took advantage of the MIDAS regression framework proposed by GSV (2003, 2004a) and extended their key evidence on U.S data to European data.

Further research as per Gonzalo et al. (2005) is recommended on asymmetric effects under bivariate MIDAS, the use of alternative hedging instruments in multi-factor asset pricing models under MIDAS dynamics, asymmetric and time varying correlation effects between equity and bond returns, and counter-cyclical risk aversion coefficients under preferences with habit persistence.

Leroi (2009) used Merton's (1973) single factor risk-return framework to determine risk-return relationship in the South African stock market. The GARCM-M model by Engle, Lilien and Robins (1987) was used to estimate the risk-return trade-off of 50 daily excess returns of market and industry stock prices indexes of the Johannesburg stock exchange listed companies. The results were that 95 percent of stock price indexes showed a

positive and a highly statistically significant coefficient of risk aversion, but 5 percent were not only statistically insignificant but also showed a negative coefficient of risk aversion. This provided evidence that the South African stock market coincides with Merton's (1973) ICAPM theoretical hypothesis of a positive relationship between excess market returns and the market risk premium.

Several limitations noted by Leroi (2009) which need to be overcome by other researchers are matters dealing with the methodological approach, volatility characteristics of the risk premium as well as data span and frequency. Guo and Neely (2006) suggest that the leverage effects be accounted for to address the asymmetry in the response to the conditional volatility. They also proposed that the long-run conditional variance is critical in determining equity risk premium which requires GARCH model to uncover these short and long run conditional variance dynamics.

In further research Leroi (2009) suggested exploration of MIDAS approach by Ghysels, Santa-Clara and Volkanov (2004) which has become more popular in uncovering the market risk-return trade-off to see if it can arrive at similar results as those of Leroi's (2009) paper.

Assaf (2005) investigated the impact of automation on the volatility dynamics and risk-return relationship in the Toronto Stock Exchange (TSE) in Canada, the results from TSE 300 indicated that automation has significantly altered the structure of market volatility. On the outset of automation, new information is assimilated into prices and leading to an increase in persistence of volatility. Further analysis supported the existence of a significant link between conditional volatility and stock returns. The full sample estimates indicated that the risk –return parameter was positive and statistically significant.

According to Assaf (2005) the relationship between expected stock returns and conditional volatility has received great attention in the literature. Although a positive relationship between expected returns and volatility is consistent with the CAPM and intuitively appealing, as rational risk-averse investors require higher expected returns during more volatile periods, empirical research has been unable to establish a

convincing positive relationship between expected risk premium and conditional volatility using GARCH-M models. For U.S. stock markets, French et al. (1987) and Campbell and Henstschel (1992) observe a positive relation, whereas Glosten et al. (1992) who developed a much richer asymmetric GARCH-M model presented evidence of a negative relation, as Nelson (1991) did with his EGARCH model and Poon and Taylor (1992) who studied the U.K. stock market reported a weak positive relationship.

For the Canadian equity markets the hypothesis that volatility is a significant determinant of stock pricing was confirmed for all TSE stock returns. Irrespective of the index, the estimated parameter of standard deviation capturing the influence of volatility on stock returns is positive and statistically significant (at 5 per cent level for all cases) for the whole sample period. The range of estimates is of similar order of magnitude for TSE 300, TSE 53, and TSE 100, with a stronger impact of conditional variability on TSE 100 stock returns. These results were consistent with the basic postulate of portfolio theory, and indicate that on average investor trading stocks were compensated with higher returns for bearing risk. As discussed by Engle et al. (1987) and Bollerslev et al. (1992), the sign and magnitude of the risk-return parameter depend on the investor's utility function and risk preference, and the supply of assets under consideration.

Assaf (2005) concluded that the empirical findings by 2005 were mixed regarding the sign and statistical significance of the risk-return parameter. Elyasimi and Mansurs' (1998) estimates on U.S data were negative and statistically significant, while Porteba and Summers' (1998) estimates on excess returns for daily S&P index weekly New York Stock Exchange (NYSE) returns and U.K. stock indices were positive and significant. This relationship is affected by the changes in the trading environment (i.e. automation) of the TSE.

In regard to Ananda et al. (2008) a major foundation of the risk-return relationship is the idea that managers are generally risk averse. Ross (1973) noted that Agency theory is based on the assumptions of rational behaviour and economic utilitarianism and assumes a linear positive relationship between risk and return. Fischer and Hall (1969) posit that risk averse behaviour is manifest when low risk is associated with low return, as well as high risk is rewarded by high return. Schoemaker's (1982) view is that risk averseness

influences managers to choose an alternative which maximizes utility. Aaker and Jacobson (1987) found a positive association between performance and both systematic and unsystematic risk if risk is defined using accounting data. Bettis (1981) also noted that there are some studies which found support for a positive relationship.

In contrast to the findings of positive relationship between risk and return as mentioned above, the work of Bowman (1980, 1982) led him to suggest that his results were at some degree at variance with classical finance theory; Bowman (1980) found a distinct and significant negative relationship between risk and return. Examining a large sample of firms from 85 industries, Bowman (1980) found a negative return between risk and return in firms that were performing well, and also the same happened for firms which had performed poorly; Bowman's paradox of risk-return association was as the result of puzzling findings where, the negative relationship found by Bowman (1980, 1982) in high risk and low return firms (the inferior performers), and another group of low risk and high return firms (superior performers). These findings were also reported by other researchers such as Fiegenbaum and Thomas (1986) and Cool and Dierickx (1987).

Kahneman and Tversky's (1979) prospect theory explanations, found a curvilinear relationship between risk and return. Prospect theory posits that people normally outweigh outcomes that are probable compared with outcomes that are certain, as a result, people prefer sure gains to likely gains, and prefer likely losses to sure losses. Other researchers came up with similar findings for curvilinear relationship e.g. Chang and Thomas (1989), Fiegenbaum and Thomas (1988), Singh (1986). The main point of argument in prospect theory is that manages use industry averages in evaluating risky choices, and adopt risk seeking behaviors when operating below industry average and risk averse behaviors when operating above the reference point (industry average).

According to Attiya (2008), extensive empirical work has been done for the developed markets on conditional CAPM and conditional three factor model but very few studies have been conducted in the emerging markets. The study by Iqbal and Brook (2007) have found evidence of non-linearity in the risk return relationship and concluded that for Pakistan's equity stock market the unconditional version of CAPM is rejected. Iqbal et al. (2008) have tested CAPM and Fama and French (1993) three factor model for Pakistan

market and also concluded that the test results explains the cross-section of expected returns by a number of risk factors including traded volume with daily data.

2.4 Conclusion

Researches done at the Nairobi Stock Exchange found a positive relationship between risk and return, (Gitari, 1990). However this relationship is not statistically significant hence suggesting those investors may be on one hand being under compensated or on the other being over compensated for taking on high risks. According to Akwimbi (2003), the APT which is a linear model was more successful in explaining the expected return in the NSE hence holding in this emerging market in East Africa. Gichana (2009) found that non-linear models can better forecast stock returns at the NSE which is an indication that stock returns manifest to a greater extent non-linear relationship with risk.

The aim of this paper is to find out if there is linear relationship between systematic risk and stock returns at the NSE, because over the past eight years, the trading has changed due to the introduction of Central Depository System (CDS) with positive impact on the market (Otuke, 2006), and the launching of live trading on the automated trading systems of the NSE in 2006, (NSE, 2011).

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter explains the methods used to determine the Risk-Return relationship at the Nairobi Stock Exchange between 4th January 2006 to 29th December 2010. The following components are discussed: Research Design, the Population to be studied, the mode of Data Collection and the Data Analysis and Testing of Hypotheses.

3.2 Research Design

This research was an empirical study of the NSE. Empirical study entails collection of observed data, and modeling it using statistical methods. In the study the statistical model used was ordinary linear regression analysis which was applied to quantify the strength of the relationship between the stock returns and the beta. The Wednesday average stock prices for the five years from 4th January 2006 to 29th December 2010 and data of betas for a similar period will be used to establish the risk-return relationship at the NSE.

3.3 Population

There were 43 firms listed on the NSE between 4th January 2006 to 29th December 2010 which consistently traded at the NSE whose data was collected and analysed. These made up the population of this study (see list on the Appendix).The analysis was based on the Wednesday average prices of assets. Wednesday was selected because it is believed to have a smaller degree of irrationalities like the Monday effect or the weekend effect (French, 1980).

3.4 Data Collection

Secondary data was collected from the NSE data bank. Wednesday average prices were captured from 4th January 2006 to 29th December 2010, and a total of 260 weeks' returns were obtained. All the fourty three companies were considered leading to 11180 data points (that is 5 years * 52 weeks * 43 companies). The daily stocks volume per

company was collected too making 11180 data points. Stock beta was computed for the research period covered. The dividends paid out were collected from NSE databank and captured on a flash disk and stored on an optical disk. The data was analysed in MS EXCEL to determine the stock returns using the Dividend Growth Model (Gordon, 1959).

3.5 Analysis of Data and Testing the Hypotheses

Using Gordon (1959) Model weekly price changes and weekly dividends were used to calculate each firm's weekly returns for the three years. This model was used to find weekly returns:

$$R_a = \frac{D}{P_0} + \frac{P_1 - P_0}{P_0}$$

Where: R_a is the weighted rate of return per week, D is the dividend per share in a week, P_0 is the price of the share at the beginning of the week, P_1 is the closing share price of the week. The weighted average returns and the weighted betas for each Wednesday were calculated for the 260 weeks. The daily stocks sold for each company formed the weights. A linear regression model was run to determine the constants A and B for the linear relation between R_a and β in the expression

$$R_A = A + B * \beta_A + \epsilon_A$$

In the above equation, R_A is the weekly weighted stock return and β is the weekly weighted beta, B is the excess return per unit of beta and A is return not associated with beta. A regression assumes that: the dependent variable can be calculated as a linear function of a specific set of independent variables plus an error term; the error term has a mean of 0; the error terms have constant variance for all the observations; the random variables ε_i are statistically independent of each other; the number of observations is greater than the number of independent variables, and they have no exact linear relationship between them.

The coefficient of determination (R^2) was used to determine how much of the variation in return is explained by the variation in the beta. The T-test was used to test linearity by testing the significance of the slope (B) of the line of regression at 95% confidence level.The significance of the regression was tested using F-test.

CHAPTER FOUR

DATA PRESENTATION AND INTERPRETATION OF FINDINGS

4.1 Introduction

This chapter discusses the findings of the research. The objective of this research was to find out whether the relationship between return as the dependent variable and beta as the independent variable is linear or not. The chapter therefore discusses how the two variables were operationalized; it provides a statistical description of the distribution of the data on the variables; and how the variables correlated. Further the regression analysis findings are presented interpreted.

4.2 Analysis of Data and Presentation of Findings.

4.2.1 The Sample

This study aimed at studying all the firms on the NSE listed between January 2006 and December 2010. The data was collected from the NSE including Wednesday stock volumes, corresponding prices and dividends. Some of the companies were dropped from the sample of analysis due to unavailability of the relevant data as some of the companies had joined the NSE during the period of study and the available data could not allow this analysis. This left the analysis to forty-three companies which were analyzed.

4.2.2 Company Returns

The data collected from the Database of the NSE included Wednesday stocks volumes, prices and dividend records for all listed firms between 2006 and 2010. After sorting and organizing the data the Wednesday returns were calculated for each Wednesday. This calculation was done by first dividing annual dividend by 52 weeks to reduce the dividend to weekly basis before applying the model.

$$R_a = \frac{D}{P_0} + \frac{P_1 - P_0}{P_0}$$

Where R_a is the return for a given week; D is the dividend for the week; P_n is the stock price for the Wednesday in the week while P_1 is the price of the stocks for the following

For each company a simple linear regression analysis was done to confirm the nature of their relationship. The results for each company are recorded in Table 3. Twenty-four companies recorded positive coefficients with TPS Eastern Africa (Serena) Ltd recording a coefficient of 1.4769. Twenty-one countries recorded a negative gradient with Carbacid Investments Ltd and EAAGARD recording -0.4370 and -0.4357 respectively. Only five companies B.O.C Kenya Ltd, Crown Berger Ltd, Kapchorwa, Marshalls (E.A.) Ltd and The Co-operative Bank of Kenya Ltd had their values of T greater than the corresponding critical values of T indicating a linear relationship. The remaining thirty-eight had the values of their T values less than the critical values of T.

The analysis of the constant term resulted in twenty-six companies that had positive intercepts while the remaining seventeen had negative intercepts. These were the values of return that do not depend on the variation of beta. Seven companies had the T values of their intercepts greater than the critical value of T. the remaining companies had their T values less than the critical. Sixteen companies had values of R-Square more than 50%. The rest of the companies had their values of R-Square less than 50%. Eleven companies had their F-values greater than the F-critical while the remaining 36 had their critical values less than the critical F-values.

The focal point of the results is that thirty-eight companies had the test for the significance of the coefficient indicating non-linearity, twenty-seven companies had the values of R-Square less than 50% and thirty-two companies had their F values less than the critical. This lead the research that generally the relationship between return and beta cannot be linear as far as the sample is concerned.

CHAPTER FIVE

SUMMARY OF FINDINGS AND CONCLUSIONS.

5.1 Summary of Findings and Conclusions

5.1.1 Summary of the Findings

This research was basically a test on the nature of the relationship between risk and return. The CAPM suggest that the relationship between is linear risk and return in which beta is the coefficient of the difference between the market return and the risk-free rate. However, in this research beta is not the gradient but the variable while by rearrangement of the model the difference between the market return is the gradient. The research therefore sought to find out whether this relationship between return and risk captured by beta is as linear as suggested by the CAPM.

In this endeavor data as collected from the NSE which included Wednesday stock prices, Wednesday stock volumes, and the dividends. These data were used to calculate the returns of stocks, the average Wednesday market returns and the betas of the companies. The values of beta and return were reduced to annual values enabling every company to have five paired values of return and beta. Regression analysis was conducted on the paired values of risk and return for each company.

Most of the companies did not pass the linearity test as only thirty-two out of the forty-three had their F-values greater than the critical values of F. The test for the significance of the coefficient term also revealed that thirty-eight companies did not pass this test. The results therefore testify that on the NSE between 2006 January and 2010 December the relationship between return and beta of firms was not linear based on the Wednesday returns.

5.1.2 Conclusions

This research was a test on the linearity of CAPM. The analysis indicated that a majority of the analyzed companies did not pass the test of linearity in all aspects. A majority had their coefficient terms fail the T-test, a majority failed to pass the T-test on their intercept terms, a majority had weak R-Square values and finally a majority failed the F-test.

Assuming that these statistical tests are accurate measures in themselves then the conclusion can only be that the relationship between return and beta is not linear.

5.2 Recommendations

This research has provided evidence that the relationship between betas of companies is not linear there is a need to establish the relationship between return and risk in order to give direction to enable investors make better investment decisions and reduce the possible use of trial and error or use of a model that may not be capturing this relationship properly.

5.3 Limitations of the Study

The data covers a period of five years from 2006 to 2010 and only the firms listed on the NSE are considered. Despite the period being long enough the research has not delved into the periods before 2006 and further the results are time and NSE specific. This in itself raises the question of the generalizability of the findings across time, and across other stock markets.

The application of the CAPM on the NSE implies the assumption that the NSE is an efficient market. It is not determined whether the NSE was efficient during the period of study or not. This research has not investigated the efficiency of the NSE during the study period. In fact it cannot be clearly explained whether the results show that the NSE is inefficient or whether it is the model which has failed on the efficient NSE.

The variable used to operationalize return is weak as it may not be able to capture return in its entirety. According to the EMH of Fama (1965) security prices should be able to properly measure market sentiment and information value if the market is efficient market. It is known that companies do not pay out all the return and sometimes issues with agency costs may affect return. There is therefore a need to capture return in a more accurate manner than using dividend and stock prices.

5.4 Suggestions for Further Research

The research period is only five years between 2006 and 2010 yet the NSE has been in existence for a longer period of time. What would the results be if the period of study was

earlier than 2010? Would the results be the same? What if the study was to cover a longer period of time, say twenty years? A study can be conducted with respect to the time-related questions raised here.

The issue of the NSE accurately capturing return based on market prices and dividend is to be investigated. Given that the NSE (and Kenya as a whole) is not technologically and legally advanced like the markets in the developed countries there are grounds to motivate an investigation to ascertain how returns can be properly captured.

The research limited itself to testing linearity but did not go further to ascertain whether there is any non-linear model that can strongly explain the relationship between beta and return. A research can therefore e conducted to ascertain whether there is no relationship whether the relationship is quadratic, cubic or logarithmic.

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APPENDICES

Table 1

Returns of Companies

COMPANY	2006	2007	2008	2009	2010
1. Athi River Mining	0.0108	0.0118	0.0089	0.0117	0.0003
2. B.O.C Kenya Ltd	0.0000	0.0128	0.0000	-0.0005	0.0053
3. Bamburi Cement Ltd	0.0145	-0.0022	-0.0025	0.0197	0.0027
4. Barclays Bank Ltd	0.0098	-0.0093	-0.0094	-0.0032	0.0061
5. British American Tobacco Kenya Ltd	0.0023	-0.0204	-0.0060	-0.0053	0.0250
6. Car and General (K) Ltd	0.0479	0.0472	0.0015	-0.0124	0.0569
7. Carbacid Investments Ltd	0.0000	0.0147	0.0000	0.1871	0.0168
8. CFC Stanbic Holdings Ltd	0.0105	0.0494	0.0085	-0.0209	0.0443
9. city trust	-0.0063	0.0277	0.0131	-0.1267	0.0198
10. CMC Holdings Ltd	0.0291	-0.0086	-0.0022	-0.0117	0.0062
11. Crown Berger Ltd	-0.0100	0.0062	-0.0123	0.0083	0.0178
12. Diamond Trust Bank Kenya Ltd	0.0141	0.0082	0.0023	-0.0101	0.0129
13. E.A.Cables Ltd	0.0349	0.0043	0.0002	-0.0238	-0.0128
14. E.A.Portland Cement Ltd	-0.0540	0.2196	0.1349	-0.0055	0.4457
15. EAAGARD	0.0319	0.7485	-0.0017	-0.0197	0.0000
16. East African Breweries Ltd	0.0040	-0.0003	-0.0284	0.0097	0.0015
17. Equity Bank Ltd	0.0227	-0.0021	-0.0003	-0.0001	0.0033
18. Eveready East Africa Ltd	-	-0.0159	-0.0075	0.0105	-0.0055
19. EXPRESS	0.0896	0.0288	-0.0180	-0.0066	0.0124
20. Housing Finance Co Ltd	0.0288	0.0123	-0.0716	0.0039	0.0331
21. Jubilee Holdings Ltd	0.0225	-0.0456	-0.0055	0.0011	0.0009
22. KAPCHORWA	0.0142	0.0589	-0.0048	-0.1273	0.1759
23. KenGen Ltd	-0.0241	-0.0085	-0.0155	0.0106	0.0039
24. Kenya Airways Ltd	0.0052	-0.0103	-0.0112	-0.0075	0.0317
25. Kenya Commercial Bank Ltd	0.0062	0.0079	-0.0053	-0.0018	-0.0021
26. Kenya Power	0.0265	-0.0210	-0.0241	-0.0067	-0.0192
27. LIMURU TEA	0.0009	-0.0011	0.0033	0.0025	0.0015
28. Marshalls (E.A.) Ltd	0.0218	0.0674	-0.2150	0.0000	-0.0247
29. Mumias Sugar Co. Ltd	0.0158	-0.0361	-0.0108	-0.0028	-0.0072
30. Nation Media Group	0.0110	-0.0053	0.0019	-0.0061	0.0041
31. National Bank of Kenya Ltd	0.0196	-0.0206	-0.0062	0.0059	-0.0051
32. NIC Bank Ltd	0.0427	-0.0180	-0.0018	-0.0016	-0.0089
33. Olympia Capital Holdings ltd	-0.0380	0.0854	0.0304	0.0142	0.0122

Table 1 cont...

34. Pan Africa Insurance Holdings Ltd	0.0735	0.0125	0.0117	0.0290	-0.0196
35. Rea Vipingo Plantations Ltd	0.0281	-0.0020	-0.0311	-0.0076	0.0621
36. Sameer Africa Ltd	0.1206	-0.0114	0.0112	0.0303	0.0154
37. Sasini Ltd	0.0672	-0.0212	-0.0092	0.0173	0.0393
38. Scangroup Ltd	0.0547	-0.0024	-0.0093	0.0189	0.0282
39. Standard Chartered Bank Ltd	0.0061	-0.0204	-0.0078	-0.0056	0.0054
40. The Co-operative Bank of Kenya Ltd	-	-	-0.0267	0.0206	0.0150
41. Total Kenya Ltd	-0.0084	0.0136	-0.0035	-0.0177	0.0120
42. TPS Eastern Africa (Serena) Ltd	0.0002	-0.0029	-0.0519	-0.0465	0.0032
43. UNGA GROUP	-0.0158	-0.0070	0.0084	-0.0032	-0.0203

Table 2

Betas of Companies

COMPANY	2006	2007	2008	2009	2010
1. Athi River Mining	0.452	0.270	0.529	0.517	-0.046
2. B.O.C Kenya Ltd	0.000	0.451	0.000	-0.039	0.116
3. Bamburi Cement Ltd	0.080	0.357	0.151	0.405	-0.135
4. Barclays Bank Ltd	0.651	0.207	0.625	0.651	0.384
5. British American Tobacco Kenya Ltd	-0.038	-0.260	0.089	0.102	-0.216
6. Car and General (K) Ltd	0.270	0.485	0.035	0.039	-0.328
7. Carbacid Investments Ltd	0.000	0.023	0.000	-0.407	-0.020
8. CFC Stanbic Holdings Ltd	0.165	0.688	0.435	0.061	-0.311
9. city trust	-0.122	2.507	0.032	0.002	-0.797
10. CMC Holdings Ltd	0.132	1.284	1.044	1.126	0.030
11. Crown Berger Ltd	-0.004	0.647	0.258	0.558	1.158
12. Diamond Trust Bank Kenya Ltd	2.763	0.247	0.994	0.601	0.424
13. E.A.Cables Ltd	0.586	0.528	0.731	0.626	0.641
14. E.A.Portland Cement Ltd	-0.008	0.264	0.018	-0.143	0.050
15. EAAGARD	-0.238	-0.218	0.018	-0.140	0.477
16. East African Breweries Ltd	0.143	0.085	0.927	0.610	-0.018
17. Equity Bank Ltd	0.204	0.776	1.581	1.274	0.448

18. Eveready East Africa Ltd	-	0.341	0.507	0.461	0.828
19. EXPRESS	0.034	-0.316	0.372	-0.098	0.059
20. Housing Finance Co Ltd	0.301	0.700	1.719	0.369	0.350
21. Jubilee Holdings Ltd	0.312	0.343	0.140	0.439	0.153
22. KAPCHORWA	0.057	0.024	-0.004	-0.042	0.335
23. KenGen Ltd	0.320	1.099	0.963	0.862	0.563
24. Kenya Airways Ltd	0.339	0.448	0.487	0.889	1.177
25. Kenya Commercial Bank Ltd	0.356	-0.458	1.092	0.679	0.930
26. Kenya Power	0.172	0.559	0.950	0.949	-0.440
27. LIMURU TEA	0.000	-0.067	0.006	0.011	-0.061
28. Marshalls (E.A.) Ltd	0.148	-0.009	-0.206	0.000	-0.087
29. Mumias Sugar Co. Ltd	0.215	1.755	0.911	0.818	0.129
30. Nation Media Group	0.155	0.314	0.931	0.399	0.208
31. National Bank of Kenya Ltd	3.031	0.976	0.910	0.762	0.340
32. NIC Bank Ltd	-0.358	0.517	0.784	0.487	0.580
33. Olympia Capital Holdings ltd	-0.106	-0.078	0.257	0.018	0.227

Table 2 Cont..

34. Pan Africa Insurance Holdings Ltd	-0.331	0.126	0.266	0.214	0.148
35. Rea Vipingo Plantations Ltd	0.363	0.297	0.369	0.092	0.652
36. Sameer Africa Ltd	1.429	0.501	0.860	-0.060	0.703
37. Sasini Ltd	0.632	0.414	0.677	0.436	0.789
38. Scangroup Ltd	0.470	0.357	0.653	0.652	0.391
39. Standard Chartered Bank Ltd	-0.040	0.272	0.291	0.209	-0.186
40. The Co-operative Bank of Kenya Ltd	0.000	0.000	0.008	0.362	0.486
41. Total Kenya Ltd	0.051	-0.315	2.502	0.304	0.028
42. TPS Eastern Africa (Serena) Ltd	0.000	0.000	0.000	-0.023	0.000
43. UNGA GROUP	0.923	0.272	0.210	0.478	-0.417

Table 3

Regression results

COMPANY	DF	grad	t-value	tc	intercept	t value	rsquare	f value	fc
1. Athi River Mining	8	0.0164	0.0067	1.8595	0.0031	1.1263	0.6657	5.9737	5.3177
2. B.O.C Kenya Ltd	8	0.0280	11.4245	1.8595	0.0006	1.1097	0.9775	130.5193	5.3177
3. Bamburi Cement Ltd	8	0.0110	0.4232	1.8595	0.0046	0.6747	0.0563	0.1791	5.3177
4. Barclays Bank Ltd	8	0.0117	0.4764	1.8595	-0.0071	0.0131	-0.5393	0.2270	5.3177
5. B A T Kenya Ltd	8	-0.0134	-0.2365	1.8595	-0.0017	-0.1878	0.0183	0.0560	5.3177
6. Car and General (K) Ltd	8	0.0070	0.1181	1.8595	0.0172	1.5988	0.0046	0.0139	5.3177
7. Carbacid Investments Ltd	8	-0.4370	-13.8055	1.8595	0.0084	1.4532	190.5919	0.9845	5.3177
8. CFC Stanbic Holdings Ltd	8	0.0092	0.2106	1.8595	0.0164	0.9473	0.0146	0.0444	5.3177
9. city trust	8	0.0122	0.4301	1.8595	-0.0184	-0.5526	0.0581	0.1850	5.3177
10. CMC Holdings Ltd	8	-0.0225	-2.4592	1.8595	0.0188	2.2921	0.6684	6.0475	5.3177
11. Crown Berger Ltd	8	0.0272	4.4399	1.8595	-0.0123	-3.0563	0.8679	19.7131	5.3177
12. Diamond Trust Bank Kenya	8	0.0036	0.7037	1.8595	0.0018	0.2617	0.1417	0.4951	5.3177
13. E.A.Cables Ltd	8	-0.0887	-0.5429	1.8595	0.0558	0.5454	0.0895	0.2947	5.3177
14. E.A.Portland Cement Ltd	8	0.6609	0.9691	1.8595	0.1243	1.3370	0.2384	0.9391	5.3177
15. EAAGARD	8	-0.4357	-0.7238	1.8595	0.1430	0.8955	0.1487	0.5239	5.3177
16. East African Breweries	8	-0.0233	-1.4143	1.8595	0.0055	0.6608	0.4000	2.0002	5.3177
17. Equity Bank Ltd	8	-0.0125	-1.6810	1.8595	0.0154	2.0794	0.4851	2.8258	5.3177
18. Eveready East Africa Ltd	6	0.0069	0.1870	1.9432	-0.0083	-0.3982	0.0172	0.0350	5.9874
19. Express	8	-0.0495	-0.5327	1.8595	0.0218	1.0438	0.0864	0.2838	5.3177
20. Housing Finance Co Ltd	8	-0.0681	-5.7947	1.8595	0.0481	4.7013	0.9180	33.5790	5.3177
21. Jubilee Holdings Ltd	8	-0.0213	-0.1916	1.8595	0.0006	0.0174	0.0121	0.0367	5.3177
22. Kapchorwa	8	0.6389	3.1600	1.8595	-0.0239	-0.7682	0.7690	9.9857	5.3177
23. KenGen Ltd	8	0.0123	0.4980	1.8595	-0.0161	-0.8010	0.0764	0.2480	5.3177
24. Kenya Airways Ltd	8	0.0343	1.5601	1.8595	-0.0214	-1.3146	0.4479	2.4341	5.3177
25. Kenya Commercial Bank Ltd	8	-0.0086	-3.9603	1.8595	0.0054	3.3204	0.8394	15.6837	5.3177
26. Kenya Power	8	-0.0061	-0.3045	1.8595	-0.0062	-0.4482	0.0300	0.0927	5.3177
27. Limuru Tea	8	0.0317	1.8173	1.8595	0.0021	2.9345	0.5240	3.3026	5.3177

28. Marshalls (E.A.) Ltd	8	0.6592	2.2157	1.8595	-0.0098	-0.2726	0.6207	4.9092	5.3177
29. Mumias Sugar Co. Ltd	8	-0.0243	-2.8098	1.8595	0.0103	1.2426	0.7246	7.8950	5.3177
30. Nation Media Group	8	-0.0052	-0.4062	1.8595	0.0032	0.5115	0.0521	0.1650	5.3177
31. National Bank of Kenya Ltd	8	0.0100	1.6982	1.8595	-0.0133	-1.4824	0.4901	2.8841	5.3177
32. NIC Bank Ltd	8	-0.0476	-3.4583	1.8595	0.0216	2.7919	0.7995	11.9598	5.3177
33. Olympia Capital Holdings	8	0.0137	0.0911	1.8595	0.0200	0.8068	0.0028	0.0083	5.3177

Table 3 cont

34. Pan Africa Insurance Hdg	8	-0.1113	-2.1651	1.8595	0.0308	2.6120	0.6098	4.6875	5.3177
35. Rea Vipingo Plantations Ltd	8	0.1267	1.7273	1.8595	-0.0350	-1.2016	0.4986	2.9834	5.3177
36. Sameer Africa Ltd	8	0.0607	1.4553	1.8595	-0.0084	-0.2410	0.4138	2.1179	5.3177
37. Sasini Ltd	8	0.1053	0.9292	1.8595	-0.0434	-0.6312	0.2235	0.8634	5.3177
38. Scangroup Ltd	8	-0.0419	-0.4116	1.8595	0.0392	0.7396	0.0535	0.1694	5.3177
39. Standard Chartered Bank	8	-0.0436	-2.7434	1.8595	0.0003	0.0818	0.7150	7.5264	5.3177
40. The Co-operative Bank	4	0.0974	2.6333	2.1318	-0.0248	-1.9178	0.9349	6.9343	7.7086
41. Total Kenya Ltd	8	-0.0032	-0.4905	1.8595	0.1150	0.1150	0.0742	0.2406	5.3177
42. TPS (Serena) Ltd	8	1.4769	1.1513	1.8595	-0.0128	-0.9812	0.3065	1.3256	5.3177
43. Unga Group	8	0.0036	0.2698	1.8595	-0.0086	-1.2476	0.0237	0.0728	5.3177

Table 4

Table of Correlations

1. Athi River Mining	0.8159
2. B.O.C Kenya Ltd	0.9887
3. Bamburi Cement Ltd	0.2374
4. Barclays Bank Ltd	0.2652
5. B A T Kenya	-0.1353
6. Car and General (K) Ltd	0.0680
7. Carbacid Investments Ltd	-0.9922
8. CFC Stanbic Holdings Ltd	0.1207
9. city trust	0.2410
10. CMC Holdings Ltd	-0.8176
11. Crown Berger Ltd	0.9316
12. Diamond Trust Bank	0.3764
13. E.A.Cables Ltd	-0.2991
14. E.A.Portland Cement Ltd	0.4883
15. EAAGARD	-0.3856
16. East African Breweries Ltd	-0.6325
17. Equity Bank Ltd	-0.6965
18. Eveready East Africa Ltd	0.1311
19. EXPRESS	-0.2940
20. Housing Finance Co Ltd	-0.9581
21. Jubilee Holdings Ltd	-0.1100
22. KAPCHORWA	0.8769
23. KenGen Ltd	0.2763
24. Kenya Airways Ltd	0.6693
25. Kenya Commercial Bank	-0.9162
26. Kenya Power	-0.1731
27. LIMURU TEA	0.7239
28. Marshalls (E.A.) Ltd	0.7878
29. Mumias Sugar Co. Ltd	-0.8513
30. Nation Media Group	-0.2283
31. National Bank of Kenya	0.7001
32. NIC Bank Ltd	-0.8941
33. Olympia Capital Hdg	0.0525
34. Pan Africa Insurance	-0.7809
35. Rea Vipingo Plantations	0.7061
36. Sameer Africa Ltd	0.6433
37. Sasini Ltd	0.4727
38. Scangroup Ltd	-0.2312
39. Standard Chartered Bank	-0.8456
40. The Co-operative Bank	0.9349
41. Total Kenya Ltd	-0.2725
42. TPS (Serena) Ltd	0.5536
43. UNGA GROUP	0.1539

LIST OF THE 43 ANALYSED COMPANIES

1. Athi River Mining
2. B.O.C Kenya Ltd
3. Bamburi Cement Ltd
4. Barclays Bank Ltd
5. British American Tobacco Kenya Ltd
6. Car and General (K) Ltd
7. Carbacid Investments Ltd
8. CFC Stanbic Holdings Ltd
9. City Trust
10. CMC Holdings Ltd
11. Crown Berger Ltd
12. Diamond Trust Bank Kenya Ltd
13. E.A.Cables Ltd
14. E.A.Portland Cement Ltd
15. EAAGARD
16. East African Breweries Ltd
17. Equity Bank Ltd
18. Eveready East Africa Ltd
19. EXPRESS
20. Housing Finance Co Ltd
21. Jubilee Holdings Ltd
22. Kapchorwa
23. KenGen Ltd
24. Kenya Airways Ltd
25. Kenya Commercial Bank Ltd
26. Kenya Power
27. Limuru Tea
28. Marshalls (E.A.) Ltd
29. Mumias Sugar Co. Ltd
30. Nation Media Group
31. National Bank of Kenya Ltd
32. NIC Bank Ltd
33. Olympia Capital Holdings ltd
34. Pan Africa Insurance Holdings Ltd
35. Rea Vipingo Plantations Ltd
36. Sameer Africa Ltd
37. Sasini Ltd
38. Scangroup Ltd
39. Standard Chartered Bank Ltd
40. The Co-operative Bank of Kenya Ltd
41. Total Kenya Ltd
42. TPS Eastern Africa (Serena) Ltd
43. Unga Group

Source: (Nairobi Stock Exchange, 2011)