MARKET FACTORS THAT AFFECT RETURNS FOR COMPANIES QUOTED AT THE NAIROBI SECURITIES EXCHANGE

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DECLARATION

I declare that this research dissertation is my original work and has not been published before or submitted somewhere else for award of a degree. I also declare that this dissertation contains no material written or published by other people apart from where due reference is made and writer accordingly acknowledged.

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Sign…….. Date……..

I do hereby confirm that l have examined the Masters dissertation of

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And certify that the dissertation has been submitted for review with my approval.

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ABSTRACT

The Nairobi Securities Exchange is the key exchange market for stocks trading in the East and Central Africa region. Having moved from floor trading to the modern electronic Trading system, the NSE was restructured to include particular sectors with regard to economic activities. The aim of this study was to determine how market return and market beta impacts on portfolio returns for the firms quoted on the Nairobi Securities market. The study adopted a three factor model to establish the relationship between the market return, market beta and the interaction between market beta and market return for the period 2009 to 2013. The study adopted panel regression, in order to achieve the purpose of the study. A Hausman test was thus performed and it was concluded that a random effects model was appropriate. This study found that portfolio return and market return were positive ($r= 0.565$) and significant (p-value<0.000) correlated and further the random effects panel regression results indicated a positive ($\beta=3.38$) and significantly (p-value<0.05) related to Market return and Portfolio return. Secondly, the study established that portfolio return and market beta were positive ($r= 0.417$) and significant correlation (p-value<0.000) and this was further indicated by the random effects panel regression results that they had a positive ($\beta=25.93$) and significant relationship. Similarly, the study found a negative and significant relationship between the interaction between market beta and market return on the portfolio returns. Finally, the estimated model was found to be significant and that 52.21 percent of the variations in portfolio returns was jointly explained by the variations in the market beta, market return and by the interaction between the market beta and market return. The study thus concluded that the portfolio return is positive and significantly related to market returns. Secondly, the study concluded that the market beta was positive and significantly related and lastly, the interaction between the market beta and market return was positive and significantly related to portfolio returns.

Key words: Stock Return, Market return, Market Risk**.**

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TERMS AND DEFINITIONS

Beta

It determine non-diversifiable risk as it explains how the value of a security reacts to market Force (Tofallis, 2008).

Capital Asset Pricing Model (CAPM)

The CAPM explains the risk- return association with the assumption that investors are risk averse and they will only take risk only if they are compensated for the risk which they bear (Sharpe, 1964)

Diversification

This involves adding securities to a portfolio so that total risk of the portfolio is reduced (Elton, Gruber, Brown & Goetzmann, 2009).

Market Risk or Systematic risk

The changes in the return on any script due to market movements. There is nothing much an Investor can do about systematic risk of a security because it arises due to some extraneous Variables (March& Shapira, 1987)

Market Segmentation

It's a process of separating a target market into groups of consumers, with similar needs and priorities, and then designing and implementing strategies to target them (Sarin, 2010)

Return

The increase or decrease in value of an asset in a specific timeframe. The return is made up of the income and the capital gains relative on an investment.

Risk

This is a situation where there is a possibility of realized returns being less than the returns that were expected for the security held. (March & Shapira, 1987)

Risk Premium

This is the compensation for assuming additional risk. Generally Investors are risk averse and will only take risk if they will be reward (Cohen, 2002).

Unsystematic risk or diversifiable risk

The changes in the return of a stock due to the stocks specific factors or movements. The changes affect the prices of the stocks of companies which are operate in that sector and not all the stocks in the market (Shiller, 1995)

CHAPTER ONE

INTRODUCTION

1.0 Introduction

An active stock market has been considered important for economic expansion and contributes immensely to improve productivity. CAPM in its different forms has been tested for the developed markets such as, those of USA, Australia and Europe. At the inception in 1954, NSE was a voluntary organization however it is now among the leading markets in Africa.

1.1 Background of the Study

The risk-return relationship is a fundamental tenet of finance. According to the risk return theory high level of risk results into greater expected return. Logically an individual would demand a greater return for bearing higher level of risk, as explained by Markowitz (1952) as well as Fama and French (2001), investor decision is determined by the risk and return of a particular asset. The question that arises is whether the risk-return relationship can be a guide to the investment options that an investor or the industry gets into. CAPM uses proportional market risk to explain pricing and asset return. However the model did not explain well the observed market returns, of companies trading at stock market, this is because the model uses one factor to estimate the assets return.

1.1.1 Concept of risk

Investment in stocks is risky as stock prices are affected by changes in domestic and world economy. The growth of stock is equally susceptible to a number of risks (Harvey et al, 2005). The risks include changes and returns for different stocks because of changes in interest rates, inflation rates, political factors, environmental factors and economic policies.

As stocks growth is determined by the overall market movement which leads to changes in the firm's stock prices. The sensitivity of a stock to market movements is measured by Beta (β) thus a stock with Beta that is equal to one moves with the market, while a stock with a Beta that is higher than one has higher volatility than the market. A stock of a beta of less than one has a lower volatility than the market. Betas are important to investors as they enable them to establish the market risk of a stock (Sharpe, 1964).

1.1.2 Return on Investment

Studies of return on investment are based on Markowitz Model of finance, which enable an investor to form a portfolio in the beginning of the period (Markowitz, 1952). Investors maximize the expected returns from the portfolios subject to a tolerable degree of risk or minimize risk depending expected return that is acceptable.

The investors attitude towards risk enables him to measure risk by standard deviation therefore the risk and the expected returns change in specific ways as the securities are added to the portfolio. Securities are added to the portfolios depending on how their expected returns co-vary with other securities. Markowitz framework sets the foundation on which Sharpe (1964), Litner (1965) and Mossin (1966) derived the CAPM model.

1.1.3 Risk–return trade-off

The concept of risk and return relationship is based on two realities of investments and investment performance. First, investments are susceptible to some degree of risk because an investor stands the risk of losing all his cash when buying stocks, bonds, mutual funds or other investments. Second the more risk an investor assumes the greater the investment returns he may achieve.

As indicated earlier there are different kind of risks but risk return trade off encompasses volatility as the basic measure of risk. Volatility is the degree to which an

investment changes in price. Price fluctuations will depend on the category of the asset thus stocks prices change widely from one year to another as compared to swing in bonds prices which tend to be less dramatic (Harvey et al, 2005). Unsystematic risks are likely to affect at most small number of assets, because it can be reduced by diversification, which entails investing in a numerous assets in a portfolio.

1.1.4 The Nairobi Securities Exchange

Stock market is significantly crucial in the economic growth of a country. The market is vital in the growth of industry and commerce in the national economy. That is why governments and industries monitor closely the activities of the stock market. The market is important both from the of industry and investors perspective. This is because it offers the ground for trading in various financial instruments, there is also an opportunity for investment by those who have excess funds and those who lack, dealers in the market also speculate leading to fluctuations in the share prices, hedging and arbitrage opportunities are also present at the market, it also serves as a mechanism of price discovery and information distribution Stock markets are also used to instigate privatization plans which are important in the development of up-and-coming economies (Lee, 1998).

The NSE came into existence in 1954 as an association of stockbrokers who it registered as a society. At that time trading activities would take place in a hotel over a cup of tea where accountants and lawyers would meet (Muga, 1974), the stock exchange has undergone major changes and transformations and the level of activity has tremendously increased. A lot of interest in the stock exchange was generated in the 1980s when the government embarked on a privatization program targeting state corporations such as Kenya Commercial Bank and Kenya Airways.

In January 1991, the NSE changed its status into a company limited by guarantee. It also changed its trading system from the old "call-over" system to the floor based "Open Outcry" System. The realization of the critical developmental role played by the Nairobi Securities market and the capital markets at large saw the creation of the Capital Markets Authority in 1992, the Capital Markets Act, Cap. 485 (A) of the laws of Kenya was passed which led to the formation of the regulatory body. As a result of this a number of accompanying regulations have since been enacted.

In July 1994, the NSE was relocated to a more organized location at the Nation Centre. In that year, the International Finance Corporation (IFC) Capital Markets Division rated the NSE as the world best performing emerging market having posted a return of 179% in dollar terms. It is reported that the NSE 20-Share Index recorded an all-time high of 5030 Points on 18th February 1994.During the year 2000, the Nairobi Stock Exchange embarked on a major reform of the market dubbed "Market Segmentation and Re-organization". The reform process involved segmenting the market into four independent segments, which are:- The Main Investments Market Segment (MIMS) which has the highest listing financial conditions with respect to net assets and share capital at Kshs. 50 million and Kshs. 100 million respectively; the Alternative Investment Market Segment (AIMS) where listing financial requirements on net assets and share capital are at Kshs. 10 million and Kshs. 20 million respectively (www.nse.co.ke); the Fixed Income Security Market Segment (FISMS) where Treasury Bills & Bonds and Corporate Bonds are traded. The fourth market segment is Futures and Options Market Segment (FOMS) which is not yet operational in Kenya.

1.2 Statement of the Problem

Market investors wish to make an optimal investment decision that would guarantee them a desirable level of return commensurate with the magnitude of risk taken.

Unfortunately, the profile information is not easy to obtain, and if obtained, the cost of such information could be so high leading to reduction in the level of expected returns or negative returns. Some studies conducted at the NSE concerning risk and return relationship did not explain how the market beta and market returns relate to the portfolio returns at the stock exchange. Akwimbi (2003) found that arbitrage pricing theory as a linear model successfully explains the expected return at the NSE. The scholars ascertained that APT holds true for emerging markets. Kamau (2002) examines the profile relationship of companies quoted on the Main Investment Market Segment (MIMS) and the Alternative Investment Market Segment (AIMS). The study utilized historical market data from the Nairobi Stock Exchange for five years from January 1996 and December 2000. The research found out that there was no significant difference in terms of return and risk between those companies listed under the Main Investment Market Segment and the Alternative Investment Market Segment. Similar studies by Apuoyo (2010) and Nyaata (2009) however indicate mild contradiction between prediction using APT and CAPM approaches.

Although several scholars have conducted studies on risk and return, very little has been done regarding risk return trade off on portfolio returns in Kenya. As a result there is a restricted appreciation on how the industry risk and return behaves. Similarly, a lot of reforms have taken place since the introduction of Central Depository System and the launch of live trading on the NSE in 2006. As found out by the previous scholars, these changes could have an adverse effect in the risk return calculations. It is also unclear the extent to which risk-return trade-off influences investment returns in the Main Investments Market Segment firms at NSE. This study therefore seeks to establish if market return and market beta have an impact on stock investment returns on companies quoted at NSE.

1.3 Objective of the thesis

The main objective of the study is:

To determine how market factors influence stock investment returns for public equity companies in MIMS of NSE

1.3.1 Specific objectives

The specific objectives of the study are to:

1) To determine the effect of Market return on the Portfolio Returns of companies in the MIMS at NSE.

2) To determine the effect of Market Beta on the Portfolio Returns of companies in the MIMS at NSE.

3) To determine the effect of the interaction of Market Beta and Market Return on the Portfolio Returns of companies in the MIMS at NSE.

1.3.2 Research questions

The research questions for this study are:

1) How does Market return affect Portfolio Returns of companies quoted at the NSE?
2) How does the Market Beta affect Portfolio Returns of companies quoted at the NSE?
3) How does the interaction of Market Beta and Market Return affect Portfolio Returns of companies quoted at the NSE?

1.4 Significance of the Thesis

This research may benefit practitioners, who may be able to widen their knowledge of risk in an emerging market context especially in Kenya. Investors may develop an investment strategy using the predictive power of the different risk measures as their base. Practitioners will also understand how risk fits into asset pricing models. The study will also be important to the industry players who have set up performing companies that are listed at the NSE. The

study highlights on whether or not investors have been adequately paid off by higher returns for any extra risks acquired

1.5 Organization of the Thesis

This study was confined to the Nairobi Securities Exchange although reference was also made to other emerging markets. Chapter one of this study presents the introduction covering the background of the Study, statement of the problem, objectives and significance of the study. Chapter two examines the literature review covering reviews of theories and empirical studies, definitions and concepts of risk, and relevant previous researches on the Nairobi Stock Exchange. Chapter three covers the research design whereas chapter four presents the analysis of data and discussions and lastly chapter five summarizes the findings, Conclusions and provides recommendations based on the findings.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter presents literature on risk and return of public equity firms related to the underlying study. It summarizes the studies done by deferent researchers in the same field by summarizing the theories, empirical review and general literature.

2.2 Review of theories

2.2.1 Markowitz portfolio theory

Portfolio theory was developed by Harry Markowitz (1952), it is frequently used in financial industry. Asset portfolios are constructed based on maximizing returns with a given level of risk. Portfolio theory provides an avenue to generate the optimal portfolio for the investor. Investors aim at maximizing returns while minimizing risks, this is achieved by diversifying investments. The total risk of a portfolio is different from the risk of the assets of the portfolio aggregated; consequently the portfolio return is the weighted average of the individual asset. Markowitz asserts that investors should select portfolio on the basis of overall risk reward effects and not constructing portfolios based on the individual securities risk rewards characteristics. APT is offered as one way of estimating risk and return in the market, but the most understood model is CAPM.

The CAPM model uses three elements i.e. the anticipated return of a security, risk-free rate and Beta which is the risk factor to measure the possible return in comparison with the risk the asset presents. CAPM has been widely used by analysts to determine whether risk is or is not worth the expected return.

2.2.2 The Arbitrage pricing theory (APT)

The Arbitrage Pricing Theory measures the prices that an asset should have on the market by use of either macro-economic factors or fundamental factors. These factors are weighted by beta coefficient sensitivities commonly known as factor loading. The model was developed by Stephen Ross in (1976).The model identifies the so called "mispriced assets." These securities (assets) have values which are higher than what is reflected in the market; therefore they present a capital appreciation opportunity. The stocks are likely to outperform

the market as a whole at any time hence referred to as value stocks. In finance arbitrage means taking advantage of one or more market imbalances to reduce the risk of a financial transaction.

Risky asset returns can be computed using APT model as shown below:

$$E(r) = a_j + b_{j_1}F_1 + b_{j2}F_2 + ... + b_{jn}F_n + \varepsilon_j \quad \text{..... (i)}$$

Where

- a_j is a constant for asset j i.e the returns at 0 risk factors.
- Fi is the independent variable
- b_{jn} is the factor loading,
- and ϵ_j is the error term

From the above model the expected return of an asset can be obtained by adding calculations of Bj(F) where each calculation measures security value based on an economic factor. The summation of all the factors and random shock gives the relative price of the asset. APT computes asset price using various economic and fundamental factors on assumption that in case market price deviates from the price suggested by the model arbitrageurs will make use of this inequality and veer the price back to the balance levels.

2.2.3 Capital asset pricing model (CAPM)

By the mid-1950s, it was clear that there existed risk and return relationship for the stocks trading in the market. However, there was no proper explanation and how risk affects the expected returns (Fama, 2010).In 1959 Markowitz came up with his document on portfolio theory, which was the brainchild of CAPM; this model was further improved by Sharpe in (1964) and Litner (1965).

CAPM is simple and elaborately appealing to the users that it laid the foundation of asset pricing theory where it was asserted that an investor can reduce risk of portfolio returns

by selecting stocks that are inversely related. Under CAPM the following assumptions stand (i) investors prefer less risk and more returns. (ii) The borrowing and lending rates are both equal (iii) there are no transaction cost and or taxes (iv) the expected returns and risk are the only two variables that need to be considered in an investment decision. CAPM states that unsystematic risk can be reduced by diversifying ones portfolio. The CAPM formula can be set out as:

E(r) = Risk-free rate %+(β x Market Risk Premium%)……(ii)

Where market risk premium is E (Rm) – Rf.

The risk-free rate is the rate obtained on Government treasury bills, while the market risk premium (MRP) is the premium over the risk free rate on the market. Beta, is a factor which indicates how specific stock price changes in relation to the market in which it trades. CAPM theory states that volatility is the only risk that investors need to be compensated for. The other risks which are unsystematic can be addressed by diversifying the portfolio.

2.2.4 Risk-return relationship

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

However, there have been exceptions to this conclusion. Bowman (1980) discovered that within most industries, risk and return were negatively correlated. Fiegenbanm and

Thomas, (1988) also discovered that risk and return are negatively related. Various explanations have been advanced to explain these contradictions. Laughbumn, et al, (1980) established that investors are not uniformly risk averse; as they assume a combination of both risk taking and non risk taking behaviors. They further established that target levels are important in determining this behavior. This indicates that when returns are below target, most investors will be risk averters. Fiegenbanm and Thomas (1988) and Bowman (1980) also established that troubled firms whose returns are below prospect or target returns are more risk-seeking than healthy firms. This clearly shows the non-universality of risk-aversion is the most important explanation for any negative risk-return relationship.

The importance of risk and return relationship cannot be overlooked in finance. The famous theories used to explain risk-return trade -off are CAPM and APT. CAPM is regarded as the most appropriate model to explain the impact of diversification on portfolio return. This model was introduced by Sharpe, (1965) and it was originally developed by Markowitz (1952), and developed by Litner (1965) black (1972) and by extension Fama & Macbeth (1973). CAPM considers only market risk in determining the returns of a portfolio, it thus ignores other factors. Market risk is a systematic risk factor which does not affect individual company in the industry but the whole industry, and cannot be eliminated by diversifying investments.

The model was criticized by Tunali (2010), and so it was expanded to include macroeconomic and fundamental variables. Ross (1976) who came up with Arbitrage Pricing Theory model. APT is a multifactor model used in asset pricing, which states that market risk among other risk factors can be used to measure the systematic risk of stock returns. Chen, Roll & Ross (1986) used inflation rates, market returns and oil prices (economic variables) which are systematic risk factors, by using APT model Ross (1976). These factors were

examined in terms of how they relate to US stock market and they concluded that returns on stocks are determined by market, the risk factors were also found to be strongly correlated to each other.

In his study, Goriave (2004) investigated how fundamental and macro economic factors (oil, currency) affected the stock return at the Russian stock exchange between 1999 and 2003, by use of multi factor model. The findings are that oil price as risk factor offers a better premium and the dollar factor is more important than the euro.

Tunali (2010), in his analysis on how various macroeconomics variables relate to stock returns in the Turkish market, he used APT for the period 2002 to 2008. He found that there was a long term relationship between macroeconomic factors and stock return at the Turkish stock market.

Izedonmi and Abdallah (2011) investigated the impact of inflation, market capitalization and exchange rate at the Nigerian stock exchange. They found that there was no significant effect of the three variables stated above on the stock returns in Nigeria.

Both CAPM and APT have been used by many scholars in their studies and have proved quite useful in estimating the absolute relationship between risk factors and stock returns. Pettengil, Sundaram & Mathur (1995), Campbell & Mackinlay (1997), Busher & Sardosky (2006) shows that the two models can be used to estimate conditional relationship between risk and return. Pettengil, Sundaram & Mathur (1995), found that when CAPM is estimated using realized returns instead of expected returns the relationship between (Beta) and the market returns heavily relies on the association between market returns and risk free rate. This result into a conditional association between beta and realized returns which is different from the approach that was used by Fama & Macbeth (1973). On the basis of association between realized returns and risk free rate, the market is split into up market and

down market. This therefore creates a conditional association between risk and realized returns.

The direction of the market can be determined with following formula:

Excess market return = Market return - Risk free rate ……(iii)

The securities market is up if the excess market return is positive and down if the excess market return is negative and the relationship between risk and return is positive and negative respectively. Therefore the relationship between expected return and risk will always be positive while the one for realized return and beta will either be positive or negative which will be determined by the sign of the market.

Pettengil et al (1995) used this method in his study on the risk-return trade-off in US stock market in 1936 to 1990. They separated the US stock market into up market and down market and used realized return in their estimation. They found that the relationship between risk and return is always a predicted positive although it depends on the market excess returns, when using the realized returns test they also found that there is a positive and negative relationship in an up market and down market respectively.

Isakov (1989) used Pettengil et al (1995) approach while investigating the impact of risk – return relationship in the Swiss stock exchange. His study found that the risk and return are significantly related and the relationship is determined by the sign of the market which could be up or down.

2.3 Empirical Studies

Studies have been conducted on the risk-return relationship characteristics in different stock markets world over in developing and developed markets by the following scholars,

Oludoyi, (2003) examined the risk characteristics of the firms quoted on Nigerian stock market. He concluded that the covariance of the firms' with market portfolio is positive

and that the returns on the firms' stocks tend to move in the same direction with return on the market portfolio. This implies that majority of firms in a portfolio with a positive beta have restricted scope for portfolio diversification.

Goriaev (2004), in his study on the risk factors in the Russian Stock Market, found that the difference in return between the companies susceptible to the country risk and those with stable profit in any macro-economic environment is about 59% premium. The corporate governance aspect also accounted for 25% risk premium, and the size and dollar factor accounted for premium of between 33% to 39% per annum in the Russian market.

Menggen (2007), in his study on the risk return tradeoff in Chinese market, sampled the daily, weekly and monthly market return observations, using GARCH – M model, his findings were that the risk- return relationship in Shanghai stock market was quiet different from Shenghen market. He found the risk-return relationship was positive and statistically significant for the daily returns in Shenghen Stock market, while in Shanghai market there was a negative and insignificant relationship.

Battilossi & Houpt (2006) studied risk, return and volume in Spain using Bilbao Stock Exchange as case study of an emerging Market.They found evidence of autocorrelation but there was no risk return relationship, they also found a fragile evidence of the effect of trading volumes on returns.

Mayanja & Legesi (2007), in his study on cost of equity capital and risk on the Ugandan stock market to establish the inexpensive source of finance between equity finance and bank finance. Their findings were that the assumption often made by stock brokers that all stocks have the similar risk is erroneous.

A study by Gitari (1990) found out that it was apparent that Kenyan Publicly quoted companies' exhibit systematic risk that is positively related to return. This relationship was not statistically significant thereby suggesting that investors may either be under or over-compensated for taking high risks. This suggested the need of low risk analysis on the part of investor, rather than being mere risk takers. The results also indicated a negative but statistically insignificant association between unsystematic risk and return. He also found that the nature of risk-return relationship was independent of the nature of the industry in which a company operates reinforcing the conclusion on the relationship between unsystematic risk and returns.

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

Musyoki (2011) examined the predictability of accounting earnings using changes in share prices of companies listed at Nairobi Securities Exchange in finance and investment centre. The study covered the period between the year 2001 and 2005. The data was obtained

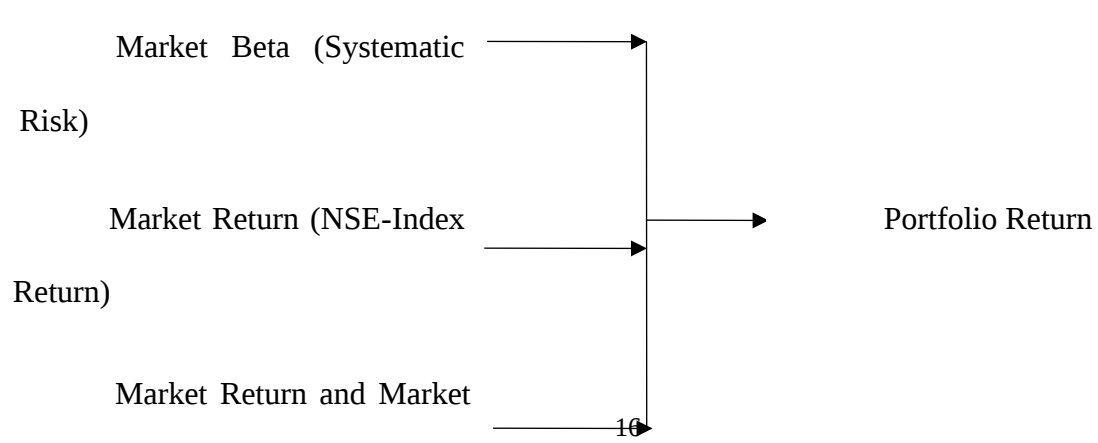
from the Nairobi Stock Exchange, where the information selected were earnings per share, dividend yield, price to earnings ratio and the share price. This information was standardized using logarithm and analyzed using SPSS program. The OLS was used to come up with an equation. Eleven companies were analyzed and all of them had a positive change towards the accounting earnings in relation to share price. Additionally the relationship between the accounting variables and the Nairobi Stock Exchange information indicated mixed results, with some companies showing a strong positive correlation and others weak correlation

Asiemwa (1992) did an empirical study to identify the relationship between investment ratios and share performance of companies quoted on the NSE. She did multiple regression analysis to establish the relationship between investment ratios and share price and concluded that earnings per share, dividend per share, price earnings and dividend yield have a significant effect on share prices. She concluded that a significant association between share prices and investment ratios exist.

2.4 Conceptual Framework.

FIGURE 1

Conceptual Framework



2.5 Operationalization of the variables

The data used was quarterly and time series methodology was employed. A portfolio is defined as companies making each sector, each sector is a portfolio, for instance the Finance and Investment sector is considered a portfolio made up of 15 firms The study therefore formed 4 portfolios which are Finance & Investment, Agriculture, Commercial services and industrial and allied, with each portfolio comprising of the different companies in that sector. The total number of observations was (5years x 4 Quarters x 4 Sectors = 80) 80 observations.

The variables will be calculated as follows:

Market Beta is obtained as: Market return = $\alpha + \beta$(Stock return) + error term……(iv)

and Where Beta of the regression is the Market Beta

Market Return (NSE Return) = (NSE t-1 - NSE t)/ NSEt-1……(v)

Portfolio Return = Weighted Average of the returns for the companies that form a portfolio which was computed as

Portfolio Return = $\Sigma(R_1W_1 + R_2W_2 + R_nW_n$ ……(vi)

Where R is the return of each stock in the portfolios and W refers to the weight in terms of value for the stock in the portfolio.

The interaction variable = market Beta X market return……...(vii)

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter explains the methodologies that were employed in the study. It provides summary of research design, target population and sample size of the study. It also provides the methods used in data collection and data analysis.

3.2 Research design

According to tromp (2008), a research design can be regarded as a composition of rules for data collection and analysis of the same in a way that combines relevance with the aim of the research. In this regard, the researcher will use a descriptive survey. Descriptive design is used in this study in explaining what, when, where or how of a phenomenon or characteristics associate with subject population and the association among the variables.

This approach has been adopted by De Lima Ribeiro et al (2006) to study the Brazilian Private Equity/Venture Capital experience.

3.3 Population and sample

The target population was composed of the forty seven firms within Main Investment Market Segment (MIMS), which form the four sectors of Nairobi Securities Exchange (NSE). A census was carried out and so the research covered 45 companies, listed in the MIMS of NSE for the period 1st January 2009 to 31st December 2013, two companies (Carbacid investments ltd, A. Bauman & Co. ltd) were suspended from the stock exchange during this period; since the target population was small the researcher did not undertake sampling on the population. The five year period was used in order to capture major factors in the economy that could affect share prices. With precision, the study focused on equity firms within MIMS, specifically agricultural sector, Finance & Investment sector, Commercial & Allied services sector, and industrial sector, which have been listed on NSE for five years (NSE, 2009-2013).

3.4 Data

The Secondary data was used in the study and it was obtained from the Nairobi Securities Exchange for the period January 2009 to December 2013. The data on the share prices, and the NSE-20 Index at the end of each quarter was gathered from the Nairobi Securities Exchange. In addition to data being obtained from NSE companies the 91-day Treasury bill rate was also obtained from the Central bank of Kenya's statistical reports.

3.5 Data analysis and the model

Data analysis involves data inspecting, data cleaning, data transformation, and data modeling with the aim of obtaining useful information; it also involves drawing conclusions, and finally decision making. There are multiple approaches through which data analysis can

be conducted; it includes diverse techniques under a variety of names in different areas of study Gay, (1992).

The study used the panel data analysis where pooled OLS model was used and diagnostic tests carried out. Since the tests failed to meet the assumptions of OLS, the fixed and random effects models were used, To determine which of the two models is appropriate Hausman test was conducted The panel data regression model used is

$$yit = xit'\,\beta + \alpha i + vit,\ i = 1,\ldots, N \text{ (individuals) } t = 1,\ldots,T \text{ (time)} \quad \text{(viii)}$$

The data was analyzed to obtain the following variables

Market Beta is obtained as

Market return = α + βStock return + error term……(ix)

Where Beta of the regression is the Market Beta

Market Return (NSE Return) = (NSE t-1 - NSE t)/ NSEt-1……(x)

Where $NSE_{t-1,}$ NSE_t are the Nairobi securities Exchange Share index at the beginning and the end of each quarter.

Portfolio Return= Weighted Average of the returns for the companies that form a portfolio.

The interaction variable = market Beta X market return

The regression model is

$$\text{Portfolio Return}_{i,t} = \alpha + b_1\text{Market Beta}_{i,t} + b_2\,\text{MarketReturn}_{i,t} + b_3\text{Interaction (Market Beta and Market Return)} + \text{error}_{i,t} \quad \text{(xi)}$$

3.6 Diagnostic Tests

The following tests were conducted to determine whether the assumptions of OLS were met.

3.6.1 Test for Multicollinearity:

The test for Multicollinearity was conducted to establish whether the independent variables are correlated. In this case the study used correlation matrix as well as the variance inflation factors to establish whether Multicollinearity existed.

3.6.2 Test for Normality:

The residuals of regression models should be normally distributed and the study therefore used the graphical method (Histogram) and the Skewness-Kurtosis test of normality in order to ascertain whether the condition is met.

3.6.3 Test for Heteroscedasticity:

The error terms/residuals from a regression model should have a constant variance (Homoskedastic) and thus to ascertain whether the residuals meet this criteria the study used the Breusch-Pagan test for Heteroskedasticity where the null hypothesis under this test is that residuals are Homoskedastic.

3.6.4 Test for Autocorrelation:

The residuals from regression should also auto-correlated and thus the study tested for autocorrelation using the Breusch-Pagan Lagrangian Multiplier (LM) test. In this case the null hypothesis of the test is that the residuals do not suffer from autocorrelation.

3.6.5 Hausman Test

In the event that the OLS assumptions are not met the study performed the Hausman test of panel data in order to establish the appropriateness of the fixed or random effects

model, where the null hypothesis of the Hausman test is that the appropriate model to be used is a random effects model.

CHAPTER FOUR

FINDINGS AND DISCUSSIONS

4.1 Introduction

This chapter presents the results from analysis and the findings with regard to the study objectives. In addition the following are presented in this chapter; descriptive statistics, trends, tests for normality, Multicollinearity, Heteroskedasticity, autocorrelation, Hausman test and finally the model results are presented.

4.2 Descriptive Results

Results in table 1 indicate the descriptive statistics of Portfolio Return, Market Return the Market Beta (risk) and the interaction of market return and market beta. As indicated in the table 4.1 below the Mean Portfolio Return for the period 2009 to 2013 was 3.91 with a standard deviation of 16.38 indicating wide variability in the Portfolio Returns over time. The Minimum and Maximum values of Portfolio Return over the same period of time were -28.39 and 88.42 respectively. The Mean Market Return for the portfolios considered was 2.58 with a standard deviation of 13.37 and this indicates high variations in Market Returns. The results

also indicate that the Minimum Market Return recorded being -31.22 and the Maximum Market Return being 25.42. The Mean Market Beta (Risk) over the period 2009 to 2013 was 1.022 and had a standard deviation of 0.69 and its maximum and minimum values were 1.8840 and -0.185 respectively. The results further indicate that the minimum Interaction (Market Return and Market Beta) recorded was -20.44895 and the Maximum Interaction (Market Return and Market Beta) being 47.891. The Mean Interaction (Market Return and Market Beta) over the period 2009 to 2013 was 6.148 and had a standard deviation of 13.434.

TABLE 1

Descriptive Statistics

	Portfolio Return	Market Return	Market Beta	Interaction
Mean	3.915126	2.582915	1.021800	6.1483199
Std. Deviation	16.3828166	13.3745429	.6933269	13.43442438
Minimum	-28.3908	-31.2163	-.1850	-20.44895
Maximum	88.4252	25.4197	1.8840	47.89074

4.3 Trend Analysis

This section presents the trend analysis of Portfolio Return, Market Return and Market Beta (Risk).

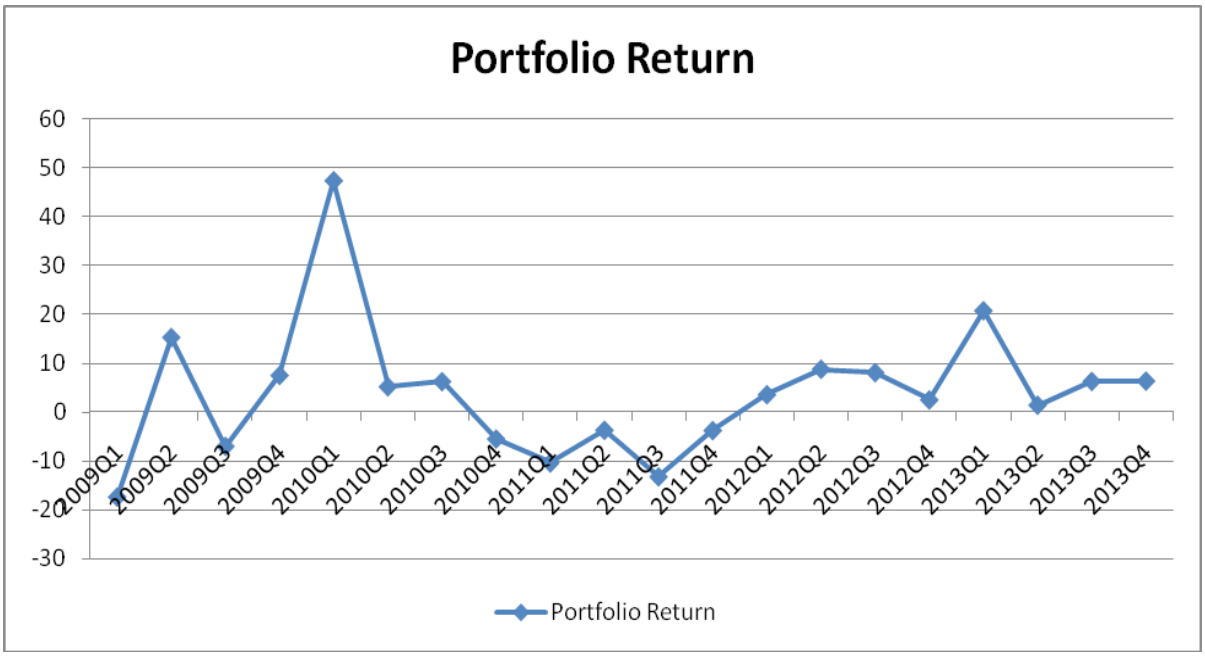
4.3.1 Annual Trends for Portfolio Return

Figure 2 indicates that Portfolio Return gradually increased from 2009 to 2010. In the subsequent year i.e. from 2010 to 2011 the Portfolio Return drastically dropped. This drastic decline in the portfolio returns was mainly attributable to the economic turbulences and downturns experienced in the economy and thus this negatively impacted on the performance of the stock market as well. With the recovery in the economy the portfolio returns increase in 2011 to 2012 and as well as from 2012 to 2013 but there was a slight decline in the

portfolio return compared to the previous period 2011 to 2013 and this was attributable to the political environment in the country.

FIGURE 2

Annual Trends of Portfolio Returns 2009 - 2013



4.3.2 Annual Trends for Market Return

Figure 3 indicates that Market Return gradually increased from 2009 to 2010. The results further indicated that in the subsequent year i.e. from 2010 to 2011, the Market Return significantly dropped. This drastic decline in the Market Return was mainly due to the low performance within the economy and thus this trickled down to the stock markets and thus negatively impacting on the market return. Following the recovery of the economy the Market return then rose in 2012 and a slight decline in 2013 and this decline was mainly attributable to the state of affairs in the country which had just concluded its elections and

thus at this time the investor confidences were negatively impacted for fear of the repeat of a state of political instability in the country.

FIGURE 3

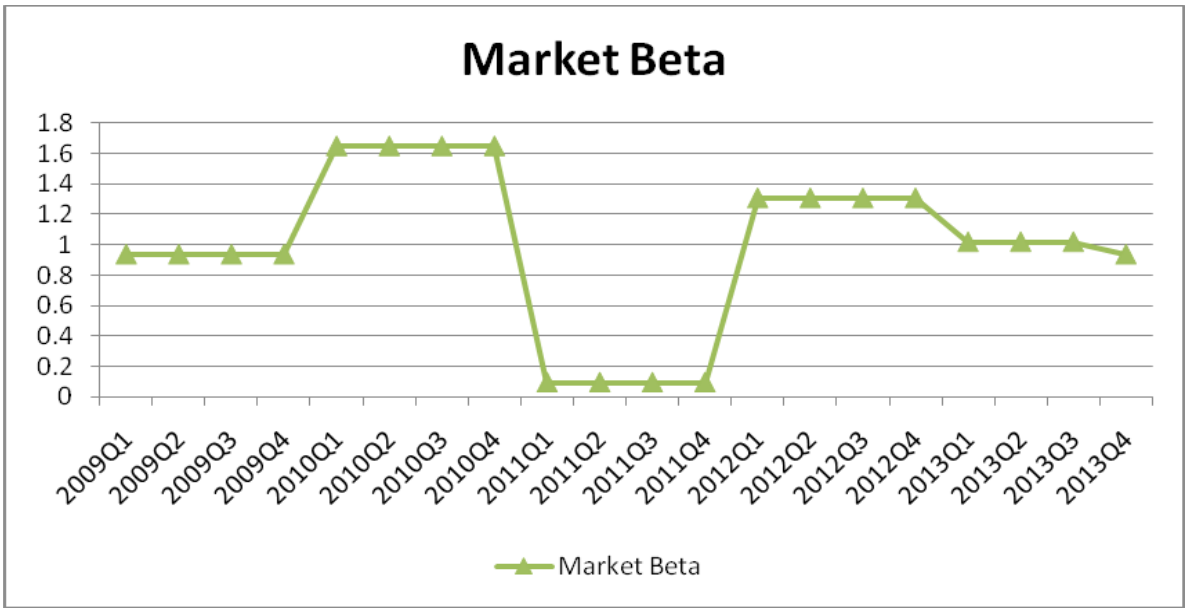
Annual Trends of Market Returns 2009 - 2013

4.3.3 Annual Trends for Market Beta (Risk)

Figure 4 indicates that Market Beta gradually increased from 2009 to 2010. The rapid increase in the Market Beta (Risk) is as a result of the increase in the Market Return as indicated in the figure 4. Theoretically, an increase in the returns is in most cases also associated with an increase in the Market Risk and thus this explains the observed pattern. The Market Beta the subsequent year i.e. from 2010 to 2011 drastically dropped as indicated in the figure 4 below is also as a result of the decline in the market returns. From 2011 to 2012 the market beta (Risk) rose and this is also as result of the rise in the market rise as indicated in the figure 3 above.

FIGURE 4

Annual Trends of Market Beta 2009 - 2013



4.4 Estimation Results

This section presents the pre-estimation and post estimation results, namely the correlation matrix, the test for normality, Heteroskedasticity and autocorrelation.

4.4.1 Correlation Matrix

The table 2 below presents the correlation matrix between the predictor and predicted variables. The table indicates that the correlation coefficient between Portfolio Return and Market Return is positive (r= 0.565) and significant (p-value<0.000) at 5%, and this therefore implies that an increase (or decrease) Market Return would be accompanied by an increase (or decrease) Portfolio Return. The results further shows that the correlation between Portfolio Return and Market Beta is positive (r= 0.417) and significant (p-value<0.000) at 5%. Similarly, this indicates that an increase (or decrease) in Market Beta would be accompanied by a decrease (or increase) in Portfolio Return. The correlation between Market Beta and Market Return was established to be positive (r = 0.383) and is significant at 5%,

this implies that an increase (or decrease) in Market Return to total deposits would be accompanied by a decrease (or increase) in Market Beta. The correlation between the Interaction (Market Return and Market Beta) and market Return was established to be positive (r = 0.664) and is significant at 5%, whereas the correlation between the Interaction (Market Return and Market Beta) and Market Beta was established to be positive (r = 0. .362) and is significant. The correlation coefficients as indicated in the table 4.2 below indicate that they are all below 0.8 and thus it is concluded that the variables don't suffer from Multicollinearity.

TABLE 2

Correlations Matrix

		Portfolio Return	Market Return	Market Beta	interaction
Portfolio Return	Pearson Correlation	1.000			
Market Return	Pearson Correlation	0.565**	1.000		
	Sig. (2-tailed)	0.000			
Market Beta	Pearson Correlation	0.417**	0.383**	1.000	
	Sig. (2-tailed)	0.000	0.000		
interaction	Pearson Correlation	.771**	.664**	.362**	1.000
	Sig.(2-tailed)	.000	.000	.001	

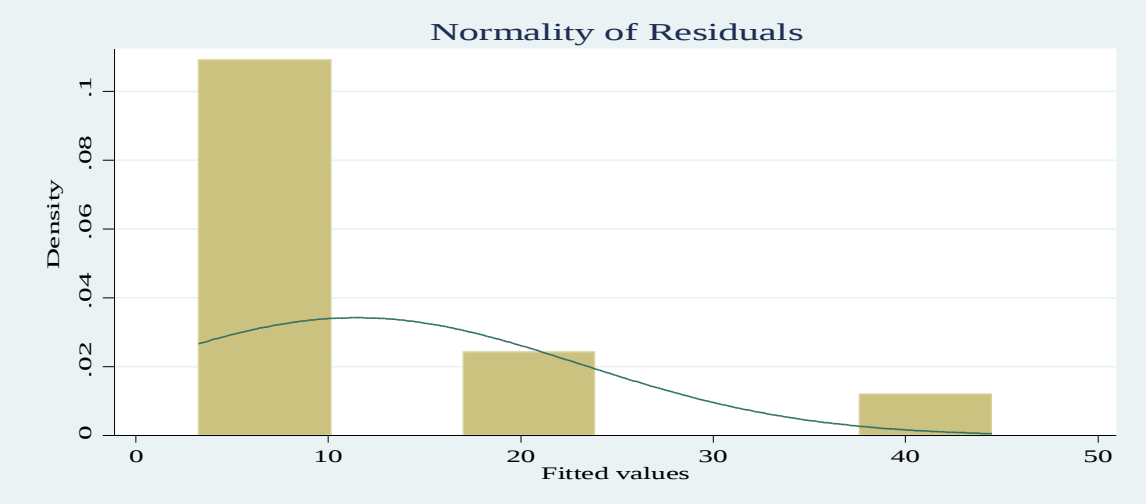
**. Correlation is significant at the 0.01 level (2-tailed).

4.4.2 Test for Normality

The test for normality was first examined using the graphical method approach as shown in figure 5. The results in the figure indicate that the residuals are not normally distributed.

FIGURE 5

Histogram of Residuals



The figure 6 below indicates the Skewness-Kurtosis test. The null hypothesis under this test is that the residuals are not significantly different from a normal distribution. Given that the p-values are less than 5% for the residual, the null hypothesis is rejected and thus the conclusion that the residuals are not normally distributed and thus the violation of the OLS assumption of normality of the residuals.

FIGURE 6

Skewness/Kurtosis Test for Normality

Skewness/Kurtosis tests for Normality

Variable	Obs	Pr(Skewness)	Pr(Kurtosis)	joint adj chi2(2)	joint Prob>chi2
portfolior~n	80	0.0000	0.0000	45.18	0.0000
marketreturn	80	0.0062	0.2579	7.81	0.0202
marketbeta	64	0.2973	0.0000	46.43	0.0000
residual	48	0.0000	0.0051	20.69	0.0000

4.4.3 Test for Heteroskedasticity

Ordinary least squares (OLS) assumption stipulates that the residuals should have a constant variance (i.e. they should be Homoskedastic). The Breusch-Pagan/Cook-Weisberg test was used in the study where the null hypothesis of the test is error terms have a constant

variance (i.e. should be Homoskedastic). The results in the figure 7 indicate that the error terms are heteroskedastic, given that the p-value is less than the 5% and this also indicates a violation of the OLS assumption of constant variance of residuals.

FIGURE 7

Breusch-Pagan/Cook-Weisberg Test for Heteroskedasticity

```
. estat hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of portfolioreturn

         chi2(1)      =   102.80
         Prob > chi2  =   0.0000
```

4.4.4 Test for Autocorrelation

The test for autocorrelation was performed to establish whether residuals are correlated across time. OLS assumptions require that residuals should not be correlated across time and thus the Breusch–Godfrey test which is also an LM test was adopted in this study. The results of figure 8 indicated that the null hypothesis of no autocorrelation is not rejected and that residuals are not auto correlated (p-value=0.5514).

FIGURE 8

Breusch–Godfrey LM Test for Autocorrelation

```
. estat bgodfrey

Number of gaps in sample:  11

Breusch-Godfrey LM test for autocorrelation
```

lags(*p*)	chi2	df	Prob > chi2
1	0.355	1	0.5514

H0: no serial correlation

Given that the normality and constant variance of the residuals on which the OLS regression hinges upon are violated the study adopted a panel regression in order to establish the effect of the Portfolio Return on the Market Return and on the Market Beta as well.

4.5 Panel Data Regressions

Given that the test for normality of the residuals and the test for Heteroskedasticity of the results indicate that the residuals are not normally distributed as well as that they are heteroskedastic the OLS assumption collapses with the exception of the test for autocorrelation which indicates that residuals are not auto correlated. This therefore leads to the treatment of the data as a panel. Panel data techniques are employed to capture time series dimension and/or ‘smooth out’ year-on-year variability in the data and thus fixed effects and random effects models are examined.

Panel data Models are described by the model;

$y_{it} = x_{it}'\beta + \alpha_i + v_{it},\ i = 1,\ldots, N$ (individuals) $t = 1,\ldots,T$ (time)……………………..(xii)

Where;

x_{it} is the it-th observation on k explanatory variables, β is the parameter vector, α_i denotes the unobserved individual-specific time-invariant effects, and the residual disturbance term v_{it} has zero mean, constant variance, and is uncorrelated across time and individuals

Depending on the nature of α_i , two models can be distinguished, first is the Random Effect Model which assumes that α_i are random variables uncorrelated with v_{it}. The second model is the Fixed Effects Model which assumes that the α_i are individual fixed parameters. The results of both the random and fixed effects model are presented in the table 4.6 and table 4.7 respectively.

4.7 Hausman Test

In order to determine whether the fixed or random effects model is appropriate Hausman test was used. The Hausman test fundamentally tested whether the unique errors (u_i) are correlated with the regressors. The results in table below illustrate the results of the

Hausman test. A resultant p value of 1.000 was larger than the conventional p value of 0.05 leading to the acceptance of the null hypothesis that the unique errors (*ui*) are not correlated with the regressors and thus the random effects model is more appropriate.

FIGURE 9

Hausman Test

```
. hausman fe re
```

	Coefficients (b) fe	(B) re	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
market_ret~n	.5822234	.5822234	-9.99e-16	.0185632
market_beta	5.55285	5.55285	5.33e-15	.3580919

```
                b = consistent under Ho and Ha; obtained from xtreg
 B = inconsistent under Ha, efficient under Ho; obtained from xtreg

    Test:  Ho:  difference in coefficients not systematic

                chi2(2) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                        =        0.00
              Prob>chi2 =      1.0000
```

4.8 Discussion of Panel Regression Results

In order to establish the effect of portfolio returns on the Market Return and Market Beta as well as the Joint effect (i.e. Interaction between Market Return and Market Beta) a random effects regression model was run and the results are as presented in the table 4.9 below.

The results presented in the table 4 below indicates that Market Return is positive (β=3.38) and significant (p-value<0.05). This implies an increase in the Market Return would lead to an increase in Portfolio Return. The results further indicate that Market Beta is positive (β=25.83) and significant (p-value<0.05). This implies an increase in the Market Beta would also be accompanied by an increase in Portfolio Return. Lastly, the results also indicate that the interaction variable (i.e. Interaction between Market Return and Market Beta) is negative (β= -14.91) and significantly (p-value<0.05) related to Portfolio Return. The

results further indicate that 52.21 percent of the variation in the portfolio return is explained by the variations in Market Return, Market Beta and the interaction between the Market Beta and Market Return. The estimated model is established to be significant in explaining the observed relationship given that that the probability of the reported F-statistic is less than 5%.

TABLE 4

Random Panel Regression Results

Random-effects GLS regression					Number of obs =	48
Group variable: Sector					Number of groups =	4
R-sq: within = 0.0000					Obs per group: min =	12
Between = 0.0000					avg =	12.0
Overall = 0.5221					max =	12
					Wald chi2(3) =	48.0
corr(u_i, X) = 0 (assumed)					Prob > chi2 =	0.000
portfolio return	Coef.	Std.	Err.	z	P>|z|	[95% Conf. Interval]
market return	3.382645	0.8708	3.88	0.000	1.67595	5.0893
Market Beta	25.82998	11.2450	2.30	0.022	3.79026	47.8697
zinteraction	-14.9095	7.0328	-2.12	0.034	-28.6935	-1.1254
Constant	-25.3461	9.8159	-2.58	0.010	-44.5848	-6.1074
sigma_u	0.169102					
sigma_e	11.50981					
rho	0.000216	(fraction of variance due to u_i)				

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

This chapter presents the summary of the findings as discussed in chapter four and then provides recommendations and finally suggests areas for further research.

5.1 Summary of Findings

The study findings that the portfolio return and market return are positive (r= 0.565) and significantly (p-value<0.000) correlated and thus an increase in market return would lead to an increase in the portfolio return as well. Further the regression results indicates a positive (β=3.38) and significant (p-value<0.05) relationship between Market return and Portfolio return. Specifically, this implies that a unit increase in market return would lead to a 3.38 unit increase in portfolio return. This finding is consistent with that of Oludoyi (2003) who examined the risk characteristics of the Nigerian quoted firms also found that a positive relationship exists between portfolio returns and market return. He further asserts that market returns tend to move in the same direction with return on the portfolio.

Secondly, the study findings indicate a positive (r= 0.417) and significant correlation (p-value<0.000) between portfolio return and market beta. This indicates that an increase in market beta (Risk) would also lead to an increase in portfolio returns. The regression results further indicates that the market beta and portfolio return are positive (β=25.83) and significant. This also indicates that the more risky a portfolio is the more the returns it receives. This finding is in contradiction with that of Battilossi & Houpt (2006) who examined risk, return and volume in an emerging stock market, using Bilbao Stock Exchange, and found an insignificant risk-return relationship. However it is consistent with the findings of Menggen who examined the dynamic risk-relationship and found a positive and statistically significant risk-return relationship for returns in Shenghen Stock Exchange.

The third objective of the study was to establish the joint effect of market return and market beta on portfolio returns. The study findings indicate a negative and significant relationship between the interaction between market beta and market return on the portfolio

returns. This implies that the increase in market return and market beta jointly would result to a decrease in the portfolio returns.

The findings also indicate that the model was significant in explaining the observed variations as indicated by an F-Statistic probability of less than 5%. The results further indicates that 52.21 percent of the variations in portfolio returns were jointly explained by the variations in the market beta, market return and by the interaction between the market beta and market return.

5.2 Conclusions

From the above findings this study concludes that the portfolio return is positive and significantly related to market returns. Secondly, it was possible to conclude that the market beta was positive and significantly related to portfolio returns and lastly, the interaction between the market beta and market return was negative and significantly related to portfolio returns for the firms quoted in MIMS of the NSE..

5.3 Recommendations

Given that there exists a positive and significant relationship between Market Beta and Portfolio returns it is recommended that if investors wish to have a higher portfolio return they should be risk lovers as an investor who is risk averse would probably get low returns for their investments. Secondly, the study recommends that investors who would want to maximize the returns from their portfolios should invest when the market return is favorable. This would ensure that they derive maximum returns from their investments.

5.4 Suggested Areas of Further Study

The study recommends that further studies on determining the optimal portfolio size be carried out as this would enable investors be better placed in making sound investment decisions. Further studies should be conducted for periods longer than the five years.

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APPENDICES

APPENDIX I

Introduction Letter

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KCAU/ SGS.13/wm

Thursday, July 10, 2014

Your Ref .....

To whom it may concern,

Dear Sir/Madam,

RE: RESEARCH PROJECT

This is to certify that **EMMANUEL SHIKUKU OTWEYO REG NO. 10/01393** has been permitted by the School of Business and Public Management to carry out research on the topic **"IMPACT OF RISK-RETURN TRADE-OFF ON STOCK INVESTMENT RETURNS FOR PUBLIC EQUITY COMPANIES QUOTED ON NAIROBI SECURITIES EXCHANGE".** The research is purely for academic purposes and for the partial fulfillment of the requirements for the Master of Science in Commerce degree program.

Kindly assist the student with information where possible.

Yours faithfully,

KCA UNIVERSITY SCHOOL OF BUSINESS
10 JUL 2014
P.O. BOX 56808-00200, NAIROBI

Dr. Mwangi Muchiri
Dean, School of Graduate Studies & Research

APPENDIX II

FIGURE 9

OLS Regression Results

Source	SS	df	MS		
Model	6369.84557	3	2123.28186	Number of obs =	48
Residual	5829.97513	44	132.499435	F(3, 44) =	16.02
				Prob > F =	0.0000
Total	12199.8207	47	259.570653	R-squared =	0.5221
				Adj R-squared =	0.4895
				Root MSE =	11.511

portfolior~n	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
marketreturn	3.382637	.8708557	3.88	0.000	1.627543	5.137732
marketbeta	25.82994	11.24597	2.30	0.026	3.165171	48.49471
interaction	-19.24806	9.080174	-2.12	0.040	-37.54795	-.9481751
_cons	16.61195	11.08104	1.50	0.141	-5.72041	38.94431

FIGURE 10

Random Effects Regression results

```
. xtreg portfolioreturn marketreturn MarketBeta Interaction, re

Random-effects GLS regression                   Number of obs      =        48
Group variable: Sector                          Number of groups   =         4

R-sq:  within  = 0.0000                         Obs per group: min =        12
       between = 0.0000                                        avg =      12.0
       overall = 0.5221                                        max =        12

                                                Wald chi2(3)       =     48.08
corr(u_i, X)   = 0 (assumed)                    Prob > chi2        =    0.0000
```

portfolior~n	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
marketreturn	3.382645	.8707784	3.88	0.000	1.67595	5.089339
MarketBeta	25.82998	11.24496	2.30	0.022	3.79026	47.8697
Interaction	-19.24815	9.079369	-2.12	0.034	-37.04339	-1.452912
_cons	16.61206	11.08038	1.50	0.134	-5.105084	38.32921
sigma_u	.16910206					
sigma_e	11.509812					
rho	.00021581	(fraction of variance due to u_i)				

FIGURE 11

Fixed Effects Regression Results

```
. xtreg portfolioreturn marketreturn MarketBeta Interaction, fe

Fixed-effects (within) regression               Number of obs      =        48
Group variable: Sector                          Number of groups   =         4

R-sq:  within  = 0.5398                         Obs per group: min =        12
       between = 0.7685                                        avg =      12.0
       overall = 0.5221                                        max =        12

                                                F(3,41)            =     16.03
corr(u_i, Xb)  = 0.0000                         Prob > F           =    0.0000

------------------------------------------------------------------------------
portfolior~n |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
marketreturn |   3.382645   .8707784     3.88   0.000     1.624072    5.141217
  MarketBeta |   25.82998   11.24496     2.30   0.027     3.120319    48.53964
 Interaction |  -19.24815   9.079369    -2.12   0.040    -37.58431   -.9119909
       _cons |   16.61206   11.08006     1.50   0.141    -5.764569    38.98869
-------------+----------------------------------------------------------------
     sigma_u |   3.326897
     sigma_e |  11.509812
         rho |  .07710696   (fraction of variance due to u_i)
------------------------------------------------------------------------------
```