A TEST OF ASSET-PRICING MODELS IN THE NAIROBI SECURITIES EXCHANGE

JOHNSON MUNENE WAMBUGU

B211-0012/2011

"A Thesis Submitted to the School of Business Management and Economics in Partial Fulfillment of the Award of the Degree of Master of Business Administration of Dedan Kimathi University of Technology"

APRIL, 2015

DECLARATION

This thesis is my original work and has not been presented to any college or University for examination purposes.

Signature _____ Date 07.05.2015

Johnson Munene Wambugu

B211-0012/2013

This thesis has been submitted for examination with my approval as University Supervisor.

Signed..... Date.....7/5/2015.....

Supervisor: Dr. Riro Kamau

DEDICATION

I dedicate my work to my Mom and two brothers for their encouragement and support throughout the process of carrying out this study. I also dedicate this study to the finance academia in Dedan Kimathi University of Technology, especially the supervisors, MBA lecturers and my fellow colleagues undergoing through the MBA program. I hope that this study will boost their knowledge in finance and assist them in their efforts as they endeavor to undertake similar studies.

ACKNOWLEDGEMENT

I would like to thank my supervisor, Dr. Riro Kamau, for his guidance and advice, which were an invaluable input to the successful completion of this study. I would also like to thank our MBA program lecturers for imparting us with the knowledge that has significantly helped us comprehend the intricacies of the financial world. I would also like to acknowledge the people who commented on this study and helped shape it for the better.

TABLE OF CONTENTS

ABSTRACT

The CAPM has for a long time been used to explain the expected return on stocks. However, the discoveries of market anomalies such as the Size, Book-to-Market and the Momentum effects, have greatly undermined the CAPM's ability to explain the expected returns on stocks. These anomalies prompted Fama and French (1993) and Carhart (1997) to propound asset pricing models that captured the effects of these anomalies in them. This study sought to test whether the CAPM, Fama and French (1993) Three-factor model and the Carhart's (1997) Four-factor model can explain the returns of stocks traded in the NSE, from a portfolio perspective. The stock returns used in this study were those of the forty eight companies that trade under the MIMS in the NSE, during the period January 2009 to December 2013. Six portfolios that were sorted for size and Book-to-Market were created and used to test the CAPM as well as the Fama and French (1993) Three-factor model. Also, an additional six portfolios that were sorted for size and past performance were constructed to test the Carhart's (1997) Four-factor model. The data was then analyzed using time series regression analysis and the estimated parameters were tested for significance. This study finds that even though the CAPM has been highly regarded for many years since it was put forward, when tested in the NSE from a portfolios perspective, the evidence in support of it is weak. This study finds that other significant factors existed that were not captured by CAPM, implying therefore that beta is not an adequate measure of risk. Also, as for the Fama and French (1993) Three-factor model, this study finds that it doesn't quite capture all the factors influencing the returns of stocks traded in the NSE. However, this study finds that the Carhart's (1997) Four-factor model performs better relative to the CAPM and the Fama and French (1993) Three-factor model, as it was observed to have a better explanatory power of the variation of expected returns of most of the sets of portfolios that it was tested on. The findings of this study will be of great significance to the finance academia and other interested parties as it will assist in boosting their understanding of an asset-pricing model that can explain better, the variations in returns of stocks traded in the NSE.

LIST OF ABBREVIATION AND ACRONYMS

AIMS	Alternative Investment Market Segment
CAPM	Capital Asset Pricing Model
CMA	Capital Market authority
MIMS	Main investment Market Segment
NSE	Nairobi Securities Exchange
SML	Security Market Line

LIST OF TABLES

LIST OF FIGURES

CHAPTER ONE
INTRODUCTION

1.1 Background of the study

A perfectly legitimate question that one can ask is; "why does a return on a stock differ from that of another?" This has been an area of focus in the field of finance since its inception. Any person with a background in finance, when presented with this question, has one thought that instantaneously goes through his or her mind - CAPM.

CAPM which was propounded by Sharpe (1964), Lintner (1965) and Black (1972) has always been considered to be the magnum opus, almost a magical formula for asset pricing. It attempts to explain why, the cross-sectional expected stock returns, differ, using only a single factor- beta, which is the covariance between the market return and the individual stock return (Rustam & Nicklas, 2010). Decades later CAPM is still the centre piece of most finance courses and indeed, it is often the only asset pricing model that is taught in these courses. It is also widely used in applications such as evaluating the performance of an asset or portfolio and the estimation of the cost of capital for a firm. CAPM is an equilibrium model and provided it is correct and that the market is efficient, any stock behavior that cannot be explained by CAPM is considered to be a market anomaly (Rustam & Nicklas, 2010).

The fascinating thing about CAPM is that it offers an intuitively pleasing and powerful prediction about how to measure risk and it describes the relationships between expected return and risk as measured by beta (Fama & French, 2004).Unfortunately, the empirical studies that have been conducted to test CAPM, conclude that the model is poor enough to invalidate the way it is used in application (Fama & French, 2004).

Throughout the history of stock markets, there have been many markets anomalies that have been spotted and rigorously researched on by the world's academia. Since the advent of CAPM, many studies on the variations of cross-sectional expected returns of portfolios have been conducted, using different methods, to test its empirical validity. The vast majority of these studies have been conducted on the United States Stock Markets. After testing CAPM,

Fama and French (1992), have in their findings, proof that beta alone cannot explain the differences between the cross- sectional expected stock returns in the United States Stock Markets as well as other international stock markets. Fama and French (1993) propose an addition of two more variables to the CAPM, to form a three-factor model. When tested, they find that it offered a better explanation of the cross-sectional variations of expected stock returns relative to the CAPM. The three factors include; the market factor, the ratio of book equity to market equity factor and the market capitalization or size factor. The resulting asset pricing model came to be known as the Fama and French (1993) three-factor model.

The findings of Fama and French (1993), to begin with, are very controversial because they claim that simple variables such as size (market capitalization) of the firm and the book to market equity can strongly explain the variations in the expected returns of stocks better than beta. The controversy arises in an attempt to explain why the two variables predict stock expected returns. Fama and French (1995) argue that the two factors function as a proxy to risk exposure. Kothari, Shanken and Sloan (1995) argue that book to market equity and size are able to explain the variation in cross sectional returns of stocks because of survivorship bias. After the Fama and French (1993) three-factor model was propounded, other studies started coming up, that either confirmed or refuted their findings.

Although the Fama and French (1993) three-factor model has been widely acknowledged by many researchers, it has been subject to criticism such as its inability to explain the momentum factor which is the continuation of short run past returns in the future (Nartea, Ward & Djajadikerta, 2009). Consequently it has been subject to further improvements.

Carhart (1997) finds that the addition of a new variable, momentum effect, into the Fama and French (1993) three-factor model significantly boosted its explanatory power. The resulting model came to be known as the Cahart's (1997) four-factor model. Momentum effect, just like the size factor and the Book-to-market equity factor, is a market anomaly. Jegadeesh (1990) and Jegadeesh and Titman (1993) find that there is evidence on the existence of the momentum effect on the variation of the cross sectional expected returns of stocks. They conclude that in the short run, stocks considered to be past winner out perform those that are

considered to be past losers and so, going long on past winners and going short on past losers leads to significant abnormal returns being earned. The Cahart (1997) four-factor model was found to better explain, the cross-sectional variations of expected return of stocks.

This research intended to test whether these asset-pricing models, can explain the expected returns on stocks traded in the Kenyan Stock Market.

1.2 Statement of the Problem

A few studies have been conducted to test the CAPM in the NSE but the Fama and French three-factor model and the Carhart's four-factor model are yet to be tested on the NSE, from a portfolio perspective. However, he tested CAPM empirically from an individual stock perspective unlike the Fama and French who tested CAPM from a portfolio perspective.Also, since Carhart's four-factor model, which also includes the momentum effect, was developed and tested on the United States Stock Markets, it is important that its robustness be tested using data from other stock markets such as the NSE. It is worthy to note that Carhart's approach was similar to that of Fama and French as he analyzed the stocks from a portfolio perspective. Even though some models can explain the expected return of an asset with risk to some degree, there is no model that can explain the expected return in a complete manner. My choice of working with these three asset-pricing models was aimed at getting different test result based on my own empirical study. To my knowledge no research has been conducted to test whether the CAPM, Fama and French three-factor model and the Carhart'sfour-factor model, can explain the expected returns on Kenyan equity stocks, from a portfolio perspective. This gap in research necessitated this study.

1.3 General Objectives

To test whether asset-pricing models explain the expected return on portfolios of equity stocks traded in the Kenyan Stock Markets.

1.4 Specific Objectives

i. To test whether CAPM explains the expected returns of stock portfolios in the NSE.

ii. To test whether the Fama and French (1993) three-factor model explains the expected returns of stock portfolios in the NSE.

iii. To test whether the Carhart's (l997) four-factor model explains the expected returns of stock portfolios in the NSE.

1.5 Research Questions

i. Does the CAPM explain the expected returns of stock portfolios in the NSE?

ii. Does the Fama and French (1993) three-factor model explain the expected returns of stock portfolios in the NSE?

iii. Does the Carhart's (1997) four-factor model explain expected returns of stock portfolios in the NSE?

1.6 Significance of the Study

Academicians in the field of finance will benefit from the findings of this study, concerning the explanatory power of each of the three models. This will greatly boost their efforts, in the never ending quest for an asset pricing model that can explain the expected returns on stock, completely.

The findings of this study will also be of great importance to financial advisors and potential investors in the NSE because it will enable them to determine whether a particular asset is either correctly priced or mispriced. This will enable them to build portfolios that will maximize their returns, as they try to take advantage of market imbalances where the expected return on stocks is not equal to the required return on the stocks.

Capital market regulators will also benefit from this study as they will be able to investigate on and identify possible factors that might cause market imbalances. This will help them to boost the market efficiency.

1.7 Delimitations

This study intended to test the CAPM, Fama and French (1993) three-factor model and the Cahart,s (1997) four factor model holistically from a portfolio perspective. To achieve this, financial data for most equity stocks listed in the NSE were taken into consideration for the time period beginning January 2009 to December 2013. This practice of analyzing equity stocks and testing of asset-pricing models from a portfolio perspective is widely accepted and has been replicated in many previous empirical studies and so, it is hoped that the validity of this study will be greatly enhanced.

1.8 Limitation of the Study

This study only tested three asset pricing models namely; the CAPM, Fama and French (1993) three-factor model and the Cahart's (1997) four-factor model. There are other asset-pricing models that have been put forward by various researchers in the field of finance that also strive to explain the expected return of the stocks but there is no general consensus, as to which among them, is the most superior.

Despite the fact that not all asset pricing models will be tested, the findings of this study will greatly boost the struggle for the search of a robust asset-pricing model that can explain the expected returns of stocks listed on the NSE.

1.9 Definition of key terms

Beta- it's a measure of systematic risk which is the risk that cannot be eliminated through diversification (Fama & French ,1993).

Cross-sectional variation of stock returns- it is an observation of varying returns across different stocks at a given point in time (Rustam & Nicklas , 2010).

Factor sensitivity- it's a measure of the responsiveness of the expected return of a security to a change in a factor (Fama & French, 1993).

Growth stocks or glamour stocks – they are firms considered to have a low book-to-market equity ratio (Rustam & Nicklas , 2010)

Large cap stocks- they are firms considered to have a large market capitalization as per a predetermined criterion (Keim, 1983).

Small cap stocks – they are firms that are considered to have a small market capitalization as per a predetermined criterion (Keim, 1983).

Value stocks- they are firms that are considered to have a high book-to-market equity ratio (Rustam & Nicklas , 2010).

CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction

This chapter presents the theories on efficient market hypothesis, modern portfolio theory, market anomalies, the empirical studies that have been conducted in the area of expected returns on stocks and the asset pricing models that try to explain them. The variables that try to explain the expected returns on stocks, as has been suggested by the CAPM, Fama and French (1993) three-factor model and the Cahart's (1997) four-factor model were brought out in the form of a conceptual framework.

2.2 Efficient Market Hypothesis

The efficient market hypothesis states that the market stock prices reflect all available information. However, the hypothesis can be divided into three subgroups upon which the market efficiency can be tested (Fama, 1970). These three subgroups are: efficiency in the weak-form, efficiency in the semi-strong- form and efficiency in the strong-form. Within these three sub groups, the understanding of available information is interpreted differently (Fama, 1970).

Efficiency in the weak-form refers to available information as the stocks' historical returns and prices. It implies that the stocks' market price captures all information that can be generated when examining historical stock prices and returns. This was confirmed by Fama, (1970) where he stated that the market prices are a reflection of historical stock prices and returns.

Efficiency in the semi-strong-form proposes that information that has been made public and can be easily accessed is reflected in the stocks' market prices. Public information includes not only historical data on stock prices and returns but also events pertaining to current earnings, splits, stock issues announcements etcetera (Fama, 1970). According to Fama, Fisher, Jensen and Roll (1969), stock prices do react quickly to new information and that no investor can earn excess return above the expected unless that investor trades on insider information.

Efficiency in the strong–form looks at the issue of market efficiency from a point of view of insider information and whether investors and insiders who have access to this information can earn excess returns relative to outsiders (Fama, 1970). This form of efficiency is rejected by Fama (1970). He concludes that insiders can earn abnormal returns on information that is not available to the public.

A test of the market efficiency, of the Kenyan stock market, by Dickinson and Muragu (1994) revealed that it was efficient in the weak form and no recent study on the same has come to the knowledge of the researcher. However, it is important to note that the study period in this thesis is very much different from that period when that market efficiency test was conducted and that the market efficiency could have changed since then due to the myriad of changes that have been implemented by the Kenyan CMA including stricter regulations.

2.3 Modern Portfolio Theory

The modern portfolio theory was first introduced by Markowitz (1952) in his research article about portfolio selection. Since then, his work has been fundamental for all other kinds of investment decisions topics as it pertains to the importance of diversification in order to minimize the risk and maximize on the portfolio return. This is referred to as the mean-variance analysis. Markowitz (1952) presents an investment rule that is considered to be reasonable as investors want to maximize their wealth and generate a high utility as possible. The rule states that an investor should diversify his portfolio among those securities that are expected to generate the highest return.

According to Markowitz (1952), the number of securities in a portfolio plays a crucial role because the more the securities included in a portfolio, the closer will the expected return be to the actual return. Moreover, when you add a risky asset with a low correlation into a portfolio, the overall portfolio risk reduces. This statement however is somehow limiting considering that, even by adding risky assets into a portfolio, the overall portfolio risk reduces but it cannot be eliminated entirely. Due to the fact that not the entire portfolio risk can be diversified away no matter how many securities are added into the portfolio, makes it

possible to divide the risk into two groups namely: systematic risk and un-systematic risk (Rustam & Nicklas, 2010).

Un-systematic risk is that risk that can be eliminated through diversification. It is also referred to as firms-unique risk or firm-specific risk involves risk factors connected to a specific firm or company (Rustam & Nicklas , 2010). Examples of such risks include lost contracts that influence a firm's revenues, fire at a firm's warehouse etcetera. Systematic risk on the other hand is that risk that cannot be eliminated through diversification. It is influenced by overall market conditions such as changes in the macro-economic factors (Sharpe, 1964). Since systematic risk is connected to the overall risk in the economy, it is also referred to as market risk.

2.3.1 Portfolio Selection of Risky Assets

According to Markowitz (1952) portfolio formation is based on the notion of mean-variance analysis. This means that an investor intending to form a portfolio of assets has to decide on a preferable portfolio expected return or variance. This is because the portfolio with the lowest risk is probably not the one with the highest return. There is a tradeoff between the risk and the expected return as it is possible to increase the expected return of a portfolio by allowing for more risk or decrease the risk by reducing the expected return (Rustam & Nicklas, 2010).

Markowitz's (1952) mean-variance analysis assumes that the investor is risk averse, they know their expected returns, variances, covariances and that there are no taxes or transaction costs. Mean-variance analysis is used by investors to identify efficient or optimal portfolios. The concept of risk aversion stipulates that given two assets with the same return, an investor will select the one with the lower risk implying that being risk averse is not about minimizing risk but trading off risk.

Markowitz (1952) was able to clearly illustrate how risk-return combinations assist in the creation of efficient portfolios and how an efficient frontier was derived. The efficient frontier shows how a portfolio is dominated by another based on the risk return

combinations. Portfolios that lie on upper part off the efficient frontier are regarded to be efficient portfolios (Markowitz, 1952).

2.4 Stock Market Anomalies

A market anomaly is an empirical fact that is not supported by the prevailing theory (Berk, 1995). According to Schwert (2002), a market anomaly is an empirical finding that cannot be explained by the available and maintained theories within the asset-pricing area of study. Moreover, market anomalies either unearth inefficiencies in the market or misspecifications in an asset pricing model that explains the expected return of an asset. If a market anomaly is uncovered that indicates an inefficient market, will also put a strain on the reliability of an asset pricing model that assumes that the market is efficient. However, for a market anomaly to indicate an inefficient market it must be possible for an investor to profitably trade on it, otherwise it is not economically significant and would therefore not imply market inefficiency (Rustam & Nicklas, 2010).

It is possible for an anomaly to disappear after it has been discovered because traders take advantage of it to earn arbitrage gains thereby adjusting prices to the level where the anomaly ceases to exist (Rustam & Nicklas, 2010). However, investors cannot know about the existence of a market anomaly because most anomalies tend to be specific to the research uncovering it, which might be an indicator of data snooping (Lakonishok, Shleifer & Vishny, 1994). For this problem to be avoided, new data must be the base for market anomaly testing. An anomaly may cease to exist when it has been tested on new data, either because the investors have taken advantage of it by making abnormal gains or because there is no longer a case of data snooping (Marquering, Nisser & Valla, 2006). This study intends to analyze the size effect, book-to-market and the momentum effect market anomalies.

2.4.1 Size Effect

According to Banz (1981), firm size as measured by market capitalization, is an explanatory variable to abnormal return that is not captured by asset pricing models, suggestively the CAPM. Moreover, this firm size effect which is also, commonly referred to as, the small firm effect, is not stable over time and the degree of abnormal returns that is yielded by the small

firms is subject to variations (Banz, 1981).Berk (1995) also finds that the market capitalization of a firm has got a significant explanatory power on the expected returns and since it is not captured by the CAPM, it can be included as an explanatory variable in an asset pricing model to capture the return not originally explained. Fama and French (1992) also find the size anomaly to be significant and they state that it acts as a proxy for risk and should be included in an asset pricing model, indicating that small firms are considered to be more risky than large firms. According to Rogalski and Titic (1986) and Keim (1983), the small firm effect market anomaly appears to be more evident in the month of January as these small firms have a relatively higher return in this month as compared to the other months. Kiem (1983) finds that almost half of the abnormal returns occur in the first week of January

Banz (1981) speculates that the lack of available information about small firms leads to them having fewer investors relative to other large firms with a wider range of information that enables investors to make informed decisions. This results to these small firms having a small investor base and this again leads to higher returns to those few investors. Including the January factor that is also associated with the small firm effect, additional theories for its existence have been proposed. According to Schwert (2002), the January factor arises as a result of high volatility that is common with small stocks. Due to this high volatility, the possibility of investors making an investment loss, at the end of the year are high, encouraging them to sell at this time of the year so as to realize the losses in their income tax. This consequently reduces their tax liability on capital gains. The prices of small firms will therefore reduce at the end of the year, to then rise again at the beginning of the year as investors repurchase them to ensure diversification and balance in their portfolio. Therefore, this trading due to tax reasons increases the expected returns of these small firm stocks since their price will increase during the month of January (Schwert, 2002).

However, a number of critical opinions that argue against small firm effect being a market anomaly have also arisen. Stoll and Whaley (1983) state that there is no small firm effect if transaction costs are accounted for. In fact the found that large firms outperform the small firms when transaction costs have been factored in. therefore, according to Stoll and Whaley

(1983), the firms size effect indeed exists only that it is a reversed effect where the large firms outdo the small firms in terms of positive excess returns .

To my knowledge, there isn't any strong and scientifically valid research about the small firm effect, market anomaly, in the Kenyan stock market which thereby leaves this area as highly suitable for further research.

2.4.2 Book-to-Market

Fama and French (1992) finds that there is a strong relationship between the book-to-market equity ratio and the stock performance. Firms with high book-to-market equity ratio tend to outperform those with low book-to-market equity ratio in terms of returns. This implies that the book-to-market equity ratio is a market anomaly; however, there is no consistency between researchers as to why it exists. Researchers have suggested that it exists because of risk compensation; implying that firms with high book-to-market equity are more risky and hence they should compensate the investor with a higher return. Companies that have a high book-to-market equity ratio tend to have poor historical performance and hence they are considered to be riskier (Fama, 1998).

Other researchers have argued that book-to-market equity, market anomaly, exists because of the expectation errors that investors make relating to overvaluation and undervaluation of stocks. Arguments by these researchers have been presented in the form of growth stocks and value stocks. A growth stock, also known as a glamour stock, is a stock with a low book-to-market equity ratio while a value stock is a stock with a high book-to-market equity. According to Lakonishok, Shleifer and Vishny (1994), value stocks have a higher return than growth stocks because of the investor behavior as shaped by their expectations and not because of the underlying risk. Investors are said to overrate information and thereby preferring to invest in stocks from companies with good historical performance, which causes their prices to increase making them growth stocks. However these investors whose strategy is to invest in value stocks are shown to outdo the growth stock investors because those investing in the growth stocks hold them for too long until their price eventually declines.

Lakonishok et.al. (1994) who oppose the Fama and French (1992) findings, argue that value stocks do not carry any more risk than growth stocks implying that the book-to-market equity market anomaly cannot be explained by the risk-reward concept.

According to my knowledge, the book-to-market equity, market anomaly, is sparsely researched on with regard to the NSE and a suggestion for further research is highly recommended.

2.4.3 Momentum Effect

According to Jegadeesh (1990), the momentum effect is where stocks considered as being past winners, with a high return the previous month, continued to generate abnormal returns the following month whereas the stocks considered past losers in a given month continue to perform poorly the following month. Jegadeesh and Titman (1993) investigated further the momentum effect over a longer time horizon of three to twelve months and they find that again the past winners outperformed the past losers in terms of returns thereby strengthening their theory of the existence of the momentum effect anomaly in the financial markets. Rouwenhorst (1998) and Chan, Jegadeesh and Lakonishok (1996) also find that the momentum effect last for about a year and it is not at all related to the size of the firms.

Many researchers have tried to justify the existence of the momentum effect by turning to market under reaction to new information and behavioral finance instead of risk-reward relationships. According to Jegadeesh and Titman (1993), the momentum effect market anomaly is not due to risk factors but to the under reactions by the market to earnings announcements thereby causing a gradual price adjustment. Further, Chan et al. (1996) test whether the market under reaction to earnings announcement is behind the momentum effect and their reason for doing this was because stocks that had better earnings announcement outperformed those that had an insufficient earnings announcement relative to what was expected of them. This differential in return was consistent for six months indicating a market under reaction because the released information was not immediately absorbed by the market but it was instead gradually incorporated into the prices (Chan et al., 1996).

Hong and Stein (2005) explain the momentum effect from a different angle as the focus on the different kinds of investment traders namely; those that are referred to as “news watchers” because of their investment decisions which are based on fundamental analysis and those that are referred to as “momentum traders” because of their investment decisions which are based on technical analysis. The fundamental information that the “news watchers” base their forecast on is spread over gradually resulting in an under reaction of the market as the prices slowly try to adjust to their intrinsic value. On the other hand the momentum traders only base their decisions on historical prices which thereby imply that they do not know the intrinsic value of the stocks are and consequently they do not know what the right price is. This will result in the stocks becoming overpriced and the momentum anomaly fact being confirmed.

2.5 The CAPM

CAPM was developed by Sharpe (1964), Lintner (1965) and Black (1972) from the Markowitz’s (1952) mean-variance analysis. The fundamental principle about Markowitz mean-variance analysis is to assist in the selection of efficient portfolios; portfolios that maximize on returns and minimize risk. The CAPM expresses a positive relationship between an asset’s returns and its systematic risk as measured by beta. The resulting regression line that describes this relationship is known as the SML.

The CAPM was developed on the basis of some assumptions namely; investors borrow and lend at the risk free rate, investors are risk averse and try to maximize their wealth, investors choose their portfolios based on the risk and expected return over a single period, there are no taxes and transaction costs and finally, investors have homogenous views and expectations regarding an asset’s variables such as standard deviation, expected return and correlation (Sharpe, 1964).

The formula for the CAPM as presented by Sharpe (1964) and Lintner (1965) is as follows:

$$\mathbf{E(RP_{it})} = RF_t + \beta_{it}(RM_t - RF_t) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where:

$E(RP_{it})$- expected return on portfolio i during period t.

RM_t – market return

RF_t – excess markets return or market premium.

β_{it}, – Beta value for portfolio i

$RM_t - RF_t$ -- market premium or excess market return

t – time period

The portfolio's beta is computed as follows:

$$\beta_{it} = \frac{Cov(r_i\ r_m)}{б^2_m} \quad \text{……………………………………………………(2)}$$

Where:

$Cov(r_i\ r_m)$ – Covariance between returns of portfolio i and the market return.

$б^2_m$ – Variance of the market.

The fact that beta only reflects the systematic risk is because investors are assumed diversified portfolios thereby eliminating the non-systematic risk (Sharpe, 1964). The expected return of an asset is the summation of the risks free rate and the risk premium. The SML, which is basically the CAPM, indicates the expected return of a security given its beta value. However, if a security's expected return plots above or below the SML, it is said to be either undervalued or overvalued respectively, which indicates a mispricing of that security.

Despite the fact that the CAPM is popular and widely used, it's a theory that has come under a lot of criticism. According to Berk (1995), CAPM does not hold in reality because of the flaws of the model itself of or how the model is applied while being tested empirically. Fama and French (1992), also state that CAPM's unrealistic assumptions such as lending and borrowing at the risk free rate, makes it subject to criticism. Fama and French (1992) also argue that the beta measure used in the CAPM does not sufficiently capture the expected return of an asset because market anomalies such as the firm size effect or the book-to-market equity effect are not accounted for in it. Consequently, if an asset's beta does not explain its expected return, then it would imply that the market is not efficient in the way that CAPM suggests and therefore, it would not hold as an asset pricing model (Fama & French, 2004).

2.6 Fama and French (1993) Three-factor Model

CAPM is infamously known to be unable to explain the book-to-market equity effect and size effect on stock returns together with other market anomalies. In fact, this is the reason as to why they are called market anomalies because CAPM cannot explain them (Rustam & Nicklas, 2010). Fama and French (1992) finds that beta alone cannot explain the cross sectional variations of stocks' expected returns.

Taking into consideration the size effect anomaly, book-to-market anomaly and the earnings-price ratio anomaly, Fama and French (1992), test whether the expected return on stocks can be explained given those factors are included in an asset-pricing model. They find that the book-to-market equity and the size effect anomalies explain the differences in stock returns. However, they found that the book-to-market equity and the earnings-price ratio are related and so including the earnings-price ratio in the asset pricing model would only make it redundant. In the same study, Fama and French (1992) finds that there was no significant relation between the expected returns on the United States stocks and their betas.

Propelled by their findings in 1992, Fama and French (1993) form a three-factor asset-pricing model that includes the market premium, size effect and the book-to-market equity anomaly. Their reason for adding the market premium into the model was due to the fact that stock returns were on average above the one-month Treasury bill rate.

The Fama and French (1993) three-factor model is shown below:

$$\mathbf{E(RP_{it})} = RF_t + \beta_i(RM_t - RF_t) + \beta_s(SMB) + \beta_h(HML) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(3)$$

Where:

$E(RP_{it})$- expected return on portfolio i during period t.

β_i, β_s & $\beta_{h,,}$ - Risk factor sensitivities for the market premium, size effect and the high book-to-market equity ratio.

RF_t - risk free rate.

$RM_t - RF_t$ – excess markets return or market premium.

SMB- (Small minus Big). It's the short term difference between the average returns on portfolios that have a small market capitalization and the average returns on portfolios that have a big market capitalization.

HML- (High minus Low). It's the short term difference between the average returns on portfolios with a high book-to-market equity ratio and the average returns on portfolios with low book-to-market equity ratio.

The Fama and French (1993) three-factor model has been tested by various researchers and varying conclusions have been arrived at. Connor and Sehgal (2001), agree with the Fama and French (1993) three-factor model, after testing it on the Indian stock market. They also agree with Fama and French (1993) that the CAPM does not explain the cross-section variations of stock expected returns. According to Misirli and Alper (2009), CAPM outperforms the Fama and French (1993) three-factor model on the Istanbul Stock Exchange. However, it is important to note that the Istanbul Stock Exchange is a developing market and might differ from those markets of developed countries.

A study by Nartea et.al (2009) on the New Zealand stock market finds that despite the fact that the addition of the book-to-market equity and size effect factors to the CAPM, boosts the explanatory power of the model, the enormity is not as much relative to the findings of Fama and French (1993).

2.7 Carhart's (1997) Four-factor Model

Fama and French (1996) test further, their earlier three-factor model, to see whether it can explain the relationship between average expected stock returns and the sales growth, cash flow-price ratio, earnings-price ratio, long term past returns and short term past returns. They find that the three-factor models performs well in all those cases except when it came to the short term past return. They find that an anomaly where stocks considered as short term winners continued to earn abnormal returns relative to stocks considered short term losers. This market anomaly that could not be explained by their three-factor model was referred to as the momentum effect.

After the Fama and French (1996) study, Carhart (1997), decided to modify the three-factor model, by adding one more factor to it, which would capture a one year momentum effect on stock returns. This new asset pricing model was named the Carhart's (1997) four-factor model and it is stated as follows:

$$\mathbf{E(RP_{it})} = RF_t + \beta_i(RM_t - RF_t) + \beta_s(SMB) + \beta_h(HML) + \beta_w(WML) \quad \ldots.(4)$$

Where:

$E(RP_{it})$- expected return on portfolio i during period t.

β_i, β_s, β_h, & β_w- Risk factor sensitivities for the market premium, size effect, high book-to-market equity ratio and the momentum effect factors respectively.

RF_t - risk free rate.

$RM_t - RF_t$ – excess markets return or market premium.

SMB - (Small minus Big). It's the difference between the average returns on portfolios that have a small market capitalization and the average returns on portfolios that have a big market capitalization.

HML- (High minus Low). It's the short term difference between the average returns on portfolios with a high book-to-market equity ratio and the average returns on portfolios with low book-to-market equity ratio.

WML- (Winners minus Losers). It's the short term difference between the average returns on portfolios considered to be past winners and the average returns on portfolios considered to be past losers.

According to Carhart (1997), the four-factor model does a better job at explaining the expected return on stocks because it substantially reduces the average pricing errors of the three-factor model and the CAPM. Nartea et al. (2009), find that by adding the momentum effect market anomaly, to the Fama and French (1993) three-factor model, does in fact explain the expected return on stocks on the New Zealand Stock Exchange and they illustrated this by using portfolios of stocks. Conversely, Avramov and Chordia (2006) find that the momentum effect factor inclusion into the three-factor model, does not help in explaining the expected returns on stocks in the New York Stock Market and the NASDAQ in the short run.

2.8 Conceptual Framework

The asset-pricing models that were under study try to explain the expected returns on stocks. CAPM tried to explain the returns with its single factor: market premium. The Fama and French (1993) model has three factors that try to explain the expected returns on stocks namely: market premium, size premium and the book-to-market premium. The Carhart's (1996) model has four factors that try to explain the expected return on stocks namely: market premium, size premium, book-to-market premium and the momentum factor premium.

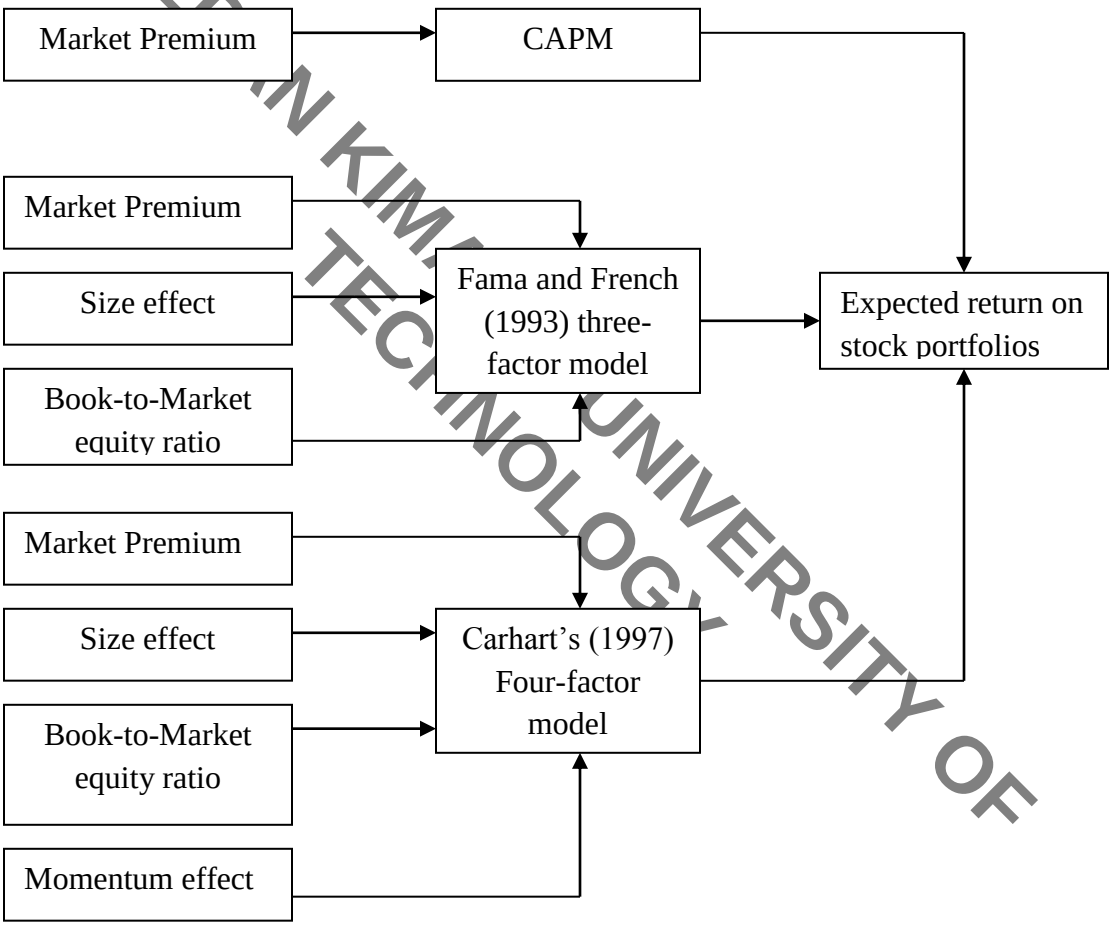

Figure 3.1: Conceptual framework for how the asset pricing models explain stock returns

2.9 Research Gap

After testing CAPM, Nambuwani (2008), concludes that during the period 2003 to 2007, the empirical work on the Kenyan stock market supports CAPM to a large extent though not fully. However, the study tested CAPM empirically from an individual stock perspective unlike the Fama and French (1993) who tested CAPM from a portfolio perspective. Moreover, the Fama and French (1993) Three-factor model and the Carhart's (1996) Four-factor models are yet to be tested empirically from a portfolio perspective, using recent returns data on stocks traded in the NSE. This therefore led to a gap in research that this study bridged.

CHAPTER THREE
RESEARCH METHODOLOGY

3.1 Introduction

This chapter contains the discussion about the approach that was adopted. It focuses on the research design that was used, the target population, sampling techniques, data collection procedures, a discussion on validity and reliability and the methods of data analysis.

3.2 Research Design

A research design is a blueprint that specifies the relationship between the variables being studied and it begins with a plan for the selection of the types and sources of information to be used to answer the research question (Cooper & Emory, 1995). This research intended to determine whether, the independent variables propounded by the three asset pricing models being studied, explain the expected returns on stocks. These variables include excess market return, size effect, book equity to market equity and the momentum effect. The study used secondary data to measure these variables and it covered the period beginning from January 2009 to December 2013.

Therefore, the quantitative research strategy was considered because the researcher intended to test the three asset pricing models with stock returns from a variety of companies listed on the NSE, for a considerable period of time, which was thus, considered to be figure intense.

3.3 Target Population

This study intended to test the CAPM, Fama and French (1997) three-factor model and the Carhart's (1996) four-factor model on the actively traded stocks in the NSE. The population that was targeted was all the equity stocks that were actively traded in the NSE within the period starting form January 2009 to December 2013. As at December 2013, the NSE was trading a total of 56 equity stocks, of which, 48 pertained to the MIMS while the remaining 8 pertained to the AIMS. The stocks contained in the AIMS however, were thinly traded and did not therefore fall under the category of actively traded stocks. This therefore implied that the target population was all those stocks traded under the MIMS, within the study period, because they were actively traded.

Table 3.1: Target Population

Market Sectors	Number
MIMS	
Agricultural	3
Commercial & Services	12
Finance & Investment	15
Industrial & Allied	18
TOTAL	**48**

3.4 Sampling Procedure

This study intended to test the three asset-pricing models using portfolios of stocks traded in the NSE. The targeted population, as described above, was the 48 stocks that were being actively traded in the NSE under the MIMS, within the study period. The researcher considered this as a rather small number to warrant any sampling because it would lead to the formation of portfolios that contained only a few stocks. Therefore, this study worked with all the stocks contained in the target population and no sampling procedures were conducted.

Table 3.2: Sample Determinants

Market Sectors	Population Number	Sample Number	Percentage (%)
MIMS			
Agricultural	3	3	100%
Commercial & Services	12	12	100%
Finance & Investment	15	15	100%
Industrial & Allied	18	18	100%
TOTAL	**48**	**48**	

3.5 Data Collection Procedure

This study adopted a quantitative research strategy that entails the analysis of objective statistical data. Therefore, the researcher intended to use secondary data on Kenyan stocks prices, to test the CAPM, Fama and French (1993) three-factor model and the Carhart's (l997) four-factor model.

The equity stocks closing price data, which were used in this study, were collected from the NSE, tabulated and converted into monthly holding period returns. This data enhanced the measurement of the portfolio expected returns, size effect, book-to-market equity and the momentum effect variables, which were used to test the asset pricing models being studied. The data on the NSE all share index was used as a proxy to the market return. Also, the 91-day Treasury bill for the period under study was collected from the Central Bank of Kenya information website and it was used as a proxy to the risk free rate.

3.6 Validity and Reliability

According to Rustam and Nicklas (2010), Reliability, relates to the issue of whether, the findings from a study, will be the same when reproduced or they were subject to random variables or events. Reliability therefore shows how stable the measures are, i.e. whether they are measuring what they aim to measure. If a study is replicated and different results are obtained, then it is possible for the reliability of measures to be questioned (Rustam & Nicklas , 2010). This study strived to generate results and measures that are reliable such that if the study were to be conducted again, in the same manner and in the same period as was done here, the same results would be generated. However, if a similar study is to be conducted, for a different time period in the future, then circumstances in the NSE might have changed and as a result, the outcome of the study could be different given the volatility in behavior of the stock market anomalies.

Validity of a study relates whether the indicators that have been created measure what they are required to measure (Rustam & Nicklas, 2010). The validity of a study is closely dependent on its reliability. Building out on this, if a measure is not stable over time i.e. its not reliable, it wont give information about what is intended to be measured since the

measure itself is unstable and not constant. As it had been considered that this study was strong in reliability, its validity is also considered to be quite strong. The asset-pricing models being tested in this study have been tested before in various stock markets around the world and in most of the cases, they are said to measure the intrinsic values of stocks. This therefore implies that they measure what is expected of them.

3.7 Data analysis

Monthly stock returns for all equity stocks listed under the MIMS in the NSE were computed from monthly closing prices using the holding period yield as demonstrated below:

$$R_{it} = \frac{(P_{i,t} + D_{i,t})}{P_{i,t-1}} \qquad \text{……..(5)}$$

Where;

R_{it} - stock i return for month t;

$P_{i,t}$ - closing price of stock i for month t;

$D_{i,t}$ – Dividend per share of stock i as at the end of month t;

$P_{i,t-1}$ – Closing price of stock i for the month t-1

To test these asset pricing models under study, the multivariate time series regression method was preferred. It is a method that has only one stage where the dependent variable is regressed on the explanatory factor premiums. This therefore implies that, the intercept coefficient of the time series regression, commonly referred to as the alpha value or the Jensen's alpha, should be equal to zero if the independent variables or factors in the model explain the expected returns on the stocks (Rustam & Nicklas, 2010).

This is a method that was used by Black, Jensen and Scholes (1972), Fama and Macbeth (1973), Fama and French (1993) and other subsequent researchers in their endeavors to test the asset pricing models in various stock markets. According to Fama and French (1993) the multivariate time series regression is more simpler but most importantly, more appropriate for comparing different model specifications because it tests how well the various combinations of factors manage to explain the expected returns on stocks.

3.7.1 Explanatory variables

The explanatory variables that were considered in the testing of the CAPM, Fama and French (1993) three-factor model and the Carhart's (l997) four-factor model include the market excess returns, size, book-to-market equity ratio and the momentum effect. These three asset pricing models that were tested are shown below:

CAPM:

$$\mathbf{E(RP_{it})- RF_t} = \alpha + \beta_i(RM_t - RF_t)+ e_t \quad \text{.....(6)}$$

Fama and French (1993) Three-factor model:

$$\mathbf{E(RP_{it})- RF_t} = \alpha + \beta_i(RM_t - RF_t) + \beta_s (SMB) + \beta_h (HML) + e_t \quad \text{.....(7)}$$

Carhart's (1997) Four-factor model:

$$\mathbf{E(RP_{it})- RF_t} = \alpha + \beta_i(RM_t - RF_t) + \beta_s (SMB) + \beta_h (HML) + \beta_w (WML) + e_t \quad \text{...(8)}$$

Where:

$E(RP_{it})$- expected return on portfolio i during period t.

α –intercept coefficient whish is interpreted as the Jensen's alpha value.

β_i, β_s, β_h,, & β_w- Risk factor sensitivities for the market premium, size effect, high book-to-market equity ratio and the momentum effect factors respectively.

RP_t -RF_t - excess portfolio return over the risk free rate.

$RM_t - RF_t$ – excess markets return or market premium.

SMB - (Small minus Big). It's the short term difference between the average returns on portfolios that have a small market capitalization and the average returns on portfolios that have a big market capitalization.

HML- (High minus Low). It's the short term difference between the average returns on portfolios with a high book-to-market equity ratio and the average returns on portfolios with low book-to-market equity ratio.

WML- (Winners minus Losers). It's the difference between the average returns on portfolios considered to be past winners and the average returns on portfolios considered to be past losers.

$\mathbf{e_t}$ – Error term.

After the monthly stock returns were computed, the SMB, HML and WML explanatory variables for the asset pricing models described above, were created following the Fama and French (1993) approach and the Cahart's (1997) approach. First, the stocks market capitalizations were computed, and then ranked according to their size, from small to big. The ranking for each stock according to size was done on December of every year under the study. The stocks below the median market capitalization formed the "Small" portfolio while the stocks above the median market capitalization formed the "Big" portfolio accordingly.

Stocks were also be independently ranked according to their book-to-market equity ratio and three book-to-market equity sorted portfolios were formed namely: low, medium and high where the low book-to-market equity portfolio consisted of the bottom 30%, the medium book-to-market equity consisted of the middle 40% and the high book-to-market equity consisted of the top 30% of the book-to market equity ratio ranked stocks. As per the Fama and French (1993) approach, the book-to market equity ratio is computed as follows: Book equity for the company's fiscal year ending in the calendar year t -1 divided by the market equity or capitalization for that company, at the end of the calendar year t – 1 i.e. end of December in the year t -1.

Six portfolios were formed at the intersection of the aforementioned size and the book-to-market equity ratio sorted portfolios as shown below:

Portfolio "S / L"- Portfolio of stocks contained in the small market capitalization group that are also contained in the low book-to-market equity group.

Portfolio "S / M"- Portfolio of stocks contained in the small market capitalization group that are also contained in the medium book-to-market equity group.

Portfolio "S / H"- Portfolio of stocks contained in the small market capitalization group that are also contained in the high book-to-market equity group.

Portfolio "B / L"- Portfolio of stocks contained in the big market capitalization group that are also contained in the low book-to-market equity group.

Portfolio "B / M"- Portfolio of stocks contained in the big market capitalization group that are also contained in the medium book-to-market equity group.

Portfolio "B / H"- Portfolio of stocks contained in the big market capitalization group that are also contained in the high book-to-market equity group.

The explanatory variables for the CAPM, Fama and French (1993) model and the Cahart's (1997) model, discussed above, will be computed as follows:

Computation of market premium:

The NASI and the Central Bank of Kenya 91-day Treasury bill were used as a proxy to the market return and the risk free rate respectively. The monthly return on the NASI was computed using the holding period yield formula as shown below:

Market premium $=(RM_t - RF_t)$

$$\mathbf{RM_t} = \frac{P_{n,\,t}}{P_{n,\,t-1}} - 1 \qquad \text{..... (9)}$$

Where:

$\mathbf{RM_t}$ – Return on the NASI in the month "t".

$\mathbf{P_{n,\,t}}$ – The closing value of the NASI at the end of month "t".

$\mathbf{P_{n,\,t-1}}$ – The closing value for the NASI at the end of month "t-1".

Computation of SMB:

$$\mathbf{SMB} = \frac{(S/L + S/M + S/H) - (B/L + B/M + B/H)}{3} \qquad \text{.....(10)}$$

Computation of HML:

$$\mathbf{HML} = \frac{(S/H + B/H) - (S/L + B/L)}{2} \qquad \text{.....(11)}$$

Computation of WML

To test the momentum effect, six portfolios were formed at the beginning of every financial year under the study period as per the Carhart's (1997) approach. Stocks were ranked

according to their twelve months' past returns and then grouped into three categories from highest to lowest as follows:

Portfolio "winners"- the top 1/3 of the stocks

Portfolio "losers"- the bottom 1/3 of the stocks

Portfolio "neutral"- the middle 1/3 of the stocks that are neither winners nor losers

Thereafter the six portfolios were formed at the intersection of the size effect portfolios and momentum effect portfolios as shown below:

Portfolio "S/L"- Portfolio of stocks contained in the small market capitalization group that are also contained in the losers group.

Portfolio "S/N"- Portfolio of stocks contained in the small market capitalization group that are also contained in the neutral group.

Portfolio "S/W"- Portfolio of stocks contained in the small market capitalization group that are also contained in the winners group.

Portfolio "B/L"- Portfolio of stocks contained in the big market capitalization group that are also contained in the losers group.

Portfolio "B/N"- Portfolio of stocks contained in the big market capitalization group that are also contained in the neutral group.

Portfolio "B/W"- Portfolio of stocks contained in the big market capitalization group that are also contained in the winners group.

After the above portfolios were formed their monthly returns were used to compute the momentum effect as follows

$$\mathbf{WML} = \frac{(B/W + S/W) - (B/L + S/L)}{2} \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(12)$$

3.7.2 Explained variable

The three models that were tested in this study, as shown above, try to explain the expected return on a portfolio. Therefore, the expected monthly return on each portfolio, for each of the years under the study period was computed. Thereafter, the excess returns for each of the six size and the book-to-market sorted portfolios were computed and then regressed on the explanatory variables for each of the three models being tested.

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS AND INTERPRETATION

4.1 Introduction

This chapter presents the findings of the study together with the analysis and implications of the findings. An illustration of the statistical tests carried out on the data will also be presented together with their results.

4.2 Data Analysis

The objectives of this study were to test whether the CAPM, Fama and French (1993) Three-factor model and the Carhart's (l997) Four-factor model can explain the expected returns on stocks traded in the NSE, from a portfolio perspective. Stock market data from the NSE as well as the 91- day Treasury bill data from the CBK, for the calendar years 2009 to 2013, were collected and processed into returns for purposes of analysis in the study.

In order to test these asset-pricing models, the researcher formed six portfolios that had been sorted for Size and the Book-to-Market effects namely: portfolios S/H, S/M, S/L, B/H, B/M and B/L. These six portfolios enabled the researcher to measure the SMB and HML factors that were used to test the Fama and French (1993) Three-factor. In addition to the six portfolios mentioned above, six additional portfolios were created to measure the momentum effect factor. These six portfolios included those stocks that were either past winners, past losers or neutral and they were also sorted for size. They included; portfolio S/W, S/N, S/L, B/W, B/N and B/L. The WML factor was measured thereafter from these six portfolios and it was used to test the Carhart's (l997) Four-factor model.

The test results of the asset-pricing models being studied were tabulated as shown below beginning with some descriptive statistics relating to the data on the portfolios that were created.

4.2.1 Mean Monthly Excess Portfolio Returns and Standard Deviations

The mean of the monthly portfolio returns over the study period was computed and tabulated as presented in **Table 4.1.**

Table 4.1: Average Monthly Excess Portfolio Returns and Standard Deviations

	Mean Excess Returns			Std. Deviation		
	H	**M**	**L**	**H**	**M**	**L**
S	3.393	5.7121	-11.073	55.7753	45.4023	23.7473
B	-6.2964	-0.0874	7.017	23.577	43.3305	68.7868

	Mean Excess Returns			Std. Deviation		
	W	**N**	**L**	**W**	**N**	**L**
S	19.4923	6.8315	-21.183	59.4505	37.8499	36.2165
B	18.9915	7.2146	-17.04	54.7583	38.7131	43.9488

From **Table 4.1**, the small cap portfolios S/H and S/M are outperforming the big size or large cap portfolios B/H and B/M, with regard to average monthly excess return with the exception of portfolio S/L. However, as concerns Book-to-Market sorted portfolios, it was difficult to make an inference as to whether high Book-to-Market portfolios outperformed low Book-to-Market, because, from what was observed in **Table 4.1**, portfolio S/H outperformed S/L whereas portfolio B/H was clearly outperformed by portfolio B/L which falls under low Book-to-Market portfolios.

As for the portfolios sorted based on their size and past performance, it can be observed from **Table 4.1** that the past winner portfolios' S/W and B/W were clearly outperforming the past loser portfolios S/L and B/L, which might thereby imply some evidence of existence of momentum in the NSE stock prices. This is consistent with the findings of Jegadeesh and Titman (1993) who finds that past winner stocks outperform past losers.

4.2.2 Testing of Asset-Pricing Models

The factor premiums proposed by the CAPM, Fama and French (1993) Three-factor model and the Carhart's (l997) Four-factor model, were computed and tabulated. For each of these Asset-Pricing Models, the portfolio excess returns were regressed against the factor premiums that they proposed. This facilitated the estimation of the alpha values and the

factor sensitivities as the intercept and slope coefficients respectively, which were thereafter tested for significance at the 5% level.

As had been explained earlier in the research methodology chapter, the testing of the validity of an Asset-Pricing model will revolve around the significance of the intercept coefficient of the model's regression output. An Asset-Pricing model whose intercept coefficient tests not to be significantly different from zero will imply that the factors premiums proposed therein are indeed the ones that influence the expected returns of stock portfolios to the exclusion of any other.

4.2.2.1 Testing the CAPM

The CAPM, as discussed in chapter two, is a single-factor model. The factor sensitivity, which is a measure of risk that cannot be eliminated through diversification, was estimated as a coefficient and the single factor was market premium. The excess returns of each of the six portfolios were regressed against the market premium, for the study period, and the results of the test, pertaining to the alpha value or intercept coefficient and the slope coefficient are displayed in **Table 4.2**.

Table 4.2: Test of the CAPM for Portfolios Sorted for Size and Book-to-Market

$E(RP_{it}) - RF_t = \alpha + \beta_i(RM_t - RF_t) + et$						
	H	**M**	**L**	**H**	**M**	**L**
		α			**t(α)**	
S	34.103	35.689	2.168	3.218	4.470	.483
B	12.415	30.879	35.313	3.447	4.259	2.525
		β_i			**t(β_i)**	
S	-4.082	-3.984	-1.760	-3.885	-5.035	-3.951
B	-2.487	-4.116	-3.761	-6.966	-5.727	-2.713
		R^2			**S(e)**	
S	.247	.355	.253	-4.082	7.984	4.494

B	.513	.416	.138	3.602	7.250	13.987

	adj R^2			F-stat		
S	.231	.341	.237	15.09517	25.35004	15.61318
B	.503	.404	.119	48.52087	32.80242	7.358974

For CAPM to be valid, the intercept coefficient must not be significantly different from zero as this would suggest the existence of other possible factors. Upon a close examination of the t-statistic for the intercept coefficients, for each of the six portfolios, they were all larger than the critical t-value except for portfolio S/L, which had a t-statistic of 0.483. This implies that the intercept coefficients for portfolios S/H, S/M, B/H, B/M and B/L are indeed significantly different from zero suggesting the existence of other possible factors apart from market premium. Therefore, the test of CAPM in this case is indicating that the evidence in support of it, in the NSE, is weak when tested from a stock portfolio perspective. This is consistent with the findings of Fama and French (1992) who also find the evidence in support of the CAPM to be weak.

4.2.2.2 Testing the Fama and French (1993) Three-factor model

Fama and French (1992) find that CAPM's single factor is not an adequate measure of the risk premium that an investor would demand for investing in a risky asset. This thereby implies that CAPM does not therefore explain the expected returns on stock portfolios. Fama and French (1993) proposes two more factors in addition to the CAPM's market premium namely; size effect factor and the Book-to-Market effect factor, to form a three-factor model as has been explained in chapter two. To test this model, the SMB and HML which represent the size premium and Book-to-Market factor premium respectively were computed. The excess returns of each of the six portfolios sorted for size and Book-to-Market were regressed against these three factor premiums and the alpha values and the factor sensitivities were estimated as intercept and slope coefficients respectively. Correlations between these factors were also determined and were tabulated as shown below.

Table 4.3: Correlation Between Factor Premiums Proposed by Fama and French (1993)

Correlation

		Rm-Rf	SMB	HML
Rm-Rf	Pearson Correlation	1	.042	-.310
	Sig. (2-tailed)		.778	.032
SMB	Pearson Correlation	.042	1	.205
	Sig. (2-tailed)	.778		0.163
HML	Pearson Correlation	-.310	.205	1
	Sig. (2-tailed)	.032	0.163	

Table 4.3 shows the correlation between the three factor premiums proposed by Fama and French (1993). It can be noted that the correlations are quite low and most of them are not statistically significant at the 5% level.

Table 4.4: Test of the Fama and French (1993) three factor model for portfolios sorted for size and Book-to-Market

$$E(RP_{it}) - RF_t = \alpha + \beta_i(RM_t - RF_t) + \beta_s(SMB) + \beta_h(HML) + e_t$$

	H	M	L	H	M	L
		α			**t(α)**	
S	27.904	36.689	1.543	3.322	4.861	.329
B	10.147	33.099	22.890	2.889	4.465	2.315
		β_i			**t(β_i**	
S	-3.168	-4.053	-1.668	-3.717	-5.293	-3.503
B	-2.182	-4.429	-2.279	.132	-.694	-2.271

	βs			t(βs)		
S	-3.168	.555	.066	3.437	3.204	.612
B	-.001	-.118	-1.597	-.008	-.695	-7.038

	(βh)			t(βh)		
S	.446	.013	.045	3.830	.128	.690
B	-.001	-.144	.516	2.707	-1.405	.381

	R^2			S(e)		
S	.577	.485	.272	8.400	7.547	4.693
B	.132	.454	.615	3.513	7.412	9.887

	adj R^2			F-stat		
S	.548	.450	.222	20.00496	13.79446	5.469571
B	.558	.417	.588	20.76145	12.2088	23.40093

For this model to be valid, the intercept coefficient which measures the alpha value must not be statistically different from zero at the 5% level as this would again imply the existence of other factors other than those proposed by Fama and French (1993). **Table 4.4** shows the results of the regression that was run. It can be observed that all portfolios, except for Portfolio S/L, had intercept coefficients whose t-statistics were larger than the critical t-value. This therefore implied that their intercept coefficients were indeed statistically different from zero suggesting the possibility of there being other factors other than those proposed. However, just like CAPM, the intercept coefficient of portfolio S/L had a t-value of 0.329 which was lesser than the critical t-value. It can also be noted that for portfolio S/L, its R^2 value of 0.272, for the Fama and French (1993) Three-factor Model test, increases significantly relative to that of the same portfolio in the CAPM test, of 0.253. Also, the F-statistic for portfolio S/L of 5.47 is larger than the critical F-value of 2.80 implying that, at least one, factor sensitivity, is significantly different from zero, at the 5% level.

Therefore, due to the fact that most intercept coefficients for the portfolios tested under the Fama and French (1993) Three-factor Model are not significantly different from zero, it can

be concluded that, the evidence in support of the this model, in the NSE, seems to be inconclusive.

4.2.2.3 Testing the Carhart's (1997) Four-factor Model

Carhart (1997) finds that the addition of the momentum effect factor, to the Fama and French (1993) Three-factor Model, improves its validity by significantly boosting its explanatory power. The momentum effect, according to Jegadeesh (1990), is the fact that stocks considered to be past winners, continue to outperform those that are considered to be past losers, in the short run. To test this theory in the NSE, additional six portfolios that were sorted for size and past performance were created. The portfolio excess returns for each of those six portfolios were regressed against the factor premiums and the alpha values and factor sensitivities were estimated as the intercept coefficient and slope coefficient respectively. **Table 4.5** begins by describing the correlation between the factor premiums proposed by Carhart (1997).

Table 4.5: Correlation between the factor premiums proposed by Carhart (1997)

Correlations					
		Rm-Rf	**SMB**	**HML**	**WML**
Rm-Rf	Pearson Correlation	1	.042	-.310	-.068
	Sig. (2-tailed)		.778	.032	.646
SMB	Pearson Correlation	.042	1	.205	-.124
	Sig. (2-tailed)	.778		0.163	.402
HML	Pearson Correlation	-.310	.205	1	-.062
	Sig. (2-tailed)	.032	0.163		.676
WML	Pearson Correlation	-.068	-.124	-.062	1
	Sig. (2-tailed)	.646	.402	.676	

The correlation between the factor premiums, as per **Table 4.5**, indicates that they are quite low and most of them are not significant at the 5% level. **Table 4.6** displays the results of the regression analysis where the intercept and slope coefficients, together with their respective t-values, for each of the six portfolios, are indicated.

Table 4.6: Test of the Carhart's (1997) Four-factor model for portfolios sorted for size and past performance.

$E(RP_{it}) - RF_t = \alpha + \beta_i(RM_t - RF_t) + \beta_s(SMB) + \beta_h(HML) + \beta_w(WML) + e_t$						
	W	**N**	**L**	**W**	**N**	**L**
		α			**t(α)**	
S	16.438	25.023	10.777	2.024	2.763	1.358
B	7.007	31.572	12.667	.825	3.807	1.406
		β_i			**t(β_i)**	
S	-3.570	-2.107	-2.820	-5.350	-2.831	-4.325
B	-2.240	-2.973	-2.990	-3.208	-4.362	-4.038
		β_s			**t(β_s)**	
S	.936	.258	.182	6.183	1.531	1.232
B	-1.012	-.363	-.258	-6.391	-2.347	-1.538
		(β_h)			**t(β_h)**	
S	.333	.184	.084	3.666	1.819	.945
B	.086	.173	.335	.899	1.860	3.319
		(β_w)			**t(β_w)**	
S	.803	-.054	-.276	6.992	-.423	-2.456
B	.729	-.059	-.192	6.070	-.504	-1.505

	R^2			S(e)		
S	.778	.320	.430	8.120	9.055	7.933
B	.714	.455	.501	8.496	8.294	9.011

	adj R^2			F-stat		
S	.758	.257	.377	37.7585	5.06224	8.1104
B	.687	.404	.454	26.8464	8.96931	10.7776

The six portfolios stated in **Table 4.6** are those that have been sorted for size and past performance as had been done by Carhart (1997). The t-statistic for three intercept coefficients for portfolios' S/L, B/W and B/L are smaller than the critical t-values indicating that those coefficients are not significantly different from zero at the 5% level. This is a major improvement relative to the CAPM and the Fama and French (1993) Three-factor Model which were only able to explain one portfolio expected returns and not any other.

The t-statistic for portfolio S/L's slope coefficients are larger than the critical t-values, indicating that the market premium factor sensitivity and the momentum factor sensitivity are significantly different from zero at the 5% level. However, the t-statistic for size premium and Book-to-Market factor sensitivities of 1.232 and 0.945 respectively are smaller than the critical t-values making them not significantly different from zero. This therefore shows that even though the Carhart's (1997) Four-factor model is holding, the size and the Book-to-Market factors however have no influence on portfolio's S/L expected returns.

Portfolio B/W's t-statistics for the slope coefficient are indicating that the market premium, size factor and the momentum factor sensitivities are larger than the critical t-values making them significantly different from zero at the 5% level. However, the t-statistic for the Book-to-Market factor sensitivity of 0.899 is smaller than the critical t-value making it not to be statistically different form zero. This implies that even though the Carhart's (1997) Four-factor model is valid, the Book-to-Market factor has got no influence on portfolio B/W's expected returns.

Portfolio B/L's t-statistics of the slope coefficient for the market premium and Book-to-Market factor are larger than the critical t-value indicating that their factor sensitivities are significantly different from zero at the 5% level. However, the t-values for the size and the momentum factors slope coefficients are smaller than their critical t-values implying that their factor sensitivities are not statistically different from zero. Again, despite the fact that Carhart's (1997) Four-factor model is holding, the size and momentum factors have got no influence of portfolio B/W's expected returns.

The R^2 values for these three portfolios range from 0.337 to 0.696 which is again, a significant improvement relative to the CAPM and Fama and French (1993) Three-factor Model. It can also be noted that the F-statistic for portfolios S/L, B/W and B/L are all larger than the critical F-value of 2.6 which implies that at least one, factor sensitivity, is significantly different from zero, at the 5% level.

Another test of the Carhart's (1997) Four-factor model was carried out for portfolios that were sorted for size and Book-to-Market and the results are displayed in **Table 4.7**.

Table 4.7: Test of the Carhart's (1997) Four-factor model for portfolios sorted for size and Book-to-Market.

$$E(RP_{it}) - RF_t = \alpha + \beta_i(RM_t - RF_t) + \beta_s(SMB) + \beta_h(HML) + \beta_w(WML) + e_t$$

	H	M	L	H	M	L
		α			$t(\alpha)$	
S	12.555	26.978	8.346	1.288	2.959	1.487
B	8.126	38.818	.934	1.859	4.233	.085
		β_i			$t(\beta_i)$	
S	-2.997	-3.945	-1.744	-3.741	-5.265	-3.782
B	-2.159	-4.492	-2.034	-6.012	-5.963	-2.248
		β_s			$t(\beta_s)$	
S	.714	.587	.043	3.927	3.456	.416

B	.006	-.137	-1.525	.074	-.802	-7.431
		(β_h)			**t(β_h)**	
S	.464	.025	.037	4.244	.242	.586
B	.134	-.151	.542	2.739	-1.469	4.393
		(β_w)			**t(β_w)**	
S	.368	.233	-.163	2.668	1.805	-2.054
B	.048	-.137	.526	.784	-1.057	3.378
		R^2			**S(e)**	
S	.637	.521	.337	9.750	9.118	5.612
B	.592	.468	.696	4.370	9.169	11.013
		adj R^2			**F-stat**	
S	.603	.476	.275	18.8687	11.691	5.45708
B	.554	.419	.667	15.5879	9.4602	24.5576

It can be observed that the t-statistic, for the intercept coefficients, of portfolios S/H, S/L, B/H and B/L are smaller than their critical t-values implying that these alpha values are not statistically different from zero. This suggests that the factors proposed in this model can at least explain the returns of two-thirds of the portfolios being studied. Relatively to the other test carried out as shown in **Table 4.7**, this is a significant boost to the validity of the Carhart's (1997) Four-factor model especially when tested using portfolios that have been sorted for size and Book-to-Market.

The entire slope coefficients for portfolios S/H and B/L have got t-statistics that are larger than the critical t-values implying that these factor sensitivities are significantly different from zero at the 5% level.. The F-statistics for the two portfolios are larger than the F-critical value of 2.6 implying that at least one coefficient is significantly different from zero. Portfolio S/H and B/L have got R^2 values of 0.603 and 0.667 which are quite high which implies that the explanatory power of the model is also quite high. All the factors proposed

by Carhart (1997) can therefore be said to have significant influence in the expected returns of portfolios S/H and B/L.

The slope coefficients for the market factor sensitivity and the momentum factor sensitivity in portfolio S/L have t-statistics that are larger than the t-critical value implying that they are significantly different from zero at the 5% level. However, the slope coefficients for the size and Book-to-Market factors have t-statistics that are lesser than the critical t-value therefore they are not considered to be significantly different from zero. This portfolio has got an F-statistic of 5.457 which is greater than the critical F-value of 2.6 which hence implies that at least one coefficient is significantly different from zero. Therefore, it can be inferred that the Carhart's (1997) factors are indeed influencing the expected returns of portfolio S/L except for the size and the Book-to-Market.

Portfolio B/L's slope coefficients for the market premium and Book-to-Market have got t-statistics that are larger than the t-critical value. This therefore implies that they are statistically different from zero at the 5% level. However, the slope coefficients for the size and the momentum factors have t-statistics that are lesser than the critical t-value. This therefore implies that they are not significantly different from zero at the 5% level. The F-value of 24.56 for this portfolio is larger than the critical F-value of 2.6 implying that at least one coefficient is significantly different from zero. In conclusion, it can be inferred that Carhart's (1997) factors can explain the expected returns of portfolio B/L except for size and momentum.

4.2.3 Test of the Market Anomalies

Auxiliary to the main objectives discussed above, the researcher also intended to test the influence of each of the market anomalies, independently, on the expected returns of the stock portfolios. The portfolios that were used are the same portfolios that were used to test the asset-pricing models under the study. Market anomalies are empirical facts that are known to exist in a market but they cannot be explained by the existing theory (Berk, 1995). The anomalies that were tested independently included the Size, Book-to-Market and the

Momentum anomaly. The excess returns of each portfolio were regressed against each anomaly independently and the results were tabulated as shown below.

4.2.3.1 Test of the Size Anomaly

The existence of the size anomaly was first suggested by Banz (1981) where he finds that small cap stocks outperform large cap stocks. This study sought to test whether the size of a firm has got any influence on the expected return on its stocks. The excess portfolio returns for portfolios that were sorted for size and Book-to-Market were regressed against the size premium, as measured by SMB and the results of the test were presented in **Table 10** below.

Table 4.8: Test for size anomaly for portfolios sorted for size and Book-to-Market.

$$E(RP_{it}) - RF_t = \alpha + \beta_s (SMB)$$

	H	M	L	H	M	L
		α			$t(\alpha)$	
S	4.079	6.163	-11.016	.550	.987	-3.189
B	-6.275	-.272	5.772	-1.824	-.043	.725
		β_s			$t(\beta_s)$	
S	.791	.520	.066	3.080	2.405	.549
B	.025	-.213	-1.436	.211	-.981	-5.202
		R^2			S(e)	
S	.171	.112	.007	7.413	6.246	3.455
B	.001	.020	.370	3.440	6.260	7.967
		adj R^2			F-stat	
S	.153	.092	-.015	9.48601	5.78514	0.30107
B	-.021	-.001	.357	0.04434	0.96236	27.0568

It can be observed from **Table 4.8** that the intercept coefficients for portfolios S/H, S/M, B/H, B/M and B/L are not significantly different from zero based on their t-statistics. Also,

the slope coefficient for the size factor, for portfolios S/H, S/M, and B/L are significantly different from zero, based on their t-statistics. Therefore, the size factor has got some influence on the expected returns of portfolios S/H, S/M and B/L. The F-statistic for these three portfolios are larger than the critical F-value of 2.8 at the 5% level, implying that at least one coefficient is significantly different from zero. However, the R^2 values for these three portfolios range from 0.092 to 0.357, which are not quite as high as the ones for the test on the Carhart's (1997) factors. It can be concluded therefore that even though the size factor has got significant influence on the expected returns on stock portfolios in the NSE, when it's tested as a single factor in an asset pricing model, the explanatory power of that model reduces significantly relative to that of the test of Carhart's (1997) Four-factor model.

4.2.3.2 Test of the Book-to-Market anomaly

Fama and French (1992) find that there was significant evidence in support of the Book-to-Market anomaly as a factor that influences expected returns on stock. This study intends to test that theory with regard to the portfolios of stocks traded in the NSE. The excess returns of the portfolios sorted for size and Book-to-Market were regressed against the Book-to-Market anomaly as measured by HML and the results were presented in **Table 11** as shown below.

Table 4.9: Test of Book-to-Market anomaly for portfolios sorted for size and Book-to-Market

	$E(RP_{it})- RF_t = \alpha + \beta_h$ (HML)					
	H	**M**	**L**	**H**	**M**	**L**
	α			**t(α)**		
S	3.539	5.767	-11.046	.542	.906	-3.302
B	-6.247	-.082	7.111	-2.068	-.013	.746
	(β_h)			**t(β_h)**		
S	.655	.246	.122	5.037	1.946	1.828
B	.222	.025	.423	3.694	.202	2.230
	R^2			**S(e)**		

S	.355	.076	.068	6.533	6.367	3.345
B	.229	.001	.098	3.021	6.319	9.534

	adj R^2			F-stat		
S	.341	.056	.047	25.3683	11.691	3.34114
B	.212	-.021	.078	13.6453	0.04073	4.97224

.

The intercept coefficients for portfolios S/H, S/M, B/M and B/L in **Table 4.9** are not significantly different from zero at the 5%, level based on their t-statistics. Also, the slope coefficients for portfolios S/H, B/H, and B/L are significantly different from zero at the 5% level with regard to their t-statistics. The F-statistic for portfolios S/H, B/H, and B/L are quite large relative to the critical F-value of 2.8 implying that at least one coefficient is significantly different from zero. However, the R^2 values for these three portfolios range from 0.078 to 0.341 and are relatively lower than those of the Carhart's (1997) Four-factor model test. This implies that even though the Book-to-Market anomaly has got a significant influence on the expected returns of portfolios S/H, B/H, and B/L, when it's tested as a single factor in an asset pricing-model, the explanatory power of that model is seen to be quite low.

4.2.3.3 Testing the Momentum Anomaly

In their study, Jegadeesh and Titman (1993) find strong evidence in support of the momentum effect as has been explained in chapter two. This study intended to test the influence of this anomaly on the expected returns of stocks traded in the NSE. To test this anomaly, six stock portfolios, sorted for size and past performance were used. Also, another set of six portfolios that were sorted for size and Book-to-Market were used. The excess returns for these portfolios were regressed against the momentum factor as measured by WML. The results of this test were displayed in **Table 4.10** and **Table 4.11.**

Table 4.10: Test of the momentum anomaly for portfolios sorted for size and past performance

$E(RP_{it})- RF_t = \alpha + \beta_w (WML) + e_t$						
	W	**N**	**L**	**W**	**N**	**L**
		α			**t(α)**	
S	-8.472	9.459	-11.001	-.766	1.195	-1.508
B	-13.495	7.299	-10.966	-1.446	.900	-1.202
		(β_w)			**t(β_w)**	
S	.729	-.069	-.265	3.524	-.463	-1.944
B	.847	-.002	-.158	4.848	-.015	-.927
		R^2			**S(e)**	
S	.213	.005	.076	11.055	7.913	7.296
B	.338	.000	.018	9.335	8.113	9.125
		adj R^2			**F-stat**	
S	.195	-.017	.056	12.4173	0.214	3.77963
B	.324	-.022	-.003	23.5015	0.00021	0.85977

Table 4.10 displays the results of the test for momentum effect on stock portfolios sorted for size and past performance. It can be observed that the intercept coefficients for all the portfolios are not significantly different from zero at the 5% level based on their t-statistics. However, as for the slope coefficients which represents the momentum factor sensitivity, it only the coefficient for portfolios S/W and B/W that were significantly different from zero at the 5% level, based on their t-statistic. The F-statistic for these two portfolios are significantly greater than the critical F-value implying that at least one coefficient is significantly different from zero. However, the R^2 for these two portfolios range from 0.01 to 0.04 which are rather low. Therefore, it can be inferred that the momentum effect has got a significant influence in the returns of portfolios S/W and B/W but its explanatory power is quite low.

Table 4.11: Test of the momentum anomaly for portfolios sorted for size and Book-to-Market

$E(RP_{it})- RF_t = \alpha + \beta_w (WML) + e_t$						
	H	**M**	**L**	**H**	**M**	**L**
	α			**t(α)**		
S	-8.012	-2.831	-5.363	-.700	-.303	-1.109
B	-8.719	2.064	-18.006	-1.774	.228	-1.337
	β_w			**t(β_w)**		
S	.297	.223	-.149	1.388	1.273	-1.645
B	.063	-.056	.652	.687	-.330	2.588
	R^2			**S(e)**		
S	.040	.034	.056	11.451	9.351	4.836
B	.010	.002	.127	4.916	9.070	13.467
	adj R^2			**F-stat**		
S	.019	.013	.035	1.92516	1.61962	2.70549
B	-.011	-.019	.108	0.4713	0.1092	6.69972

Momentum effect was also tested as a single factor, using portfolios that were sorted for size and Book-to-Market, as displayed in **Table 4.11** above. The intercept coefficients for all the portfolios were not significantly different from zero at the 5% level, based on their t-statistics. However, as for the slope coefficients, it's only that for portfolio B/L that was significantly different from zero as per its t-statistic. This implies that the evidence in support of the momentum effect, as a single factor influencing expected returns on stock portfolios in the NSE, is not that strong. However, when it's considered together with other factors like those proposed by Carhart (1997), it comes out strongly by boosting the explanatory power of a model as was observed from the test of the Carhart's (1997) Four-factor model presented in **Table 4.6** and **Table 4.7**.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATION

5.1 Introduction

In this chapter, a discussion of the findings from the processed and analyzed data was made in this chapter, where the research questions were answered and the conclusion from the findings presented. Moreover, suggestions for further research were put forward at the end of this chapter.

5.2 Summary of findings

The main objectives of this study were to test whether the CAPM, Fama and French (1993) Three-factor Model and the Carhart's (1997) Four-factor Model can explain the expected returns of portfolios of stocks traded in the NSE. This summary was based on the findings from the tests that were carried out and presented earlier in chapter four.

5.2.1 Test of the CAPM

Undoubtedly, CAPM has for a long been being held in high regard for its unique way of explaining the reasoning behind the risk adjusted premium that investors demand for investing in a risky asset such as a stock. The model has also been criticized a lot for its simplistic nature of assuming that its only one factor alone that influences expected returns on stocks, as had been discussed earlier in chapter two. The findings indicate that the evidence in support of the CAPM, from a portfolios perspective is weak. This is due to the fact that the alpha values, usually interpreted as the Jensen's alpha, for portfolios S/H, S/M, B/H, B/M and B/L were not significantly different from zero. This indicated that there was a possibility of the existence of other factors not captured by the market premium.

This is consistent with the findings of Fama and French (1992) who find no significant relationship between the returns on stocks traded in the US and their betas during the period 1963 to 1990. However, Rustam and Nicklas (2010) find CAPM to be the only model that explained stock returns better than other models in the Stockholm Stock Exchange suggesting that beta is still a good measure of risk which is in fact contradictory to the findings of this study.

5.2.2 Test of the Fama and French (1993) Three-factor Model

This model was propounded by Fama and French (1993) to cater for the inadequacies of CAPM. Fama and French (1993), believed that CAPM did not quite capture the risk adjusted premium that would be demanded by investors for investing in a risky security. They therefore proposed two factors in addition to the CAPM's single factor namely, size premium and Book-to-Market premium. The findings are showing that when this model is tested in the NSE, from a portfolios perspective, the evidence in support of it is weak. The alpha values for portfolios S/H, S/M, B/H, B/M and B/L were not significantly different from zero. This therefore indicated the possibility of existence of other factors not captured by the risk adjusted premiums in the model. However, for portfolios S/L, the test showed that indeed the model factors proposed by the model had some influence. The explanatory power of the model for that single portfolio increased significantly relative to the CAPM.

This was consistent with the findings of Connor and Sehgal (2001) who find that the CAPM does not explain the cross section expected returns on stocks traded in the Indian Stock Markets but the Fama and French (1993) Three-factor Model does. However, the findings of this study were contradictory to the findings of Misirli and Alper (2009), whom after comparing the Fama and French (1993) Three-factor Model, CAPM and other asset pricing models built out on the Fama and French (1993) Three-factor Model, on stock market data from the Istanbul Stock Exchange, conclude that the CAPM in fact outperforms the Fama and French (1993) Three-factor Model which was quite interesting.

5.2.3 Test of the Carhart's (1997) Four-factor Model

Carhart's (1997) study was motivated by the earlier work of Fama and French (1996) when they find that despite its exemplary performance, the three factor model does not quite capture the short term past returns. This led Carhart (1997) to include an additional factor that captured the momentum effect, into the Fama and French (1993) Three-factor Model to form a revised model called the Carhart's (1997) Four-factor Model. This model was tested using two sets of portfolios namely; portfolios that were sorted for size and past performance and portfolios that were sorted for size and Book-to-Market.

As for the portfolios that were sorted for size and past performance, the researcher finds that the alpha values for portfolios S/L, B/W and B/L were indeed not significantly different from zero. This is a significant improvement relative to the findings from the test of the CAPM and the Fama and French (1993) Three-factor Model. However, as for portfolio S/L, it's only the market premium and the Book-to-Market factors that were observed to have significant influence on the expected returns on the stock portfolios. As for portfolios B/W, it's the market premium, size and momentum factors that had significant influence whereas, as for portfolio B/L, it was the market premium and the Book-to-Market that had significant influence. Overall, this test showed a significant boost in the explanatory power of the model based on the portfolios R^2 values relative to those of the CAPM and the Fama and French (1993) Three-factor Model.

Also, as for the portfolios that were sorted for size and Book-to-Market, the researcher finds that portfolios S/H, S/L, B/H and B/L have got alpha values that are not significantly different from zero. This was a significant improvement when compared to the findings from the test on portfolios that were sorted for size and past performance. Moreover, it was observed that portfolios S/H and B/L had factor sensitivities that were significantly different from zero implying that the factors proposed by Carhart (1997) indeed had a significant influence on the expected returns on the stock portfolios. However, for portfolio S/L, it's only the market premium factor and the momentum factor that have got significant influence on the expected returns on the stock portfolios. Also, for portfolio B/L, it's only the market premium and the Book-to-Market factors that have got significant influence. It can also be observed that despite the fact that it was able to explain the returns of two-thirds of the portfolios tested, which is quite high, the explanatory power of it has also significantly improved relative to the CAPM and the Fama and French (1993) Three-factor Model.

This was consistent with the findings of Nartea, Ward and Djajadikerta (2009) in that, by adding the momentum effect factor to the Fama and French (1993) Three-factor Model, did infact capture the effect of past returns on the New Zealand Stock Exchange. However, Avramov and Chordia (2006) find that the momentum factor does not help in explaining

neither the returns of the past three, six nor twelve months' return, which therefore is inconsistent with what this study finds.

5.2.4 Test of the Market Anomalies

The influence of the size, Book-to-Market and the momentum anomalies, on the expected returns on the stock portfolios, was also tested. This involved the testing of these anomalies independently as single factors in an asset-pricing model. The findings from those tests were presented below.

5.2.4.1 Test of the Size Anomaly

Small cap stocks tend to outperform large cap stocks (Banz, 1981). This study intended to test whether this size anomaly exists in the NSE. After the researcher tested for this anomaly using portfolios sorted for size and Book-to-Market, he finds that indeed there is some evidence in support of its existence. The alpha values for portfolios S/H, S/M, B/H, B/M and B/L were not significantly different from zero and that the factor sensitivities for portfolios S/H, S/M, and B/L were indeed significantly different from zero. Based on the R^2 values for portfolios S/H, S/M, and B/L the explanatory power of the asset-pricing model, that had the size premium as the only single factor, was not as strong as was observed in the case of the Carhart (1997) Four-factor Model though. Therefore, the researcher recommends that the size factor be taken into consideration together with other factors such as those suggested by Carhart (1997).

5.2.4.2 Test of the Book-to-Market Anomaly

The theory that high Book-to-Market stocks were found to outperform the low Book-to-Market as Fama and French (1992) finds was also tested in this study using portfolios of stocks in the NSE sorted for size and Book-to-Market. The researcher finds that indeed the alpha values for portfolios S/H, S/M, B/M and B/L were not significantly different from zero while the factor sensitivities for portfolios S/H, B/H, and B/L are significantly different from zero. This implies that the Book-to-Market anomaly has some influence on the expected returns of some stocks although not all. But, the explanatory power of the model that contains this anomaly as a single is quite low based on the R^2 values.

5.2.4.3 Test of the Momentum Anomaly

The theory that past winner stocks outperform past losers in the short run as Fama and French (1992) find is considered as the momentum anomaly that was also tested using two sets of portfolios; the first being portfolios sorted for size and past performance and the second being portfolios sorted for size and Book-to-Market anomaly. As for the first set of portfolios, the researcher finds that the alpha values for all portfolios, were not significantly different from zero. However, it's only the factor sensitivities for portfolios S/W and B/W that were significantly different from zero. The explanatory power of this model for these two portfolios was also quite low which therefore indicates that the evidence in support of the momentum effect's ability to explain the expected returns on stock portfolios sorted for size and past performance, as a single factor, is quite weak.

As for portfolios sorted for size and Book-to-Market anomaly, the alpha values were not significantly different from zero but as for the factor sensitivities, it's only that of portfolio B/W that was seen to be significantly different form zero. This implies that the momentum effect factor was not quite explaining the expected returns of the stocks in this portfolio categorization, when used as a single factor in an asset-pricing model.

5.3 Conclusions

From the test of the asset-pricing models under study, it is evident that there are asset-pricing models that can explain the expected returns of portfolios of stocks traded in the NSE to some extent though not entirely, whereas there were others whose explanatory ability was weak.

The CAPM's single factor was found not to capture all the factors that explain the expected returns of the portfolios under the study. This implies that it didn't quite capture the risk adjusted premium that an investor would demand for having invested in a risky stock. However, it is worthy to note that the market premium was seen as a key factor that had some significant influence on the expected returns on stocks traded in the NSE.

This study also finds that the Fama and French (1993) Three -factor model also did not quite capture all factors necessary to explain the expected returns of most of the portfolios under the study. This therefore implies that the market, size and the Book-to-Market premiums that have been adjusted for risk, do not quite capture the additional return that an investor would demand for having invested in a risky asset. However, the market premium, size and the Book-to-Market factors were found to have some significant influence on expected returns of stocks although not entirely.

The test of the Carhart (1997) Four-factor Model, however, showed a remarkable improvement in the factors that influence returns on stocks traded in the NSE, especially for those portfolios that were sorted for size and past performance and those that were sorted for size and Book-to-Market. It was able to explain the expected returns of a significant majority of those sets of portfolios used in the test and it had a better explanatory power relative to the other models. However, it was still not able to explain the expected returns of a few portfolios specifically portfolio S/M and B/M under the portfolios sorted for size and Book-to-Market. This shows that despite the fact that it has done an exemplary job, other factors should still be tested.

Therefore, we can indeed state that among the asset-pricing models tested, the Carhart (1997) Four-factor Model was found to perform better than the other models as it not only explained the expected returns of most of the portfolios but also it was seen to have a higher explanatory power relative to the CAPM and the Fama and French (1993) Three -factor model.

However, despite the fact that the CAPM's validity is not coming out strongly in this study, it is also worthy to note that its single factor, market premium, when used together with other factors such as those suggested by Carhart (1997) boosts significantly, the asset-pricing model's explanatory power. This probably indicates the reason as to why; all other asset pricing models under study were built out on CAPM.

5.4 Recommendations for the study

This study finds that the Carhart (1997) Four-factor Model explains the expected returns of most of the portfolios of stocks traded in the NSE relative to the CAPM and the Fama and French (1993) Three -factor model. Therefore, this study is highly recommended to the finance academia as its findings will help shape their way of thinking as they endeavor to find an asset-pricing model that can explain the expected returns of stocks in the NSE entirely.

Also, investors can also base their investment decisions partly on the findings of this study in trying to determine whether a portfolio of stocks is correctly valued or mispriced. This will enable them to identify profitable opportunities in the market incase they arise and be able to take advantage of them as the market converges to the correct position. The capital markets regulatory bodies should also take into consideration the findings of this study as it will assist greatly in their efforts of ensuring that the market is operating efficiently. It can enable them identify gaps in the market and this will enable them to take corrective action as is deemed necessary in an endeavor to boost investor confidence in the market.

5.5 Suggestion for further research

This study was only able to study the CAPM, Fama and French (1993) Three-factor model and the Carhart's (1997) Four-factor model as unconditional models. However, in the case of CAPM and other models that had market premium as a factor, it was observed that there were times when the market returns was lesser than the risk free rate leading to a negative market premium.

Therefore, this study would like to suggest that future researchers in this area should also test these models as conditional models. This means that they would test the models subject to a given condition. For instance, periods when the market premium is positive is known as an up-market period whereas, periods when the market premium is negative is known as down-market period. Future, researchers should focus on testing these models separately based on conditions such as the market being either in the up-market period or down-market period.

REFERENCES

Avramov, D. & Chordia, T. (2006). Asset pricing models and financial market anomalies. *The Review of Financial Studies, 19*(*3*), 1001-1040.

Banz, R.W. (1981). The relationship between return and market value of common stocks. *Journal of Financial Economics, 9(1),* 3-18.

Berk, J. B., (1995). A Critique of Size Related Anomalies. *Review of Financial Studies, 8(2*), 275-286.

Black, F. (1972). Capital Market Equilibrium with restricted borrowing. *The Journal of Business, 45(3),* 444-455.

Black, F., Jensen, M. & Scholes, M. (1972). *Studies in the Theory of Capital Markets*. Praeger Publishers Inc. Available at: http://ssrn.com/abstract=908569.

Carhart, M., (1997). On persistence in Mutual Fund Performance. *The Journal of Finance, 52* (*1*), 57-82.

Chan, L. C. K., Jegadessh, N., & Lakonishok, J. (1996). Momentum strategies. *The Journal of Finance, 51(5*), 1681-1713.

Cooper, D.R., & Emory, C.W. (1995). *Business Research Methods (5th ed.)*. Chicago: Irwin.

Dickson, P. & Muragu, K. (1994). Market Efficiency in Developing Countries. A Case of Nairobi Stock Exchange. Journal of Business Finance & Accounting, 21, 133-150.

Fama, E. F., Fisher, L., Jensen, M. C., & Roll, R. (1969). The adjustment of stock prices to new information. *International Economic Review, 10*, 1-21.

Fama, E. (1970). Efficient capital markets: A review of theory and empirical work. *The Journal of Finance*, *25(2)*, 383-417.

Fama, E., & Macbeth, J.D. (1973). Risk and Return: Some Empirical Tests. *Journal of Political Economy*, *81*, 607-636.

Fama, E., & French, K. (1992). The cross-section of expected stock returns. *The Journal of Finance*, *47*(*2*), 427-465.

Fama, E., & French, K. (1993). Common risk factors in the returns on stocks and bonds. *Journal of Financial Economics*, *33*, 3-56.

Fama, E., & French, K. (1995). Size and Book-to-Market Factors in Earnings and Returns. *The Journal of Finance*, *50 (1)*, 131-155.

Fama, E., & French, K. (1996). Multifactor Explanations of Asset Pricing Anomalies. *The Journal of Finance*, *51*(*1*), 55-84.

Fama, E., & French, K. (1998). Value Versus Growth: The International Evidence. *The Journal of Finance*, *53* (*6*), 1975-1999.

Fama, E., & French, K. (2004). The capital asset pricing model: Theory and Evidence. *Journal of Economic Perspectives*, *18*(*3*), 25-46.

Hong, H., & Stein, J. C. (1999). A unified theory of underreaction, momentum trading, and overreaction in asset markets, *The Journal of Finance*, *54(6*), 2143-2184.

Jegadeesh, N. (1990). Evidence of predictable behavior of security returns. *The Journal of Finance*. *45(3*), 881-898.

Jegadeesh, N. & Titman, S. (1993). Returns to Buying Winners and Selling Losers: Implications for Stock Market Efficiency. *The Journal of Finance, 48*(*1*), 65-91.

Keim, D. B. (1983). Size-related anomalies and stock return seasonality: Further empirical evidence. *Journal of Financial Economics*, 12 (1), 13-32.

Kothari, S., Shanken, J. & Sloan, R.G. (1995). Another Look at the Cross-Section of Expected Stock Returns. *The Journal of Finance*, *50*(*1*), 185-224.

Lakonishok, J., Shleifer, A. & Vishny, R. (1994). Contrarian Investment, Extrapolation, and Risk. *The Journal of Finance*, *49*(*5*), 1541-1578.

Lintner, J. (1965). The valuation of risk assets and the selection of risky investments in stock portfolios and capital budgets. *Review of Economics and Statistics*, *47*(*1*), 13-37.

Markowitz, H. (1952). Portfolio selection. *The Journal of Finance*, *7(1*), 77-91.

Misirli, G.A. & Alper, C.E. (2009).Drivers of expected returns in Istanbul Stock Exchange: Fama and French factors and coskewness. *Applied Economics, 41(20)*, 2619-2633.

Nambuwani, A.W. (2008). *An evaluation of the capital asset pricing model for the Nairobi Securities Exchange: an econometric approach*. Unpublished Masters in Art Economics dissertation, University of Nairobi.

Nartea, G.V., Ward, B. D., Djajadikerta, H. D. (2009). Size, BM and momentum effects and the robustness of the Fama-French three-factor model: Evidence from New Zealand. *International Journal of Managerial Finance*, 35, 179-200.

Neuman, W.L. (2005). *Social Research Methods*, (6th edition). London: Pearson Publishers.

Rustam, V., & Nicklas, B. (2010). *Cross-section of Stock Returns: Conditional vs. Unconditititional and Single Factor vs. Multifactor Models*. Retrieved from http://www.essays.se/essay/cfc7cb72d3/

Rogalski, R. J., & Tinic, S M. (1986). The January size effect: anomaly or risk mismeasurement. *Financial Analysts Journal*, *42*(*6*), 63-70.

Ross, S. (1976). The Arbitrage Theory of Capital Asset Pricing. *Journal of Economic Theory*, *13*(*3*), 341-360.

Rouwenhorst, G. (1998). International momentum strategies. *The Journal of Finance*, *53*(*1*), 267-284.

Saunders, M., Lewis, P., & Thornhill, A. (2009). *Research methods for business students* (5th edition). London: Pearson Publishers.

Schwert, G W. (2002). *Anomalies and market efficiency*. Working Paper. Rochester: University of Rochester.

Sharpe, W. (1964). Capital Asset Prices: A Theory of Market Equilibrium Under Conditions of Risk. *The Journal of Finance*, *19*(*3*), 425-442.

Appendix 1

Sampling Frame:Stocks listed under the MIMS in the NSE

AGRICULTURAL

Unilever Tea Kenya Ltd Ord 10.00
Kakuzi Ord.5.00
Rea Vipingo Plantations Ltd Ord 5.00
Sasini Ltd Ord 1.00

COMMERCIAL AND SERVICES

Access Kenya Group Ltd Ord. 1.00
Car & General (K) Ltd Ord 5.00
CMC Holdings Ltd Ord 0.50
Hutchings Biemer Ltd Ord 5.00
Kenya Airways Ltd Ord 5.00
Marshalls (E.A.) Ltd Ord 5.00
Nation Media Group Ord. 5.00
Scangroup Ltd Ord 1.00
Standard Group Ltd Ord 5.00
TPS Eastern Africa (Serena) Ltd Ord 1.00
Uchumi Supermarket Ltd Ord 5.00

FINANCE AND INVESTMENT

Barclays Bank Ltd Ord 2.00
C.F.C Bank Ltd ord.5.00
Diamond Trust Bank Kenya Ltd Ord 4.00
Equity Bank Ltd Ord 5.00
Housing Finance Co Ltd Ord 5.00
I.C.D.C Investments Co Ltd Ord 0.50
Jubilee Holdings Ltd Ord 5.00
Kenya Commercial Bank Ltd Ord 1.00
Kenya Re-Insurance Corporation Ltd Ord 2.50
National Bank of Kenya Ltd Ord 5.00
NIC Bank Ltd 0rd 5.00
Pan Africa Insurance Holdings Ltd 0rd 5.00
Standard Chartered Bank Ltd Ord 5.00

INDUSTRIAL AND ALLIED

Athi River Mining Ord 5.00

B.O.C Kenya Ltd Ord 5.00
Bamburi Cement Ltd Ord 5.00
British American Tobacco Kenya Ltd Ord 10.00
Carbacid Investments Ltd Ord 5.00
Crown Berger Ltd 0rd 5.00
E.A.Cables Ltd Ord 0.50
E.A.Portland Cement Ltd Ord 5.00
East African Breweries Ltd Ord 2.00
Eveready East Africa Ltd Ord.1.00
Kenya Oil Co Ltd Ord 0.50
Kenya Power & Lighting Ltd Ord 20.00
KenGen Ltd. Ord. 2.50
Mumias Sugar Co. Ltd Ord 2.00
Olympia Capital Holdings ltd Ord 5.00
Sameer Africa Ltd Ord 5.00
Total Kenya Ltd Ord 5.00
Unga Group Ltd Ord 5.00