

**THE VALIDITY OF FAMA AND FRENCH THREE FACTOR MODEL:
EVIDENCE FROM THE NAIROBI SECURITIES EXCHANGE**

By :

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Declaration

The Research project is my original work and has not been submitted in any other university for any award.

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The Research project has been submitted for examination with my approval as the university supervisor.

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Dedication

This project is dedicated to my husband, Jacob Odera and my sons Brian, Marvin and Tevin for the joy and meaning they bring to my life.

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Table of Contents

| | |
|--|-------------|
| Declaration | ii |
| Dedication | iii |
| Acknowledgements | iv |
| Table of Contents | v |
| List of Tables | vii |
| List of Abbreviations | viii |
| Abstract | ix |
| CHAPTER ONE | 1 |
| INTRODUCTION | 1 |
| 1.1 Background of the Study..... | 1 |
| 1.1.1 Risk..... | 2 |
| 1.1.2 Return | 3 |
| 1.1.3 Relationship between Risk and Return | 3 |
| 1.1.4 The Fama-French Three Factor Model..... | 4 |
| 1.1.5 Nairobi Securities Exchange..... | 5 |
| 1.2 Research Problem | 6 |
| 1.3 Objective of the Study | 8 |
| 1.4 Value of the Study..... | 8 |
| CHAPTER TWO | 9 |
| LITERATURE REVIEW | 9 |
| 2.1 Introduction | 9 |
| 2.2 Theoretical Review | 9 |
| 2.2.1 Portfolio Theory..... | 9 |
| 2.2.2 The Capital Asset Pricing Model | 10 |
| 2.2.3 Arbitrage Pricing Theory | 12 |
| 2.2.4 Fama-French Three Factor Model | 13 |
| 2.3 Empirical Studies..... | 14 |

| | |
|---|-----------|
| 2.4 Conclusion..... | 20 |
| CHAPTER THREE..... | 21 |
| RESEARCH METHODOLOGY | 21 |
| 3.1 Introduction | 21 |
| 3.2 Research Design..... | 21 |
| 3.3 Population..... | 21 |
| 3.4 Data Collection..... | 21 |
| 3.5 Data Analysis..... | 23 |
| CHAPTER FOUR..... | 24 |
| DATA ANALYSIS AND FINDINGS | 24 |
| 4.1 Introduction | 24 |
| 4.2 Findings..... | 24 |
| 4.2.1 Summary Statistics..... | 24 |
| 4.3 Estimation Results..... | 26 |
| 4.4 Interpretation of the Findings..... | 29 |
| CHAPTER FIVE..... | 31 |
| SUMMARY, CONCLUSIONS AND RECOMMENDATIONS | 31 |
| 5.1 Introduction | 31 |
| 5.2 Summary..... | 31 |
| 5.3 Conclusions | 32 |
| 5.4 Recommendations for Policy | 33 |
| 5.5 Limitations of the study | 33 |
| 5.6 Areas for future Research | 33 |
| References..... | 34 |

List of Tables

| | |
|---|----|
| Table 4.1: Summary statistics for the portfolios, excess market portfolio return, SMB and HML..... | 25 |
| Table 4.2: Correlation between three risk factor portfolios..... | 25 |
| Table 4.3: Number of stocks in each nine portfolios..... | 25 |
| Table 4.4: Average monthly rate of excess returns for constructed portfolios and the standard deviations for dependent variables..... | 25 |
| Table 4.5: Regression results of Fama and French three-factor model..... | 26 |
| Table 4.6: Adjusted-R square values of each of the portfolio regressions..... | 28 |
| Table 4.7: F-statistics values..... | 28 |

List of Abbreviations

| | |
|--------------|---|
| AIMS | Alternative Investment Market Segment |
| CAPM | Capital Asset Pricing Model |
| FF3F | Fama and French Three Factor model |
| FISMS | Fixed Income Security Market Segment |
| FOMS | Futures and Options Market Segment |
| MIMS | Main Investment Market Segment |
| NSE | Nairobi Securities Exchange |
| NYSE | New York Stock Exchange |
| SPSS | Statistical Product and Service Solutions |

Abstract

Since investment returns reflects the degree of risk involved in an investment, investors need to be able to determine how much of a return is appropriate for a given risk. A number of models have been used to determine this return such CAPM, APT and more recently the FF3F models. This study investigates the claim of the Fama and French three-factor model to be a “risk” model of stock price formation that is consistent with efficient market pricing. The study was performed at the NSE for the period spanning the period 2008–2012. The study provides some empirical evidence in an emerging market, the NSE. Multivariate regression analysis was applied on the nine portfolios made on the basis of size and book to market value. Monthly data of 60 companies were taken for the period of five years starting from January 2008 to December 2012. Estimation results show that the Fama and French three-factor model has a limited potential to explain variations on the return of portfolios which are constructed by using stocks operating on NSE during the years from 1st January 2008 to 31st December 2012. As was the case in the previous studies of Fama and French, the SMB slope(s) is higher for small stock portfolios than the others. They concluded the SMB captures the size effect in portfolio returns. However, big size portfolios and M/H portfolio have insignificant slopes. This means that size effect is not measured on big size and M/S portfolios. High minus Low (HML) is the risk factor capturing the book to market effect of stocks on average excess portfolio returns. Book-to-Market value is effective for high BE/ME stock portfolios but this effect is ambiguous meaning that BE/ME ratios effects average excess portfolio returns in an unsystematic and unambiguous manner. The study recommends that cost of capital estimates would be more accurate using a multiple factor model such as the four-factor model rather than the FF3F model; portfolio performance evaluation should take into account the size, BM and momentum effects; and the existence of size and BM return premia appear to rewards to risk bearing rather than due to market inefficiency.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Standard asset pricing theory suggests a direct relationship between expected excess returns and risk. The rate of return on an investment is weighted by the perceived risk in undertaking such an investment. This implies a direct relationship between market risk and return for the reason that risk-averse investors require additional compensation for assuming extra risk. Thus, it is unambiguous that risk-return relationship is a fundamental concept in investment decision making and that it is accepted as the cornerstone of rational expectations asset pricing models. Many researchers have investigated the relationship between expected return and conditional variance of aggregate wealth. This has led to a long tradition of theoretical and empirical work on relationship between risk and return. This comes as no surprise given that this fundamental trade-off is a long standing phenomenon in investments analysis and is the foundation of financial economics. (Leon, Nave and Rubio, 2005). Merton (1973) intertemporal capital asset pricing model (ICAPM) predicts a positive relationship between the conditional mean and variance of market returns.

Capital asset pricing model (CAPM) says that the expected return on an asset above the risk-free rate is proportional to systematic risk. It states that there should be a relationship between the market portfolio's beta and the cross section of average returns but empirical results of the data taken from various stock markets are mixed. Some researchers failed to find a significant relationship. French, Schwert and Stambugh (1987), Baillie and Degennaro (1990) and Campbell and Hentschel (1992) found a positive but insignificant relationship between conditional variance and the conditional expected return. Other researchers have found the risk-return trade-off to be negative. Campbell (1987), Nelson (1991), Brandt and Kang (2004) find a significant negative relationship. Glosten, Jagannathan and Runkle (1993), Harvey (2001) and Turner, Statz and Nelson found a positive and negative relation depending on the method used. Ghysels, Santa-Clara and Valkanov (2005) found a significant and positive relationship between market return and conditional volatility. CAPM uses a single factor (proportional market risk) to explain

pricing and asset returns. It is an elegant theory, and a remarkable breakthrough in finance that won its creator, William Sharpe, the Nobel Prize in Economics in 1990. But, it did not do a very good job of explaining the observed market returns. Small companies and value companies had persistently higher returns than CAPM could explain. These anomalies presented problems that made a generation of economists buggy. Prices and performance just did not fit the model very well. (www.investorsolution.com)

A strong negative relationship was found between firm size and average returns by Banz (1981). Another variable which makes a significant impact in explaining average return is the ratio of book-to-market (B/M) which was documented by Chan et al. (1991). In 1992, Fama and French (FF) presented three factor model that explained most of the return of a stock which states that value stocks (with high B/M ratio) provide better returns as compared to growth stock (with low B/M ratio) and small firms provide better returns as compared to big firms.

The objective of this study was to empirically analyze how well Fama–French three factor asset pricing model explains the cross-sectional deviations in expected stock returns in Kenyan market. This study aimed to help local and foreign individual investors, institutional investors and policy makers to better understand the risk/reward characteristics of Kenyan market. This would also be useful to construct a portfolio to capture future performance (maximum return on a given level of risk).

1.1.1 Risk

Any investment venture contains an element of risk and return. Risk is the probability that possible future outcome may deviate from the expected outcome. The greater the magnitude of deviation, the greater the risk. The possibilities of the various possible future outcomes can be predicted with some degree of confidence from the past knowledge of the event. This view is supported by Samuelson (1937), the Nobel Laureate when he says that we have but one sample of history and one must start analyzing the past in order to understand the future. This calls for use of historical data to look into the future. Relative to return, risk is the possibility that realized returns will be less than the returns that were expected. The source of such risk is the failure of dividends or interest and for the asset price to materialize as expected. Some schools of thought have defined risk as volatility. Thus the price of a stock which tends to rise or fall more than the

average stock price is considered risky. They even propound a quantitative measure of this risk known as beta. This beta is as well called the systematic risk. The systematic risk (or beta) is that portion of the total risk caused by factors affecting all the securities in the market. The factors include among others, economic, political, sociological changes in the country involved. This type of risk cannot be eliminated by diversification and it measures the assets sensitivity to market risk. The other type of risk is the unsystematic risk also called specific risk. It arises due to unique uncertainties of individual securities such as size and book to market value of a firm. Studies have indicated that small firms systematically experienced average returns nearly 20% higher than those of large firm even after accounting for differences in accounting beta. Another study found that average returns of US stocks are positively related to the book to market ratio of a firm's. (Rosenberg et.al,1985). Unsystematic risk can be mitigated by forming well diversified portfolios.

1.1.2 Return

Return is the rate at which an investment generates cash flows above the purchase cost of the investment. According to Fischer et.al (1995), the correct measure of total return on any security must incorporate both income and price change. The income is the periodic cash receipts from the investment either in the form of interest or dividends. Therefore the conceptual definition of total return of an investment across time or from different securities is that it is the sum of income and price change(+/-). The return of a portfolio is equal to the weighted average of the return of individual securities in the portfolio with weights being equal to the proportion of investment value in each asset. Markowitz (1952) suggests a risk-averse investor will prefer a portfolio with the highest expected return for a given level of risk or choose a portfolio with the lowest level of risk for a particular level of expected return. This is referred to as risk-return trade-off, which is the balance an investor can decide on between the desire for the lowest possible risk for the highest possible return. (Investopedia, 2011).

1.1.3 Relationship between Risk and Return

Investors are interested in knowing the risk involved and the return to be expected at the end of their investment period and this is true of any rational investor who aims at maximizing return while simultaneously minimizing risk. Risk is the cost of investment for which the investor

expects a return. This makes it of importance for investors to know and relate risk and return in an investment market. (Markowitz, 1952).

According to Gordon et.al. (2003), the link between risk and return is among the fundamental concepts in finance and is very useful to investors and portfolio managers. They further suggest systematic risk is the only relevant measure of risk for investors, although many researchers have shown betas and returns being not related empirically in domestic and international stock markets. Other studies such as study by Fama and French (1992, 1993) show other factors other than market risk affect returns. FF3F model stipulates that there is an inverse relationship between size and returns and a direct relationship book to market equity value and returns.

1.1.4 The Fama-French Three Factor Model

The Fama and French (1993) three factor asset pricing model (FF3F) was developed by Eugene Fama and Ken French as a result of increasing empirical evidence that the Capital Asset Pricing Model performed poorly in explaining realised returns. After testing CAPM on thousands of portfolios, Fama and French found that on average, a portfolio's beta explains about 70% of its actual returns. For example, if a portfolio was up 10%, about 70% of the return can be explained by the advance of all stocks and the other 30% is due to other factors not related to beta. Explaining 70% of a portfolios return using CAPM is fine, but Fama and French thought they could do better. They designed a more elaborate model that uses three risk factors. In the Fama-French Three Factor model, beta is still the most important risk factor because it still accounts for 70% of the typical diversified portfolio return. However, the size of the stocks in a portfolio and the price-to-book value of the stocks made significant differences. Fama-French tested thousands of random stock portfolios against their model and found that a combination of beta, size, and value explained 95% of a diversified portfolio's return. In other words, when analyzing the returns of a diversified stock portfolio against the stock market, 95% of the return could be explained by the portfolio's sensitivity to the market (beta), the size of stocks in the portfolio (size), and the average weighted book-to-market (BtM). The Fama-French Three Factor Model was far better than the 70% explanatory power of beta alone using CAPM. The FF3F model thus provides a highly useful tool for understanding portfolio performance, measuring the impact of active management, portfolio construction and estimating future returns. The Three

Factor Model has replaced Capital Asset Pricing Model (CAPM) as the most widely accepted explanation of stock prices in the aggregate and investor returns.

Fama and French (1993) extended the Fama and French (1992) study by using a time-series regression approach. The analysis was extended to both stocks and bonds. Monthly returns on stocks and bonds were regressed on five factors: returns on a market portfolio, a portfolio for size and a portfolio for the book-to-market equity effect, a term premium and a default premium. For stocks, the first three factors were found to be significant and for bonds, the last two factors. As a result, Fama and French (FF) constructed a three factor asset pricing model for stocks that includes the conventional market factor and two additional risk factors related to size and book to market equity. They find that this expanded model captures much of the cross section of average returns amongst US stocks.

The model states that the expected return on a portfolio in excess of the risk free rate is explained by the sensitivity of its return to three factors: (i) the excess return on a broad market portfolio, (ii) the difference between the return on a portfolio of small stocks and the return on a portfolio of large stocks (SMB) and (iii) the difference between the return on a portfolio of high-book-to-market stocks and the return on a portfolio of low-book-to-market stocks (HML).

1.1.5 Nairobi Securities Exchange

Stock market is an important part of the economy of a country. It plays a pivotal role in the growth of the industry and commerce of a country that eventually affects the economy of that country to a great extent. That is reason that the governments, industries and even the central banks of countries keep a close watch on the happenings of the stock market. The stock market is important from both the industry's point of view as well as the investor's point of view. In addition to offering trading, investment, speculation, hedging and arbitrage opportunities, the stock market also serves as a mechanism for price discovery and information dissemination. Stock markets are used to implement privatization programs and they often play an important role in the development of emerging economies (Lee, 1998).

In Kenya, dealing in stocks and shares started in the 1920s under the British rule. There was no formal market then, no rules and no regulations to govern stock brokerage activities. Trading

took place on gentleman's agreement in which standard commissions were charged with clients being expected to honor their contractual agreements of making good delivery and settling relevant costs. In 1951 an estate agent named Francis Drummond established the first professional stock broker firm, later others were established. The NSE was founded in 1954 when trading used to take place over a cup of tea at New Stanley Hotel (Muga, 1974). It was constituted as a voluntary association of stock brokers registered under Societies Act in 1954 and in 1991 the NSE was incorporated under the Companies Act of Kenya as a company limited by guarantee and without a share capital. Subsequent development of the market has seen an increase in the number of stockbrokers, investment banks, establishment of custodial institutions and credit rating agencies and increase in the number of listed companies. Securities traded include equities, bonds and preference shares (www.nse.co.ke).

The NSE is currently broadly segmented into four segments. The Main Investment Market Segment (MIMS), the Alternative Investment Market Segment (AIMS), the fixed Income Security Market Segment (FISMS) and the Futures and Options Market Segment (FOMS). The MIMS is the main market and has the highest entry and continuity market requirements with respect to net assets and share capital among others. Further it is segmented into ten sectors namely the Agricultural, Commercial and services, Banking, Construction and Allied, Energy and petroleum, Insurance, Investment, Manufacturing and Allied, Telecommunication and Technology. The AIMS on the other hand has lower entry and continuity requirements. There are a total of 60 companies listed under the main and alternative market segments of the NSE.

A number of market reforms have taken place in the market including the adoption of the Automated Trading Systems which allow live trading and the Central Depository System (CDS) with positive impact on the market.

1.2 Research Problem

In Finance theory, it is generally accepted that the expected return of the market is positively and proportionally related to the conditional volatility meaning that if there are expectations of higher levels of risk associated with a particular investment then greater returns are required as compensation for that higher expected risk. However, the existing empirical evidence on risk and return has drawn conflicting conclusions suggesting the existence of additional factors which are

relevant for asset pricing. It appears that much of the theory has difficulty capturing the actual behaviour of asset prices, as numerous persistent patterns in stock returns that contradict these rational models have been documented. A number of empirical studies conducted to test the validity of CAPM give results against the model. Fama-French (1992) while testing validity of CAPM found that the relationship between beta and average return for NYSE common stocks was weaker than predicted by CAPM. Lintner (1965) performed the first empirical test of the CAPM using a two-stage regression. He rejected the CAPM based on his tests.

As a result of failure of CAPM in explaining realized returns, tests have been done on other models. Rogers et.al (2007) compared three alternative models for the prediction of the expected returns in the Brazilian stock market: 1) the Sharpe-Litner-Mossin version of the CAPM; 2) the Fama and French Three-Factor model; 3) and the Reward Beta Model, presented by Bornholt (2007). The tests were conducted on portfolios, in accordance with the Fama and French's (1993) and Bornholt's (2007). As well as other evidences found in the Brazilian market, the results tend to support the Fama and French Three-Factor model to explain future returns. Thus, it is indicated for prediction of expected returns in the Brazilian stock market, a Two-Factor model: 1) one that captures the market excess of return; and 2) another one that captures the size effect of the firm. Bundoo (2006) applied Fama and French model (1993) on Stock Exchange of Mauritius. The empirical evidences confirmed that Fama and French model holds for Stock Exchange of Mauritius. This study also found that FF3F model is vigorous in explaining realized results.

The NSE is an emerging market which came into being in 1954. A lot of reforms have taken place in the market including the adoption of the Automated Trading Systems which allow live trading and the Central Depository System (CDS) with positive impact on the market. There have been various studies of the risk-return relationship at the NSE, however, there is a lack of empirical evidence of whether the size and value premium are present in this market.

There are limited studies on the FF3F model that have been done in Africa and particularly in Kenya, studies have not been done on the validity of FF3F model at the NSE. The only relevant study is by Oliech (2002) whose objective was to establish the effect of size and book to market

value on returns. The findings of his study were that size and book to market value have no relationship with returns of companies quoted at the NSE. This study is in the same spirit as that of Oliech but also include effects of the market risk on returns of companies listed at the NSE, thus testing the FF3F model by answering the question, is the Fama-French model valid at the Nairobi Securities Exchange?

1.3 Objective of the Study

To test the validity of the Fama and French Three Factor model for companies listed at the Nairobi Securities Exchange (NSE).

1.4 Value of the Study

The findings of this study would provide important insights into the interrelations between stock returns, the book-to-market (B/M) factor, and a range of attributes, including firm performance, leverage and stock volatility.

A clear understanding of the applicability of the model would be important for investors as it would affect expected rates of return on every existing asset investment, for example it could help individual investors make some predictions about the future and therefore, affect their investment decision making.

It would provide information that financial advisors can use in advising their clients on the performance of securities listed in the NSE.

It would provide further knowledge to scholars in the field of financial theory and aid in future research. This is because the risk-return relationship can also be regarded as an essential part for many financial applications and key components for example to mean-variance portfolio theory and for different asset pricing models.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter explains what is known about the topic in the existing literature and findings of previous studies on the topic. It discusses key theoretical considerations from previous studies to inform the objective developed for this study. It also highlights the conceptual framework, models and tools which will guide the research project.

2.2 Theoretical Review

A financial theory gives a range of asset pricing models which are relevant to a relation between expected returns and one or a variety of variables that illustrate various sources of risk. Identifying these variables is based on the assumptions on which the model is established. There are various models which have been used to explain the relationship between risk and return and how one can maximise return while reducing risk. Such models include portfolio theory which explains how risk can be minimised, the Capital Asset Pricing Model (CAPM) which has one source of risk, the Arbitrage Pricing Theory (APT) which takes into account several factors of risk and the Fama and French Three Factor Model which is the subject of this study. These models are examined here below.

2.2.1 Portfolio Theory

Portfolio theory was introduced by Markowitz (1952) in his paper "Portfolio Selection," which appeared in the 1952 *Journal of Finance*. Thirty-eight years later, he shared a Nobel Prize with Merton Miller and William Sharpe for what has become a broad theory for portfolio selection.

Prior to Markowitz's work, investors focused on assessing the risks and rewards of individual securities in constructing their portfolios. Standard investment advice was to identify those securities that offered the best opportunities for gain with the least risk and then construct a portfolio from these. Following this advice, an investor might conclude that railroad stocks all offered good risk-reward characteristics and compile a portfolio entirely from these. Intuitively, this would be foolish. Markowitz formalized this intuition. Detailing mathematics of

diversification, he proposed that investors focus on selecting portfolios based on their overall risk-reward characteristics instead of merely compiling portfolios from securities that each individually has attractive risk-reward characteristics. In a nutshell, investors should select portfolios not individual securities.

If we treat single-period returns for various securities as random variables, we can assign them expected values, standard deviations and correlations. Based on these, we can calculate the expected return and volatility of any portfolio constructed with those securities. We may treat volatility and expected return as proxy's for risk and reward. Out of the entire universe of possible portfolios, certain ones will optimally balance risk and reward. These comprise what Markowitz called an efficient frontier of portfolios. An investor should select a portfolio that lies on the efficient frontier.

James Tobin (1958) expanded on Markowitz's work by adding a risk-free asset to the analysis. This made it possible to leverage or deleverage portfolios on the efficient frontier. This led to the notions of a super-efficient portfolio and the capital market line. Through leverage, portfolios on the capital market line are able to outperform portfolio on the efficient frontier.

Sharpe (1964) formalized the capital asset pricing model (CAPM). This makes strong assumptions that lead to interesting conclusions. Not only does the market portfolio sit on the efficient frontier, but it is actually Tobin's super-efficient portfolio. According to CAPM, all investors should hold the market portfolio, leveraged or de-leveraged with positions in the risk-free asset. CAPM also introduced beta and relates an asset's expected return to its beta.

Portfolio theory provides a context for understanding the interactions of systematic risk and reward. It has shaped how institutional portfolios are managed and motivated the use of passive investment techniques. The mathematics of portfolio theory is used in financial risk management and was a theoretical precursor for today's value-at-risk measures.

2.2.2 The Capital Asset Pricing Model

By the mid 1950s the investment world appreciated that there was a relationship between risk and stock market returns. However, there was no precise definition of risk and how it drives expected return (Fama, 2010).

As a result university finance courses as well as professional amateur investors focused their efforts on security analysis. This involved various techniques of fundamental analysis which could identify undervalued shares (e.g shares trading on the market at prices below their accounting based net-asset value).

All of this changed in 1959, when Markowitz published his paper on portfolio theory. The offspring of this theory was Capital Asset Pricing model delivered to the world via the work of Sharpe in 1964 and that of Lintner a year after. CAPM is elegantly simple and intuitively appealing *tour de force* that laid the foundations of asset pricing theory (Fama, 2010). His statement was that an investor can reduce the standard deviation of portfolio returns by choosing stocks that do not move exactly together, that is, are negatively correlated. The CAPM indicates the expected or required rates of return on risky assets. CAPM is based on assumption that investors prefer less risk and more return. It is the assumption of CAPM that borrowing and lending rates are equal; that there are no transaction costs or taxes; that betas are stable and that the market portfolio chosen for comparison is appropriate. Furthermore, expected returns and standard deviation are the only two variables that need to be considered in an investment decision. The main statement of the CAPM is that one can reduce risk nicely by diversifying one's portfolio.

The CAPM formula can be set out as:

Risk-adjusted return required from a share = Risk-free rate%+(β x Market Risk Premium%)

The risk-free rate is generally accepted to be the rate obtainable on a long-term (10-year) government bond, while the market risk premium (MRP) is the premium above the risk free rate that has historically been returned by a particular share market. Another way of looking at (MRP) is to regard it as the return above the risk free rate which is required by investors as the reward for investing in a risky stock market.

β , or beta, is a factor which reflects a particular share volatility relative to the market in which it trades. In other words, when the market as a whole rises or falls by a particular percentage, beta describes an individual shares reaction to that rise or fall. According to CAPM, volatility is the only risk that investors need to be compensated for. All other risks, according to the theory can be addressed by investing in a diversified portfolio.

Fama, 2010 explains the importance of CAPM as follows: “The CAPM gave a clean story about risk and expected return that allowed us to judge the performance of active (fund) managers.” It also generates a theoretically-derived relationship between required return and systematic risk which has been subject to frequent empirical research and testing.

2.2.3 Arbitrage Pricing Theory

A substitute and concurrent theory to the CAPM is one that incorporates multiple factors in explaining the movement of asset prices. The APT was initiated in 1976 by Stephen Ross who explained that an asset’s price today should equal the sum of discounted future cash flows, where the expected return of the asset is a linear function of the various factors. Factors may be economic factors (such as interest rates, inflation, GDP) financial factors (market indices, yield curves, exchange rates) fundamentals (like price/earnings ratios, dividend yields), or statistical (e.g. principal component analysis, factor analysis.) The factor model’s beta coefficients i.e. sensitivities may be estimated using cross-sectional regression or time series techniques.

The APT is rarely successful to analyse portfolio risks by assessing the weighted sum of its components. Equity portfolios are far more diverse and enormously large for separate component assessment, and the correlation existing between the elements would make a calculation as such untrue. Rather, the portfolio’s risk should be viewed as a single product’s innate risk. The APT represents portfolio risk by a factor model that is linear, where returns are a sum of risk factor returns. Factors may range from macroeconomic to fundamental market indices weighted by sensitivities to changes in each factor. These sensitivities are called factor-specific beta coefficients or more commonly, factor loadings. In addition, the firm-specific or idiosyncratic return is added as a noise factor. This last part, as is the case with all econometric models, is indispensable in explaining whatever the original factors failed to include. In contrast

with the CAPM, this is not an equilibrium model; it is not concerned with the efficient portfolio of the investor. Rather, the APT model calculates asset pricing using the different factors and assumes that in the case market pricing deviates from the price suggested by the model, arbitrageurs will make use of the imbalance and veer pricing back to equilibrium levels. At its simplest form, the arbitrage pricing model can have one factor only, the market portfolio factor. This form will give similar results to the CAPM.

2.2.4 Fama-French Three Factor Model

The Three Factor Model initiated by Fama and French in 1993 takes a different approach to explain market pricing. Fama-French found that investors are concerned about three separate risk factors rather than just one. Actually, they found that in the real world, investors care about lots of different risks. But, the risks that have systematic prices attached to them and that in combination do the best job of explaining performance and pricing are market, size and value.

Investor returns are the mirror image of a firm's cost of capital. Even in the secondary market, the cost of a firm's capital is best estimated by the price of their securities. Small firms must pay more for capital when borrowing or issuing securities in the capital markets. Distressed firms (value), those that have poor prospects, bad financial performance, irregular earnings and/or poor management must also pay more for capital. Small firms and distressed firms have lower stock prices to compensate investors for these risks. Fama-French found that most appropriate measurement, the one with the most explanatory power, was the ratio of the stock's adjusted Book value to its Market price (BTM). Stocks with high BTM are value stocks.

So, everybody that buys any traded stock (or portfolio of stocks) takes market risk. If your portfolio holds all traded stocks in the weighted proportion of the total market, that's the end of the story. But, if your portfolio differs in its makeup in average size or on the growth-value spectrum of the market, then you will have a different result. There are additional premiums for accepting a portfolio either larger or smaller than the market, and/or with a tilt toward growth or value different than the market. (These risks are sometimes called a priced risk, because we can identify additional return for accepting them.)

Fama-French defined the size premium as the difference in returns between the largest stocks and the smallest stocks in the database. They defined the value premium as the difference in returns between the stocks with the 30% highest Book to Market Ratios (BTM) and the 30% lowest BTM.

So, the formula becomes the sum of: The zero risk return, market premium (Beta), size Premium, value premium, impact of management (Alpha) and random error.

Algebraically, it is given by:

$$E_T[r_{i,T+1}] = r_f + b_i \lambda^{\text{market}} + S_i \lambda^{\text{size}} + h_i \lambda^{\text{value}} \quad \dots\dots\dots \text{Equation 1}$$

The Roman letters in the terms on the right side of Equation 1 represent risk exposures, while the λ 's are associated with the premiums on the three types of risk. The familiar empirical specification of the Fama and French three factor model is:

$$r_{i,t} - r_{f,t} = \alpha_i + \beta_i (r_{m,t} - r_{f,t}) + S_i \text{SMB}_t + h_i \text{HML}_t + \varepsilon_t \quad \dots\dots\dots \text{Equation 2}$$

Equation 2 represents a regression of realised excess returns of an asset on the market factor and two factor mimicking portfolios. The SMB (Small minus Big) is the size factor, and is calculated as a return on a zero-cost portfolio that establishes a long position in a portfolio of small firms and finances it with a short position in large firms. Similarly, the value factor, HML (High minus Low), is constructed from a zero-cost portfolio that buys firms with a high book-to-market ratio and shorts firms with a low book-to-market ratio. Because market capitalisation and value ratio indicators are correlated, Fama and French (1993) use a sorting procedure that results in portfolios that do not confound the size and the value effects. In sum, the HML factor captures the value premium that is independent of the effect of size and the SMB factor captures the size premium that is independent of the effect of the book-to-market ratio.

2.3 Empirical Studies

Robert and Viallet (1990) studied several asset pricing models in an international setting. They used data on a large number of assets traded in the United States, Japan, the United Kingdom,

and France. They obtained monthly stock return data for four countries spanning 15 years from January 1969 through December 1983. They found that multifactor models tend to outperform single-index models in both domestic and international forms especially in their ability to explain seasonality in asset returns. They also found that the behaviour of the models is affected by changes in the regulatory environment in international markets.

Choudhary and Choudhary (2010) tested the validity of the CAPM for the Indian stock market using monthly stock returns from 278 companies of Bombay stock exchange (BSE) 500 index listed on the BSE from January 1996 to December 2009. The findings of the study were not supportive of the theory's basic hypothesis that higher risk (betaism) associated with a higher level of return. The results obtained provide credence to the linear structure of the CAPM equation being a good explanation of security returns. The CAPM's prediction for the intercept is that it should be equal to zero and the slope should equal the excess returns on the market portfolio. The findings of the study contradict the above hypothesis and indicate evidence against the CAPM. In the light of above findings, they concluded that beta is not sufficient to determine the expected returns on securities/portfolios. They further recommended research on the combinations of market factors, macroeconomic factors and firms' specific factors can be carried out to solve the CAPM puzzle.

Chen, Roll, and Ross, (1986) have produced a set whether innovations in macroeconomic variables are risks that are rewarded in the stock market. The financial theory suggest that the following macroeconomic variables should systematically affect stock exchange market returns: the spread between the long and short interest rates, expected and unexpected inflations, industrial production and spread between high-low grade bonds. By studying New York stock exchange index in 1985, they found that theses sources of risks are significantly priced. Furthermore, neither the market portfolio nor the aggregate consumption are priced separately. They also found that oil price risk is not is separately rewarded in the stock market.

Lehmann, Bruce and David (1989), in their tests on Empirical Foundations of the Arbitrage Pricing Theory provided a detailed and extensive examination of the validity of the APT based on maximum likelihood factor analysis of large cross sections of securities. They used CRSP to provide two sets of equity returns: daily returns on all stocks listed on the New York and

American Stock Exchanges since July 1962 and monthly returns on all securities listed on the New York Stock Exchange since 1926. The empirical implementation of the theory proved incapable of explaining expected returns on portfolios composed of securities with different market capitalizations although it provided an adequate account of the expected returns of portfolios formed on the basis of dividend yield and mean variance where risk adjustment with the CAPM employing the usual market failed.

Cauchie, Hoesli, and Isakov, (2002) investigated the determinants of stock returns in a small open economy in an Arbitrage Pricing Theory framework. The analysis was conducted with monthly data from the Swiss stock market over the period 1986-2000. They used data on industrial sector indices, as well as macro-economic data. Both a statistical and a macro-economic implementation of the model are provided. They found that Swiss equity returns are influenced by both global and domestic economic conditions. The results also show that the statistically determined factors may yield a better representation of the determinants of stock returns than the macro-economic variables.

Kothari et al. (1995) and MacKinlay (1995) argue that a substantial part of the risk premium in the FF3F model is due to 'survivor bias' and data snooping. But a number of papers have weakened and even dismissed the survivorship-bias and the data snooping hypothesis. For instance, Lakonishok et al. (1994) find a strong positive relation between average return and BE/ME for the largest 20 per cent of NYSE-Amex stocks, where survivor bias is not an issue. Similarly, Fama and French (1993) find that the relation between BE/ME and average return is strong for value-weight portfolios. As value-weight portfolios give most weight to larger stocks, any survivor bias in these portfolios is trivial. There are also many studies using different sample periods on US and non-US data confirming the existence of the size and book-to-market equity effects.

Fama and French (1996) explained the pattern of average returns which CAPM was unable to capture. According to them average return is related to firms characteristics like cash flow/price, past sales growth, size, long term past returns, earnings/price, book-to-market equity and short term past returns. In this study they concluded that three factors model explain average returns

better than CAPM and capture average-return anomalies except for continuation of short-term returns.

Chawarit (1996) compared CAPM to APT model to explain the predictability of return of stocks listed on stock exchange of Thailand for the period 1990 to 2000. The study was further divided in to two parts of times that is, before economic crises and after it. The research found that in comparison with CAPM model, APT model is better while explaining the return of stock for Thailand Stock Exchange.

Fama and French (1998) provide additional valuable out-of-sample evidence. They tested the FF three-factor model in thirteen different markets over the period 1975 to 1995. They find that twelve of the thirteen markets record a premium of at least 7.68 percent per annum to value stocks. Seven markets show statistically significant BM/ME betas.

For the period 1929 to 1997, Davis et al. (2000) comprehensively examined the covariance and average returns. They divided the data in two phases first from July 1929 to June 1963 and second from July 1963 to June 1997 and found out that value premium was higher than size premium and was statistically significant for the first phase.

Aleati et al. (2000) studied the effect of risk on return for Italian stocks. Time series regressions were used to examine the data from 1981 to 1993 for stocks listed on Italian Stock Exchange. Instead of portfolio returns they used the individual stocks returns in contrary of most of researcher. They found empirical evidence that default premium, changes in market index, changes in interest rates, changes in oil prices and SMB and HML and factors which determine assets returns.

Connor and Sehgal (2001) tested F and F three factor model on stock returns in Indian market and concluded that over the period of time mean returns were not only explained by the market factor but also by the market, size and book-to-market factors.

Maroney and Protopapadakis (2002) tested the FF three-factor model on stock exchanges of Australia, Canada, Germany, France, Japan, the UK and the US. The size effect and the value premium survive for all the countries examined. They conclude that the size and BE/ME effects are international in character. Using a Stochastic Discount Factor (SDF) model, and a variety of macroeconomic and financial variables, do not price assets better than the Fama and French three-factor model.

Faff (2001) use Australian data over the period January 1991 to April 1999 to examine the power of the Fama French three-factor model. He finds strong support for the Fama and French three factor model, but find a significant negative rather than the expected positive, premium to small size stocks. Faff conjectures that his results are consistent with evidence from other markets, on a reversal of the size effect.

Gaunt (2004) studies the Fama French (FF) three-factor model on the Australian Stock Exchange (ASX) for a sample of 6,814 companies over the period January 1993 to December 2001. He finds that beta risk tends to be greater for smaller companies and those with lower BM ratios. However, the study does not find a strong small firm effect but there is evidence of the BM/ME effect increasing monotonically from the lowest to the highest book-to-market equity portfolios. Overall, the evidence indicates that the three-factor model provides a better explanation of observed Australian stock returns than the CAPM.

Drew and Veeraraghavan (2002) tested the existence of size and value premium in Malaysian market from December 1991 to December 1999. Their research found out the effect of size and value premium in stock returns which was not explained by the CAPM. Drew and Veeraraghavan (2003) applied Fama and French three factor model to examine the explanatory power of a single index. The studies were done on Hong Kong, Korea, Malaysia and Philippine markets and found out that F and F three factor model better explains the stock returns.

Bundoo (2006) applied Fama and French model (1993) on Stock Exchange of Mauritius. The empirical evidences confirmed that Fama and French model holds for Stock Exchange of

Mauritius. This study also found that F and F three factor model is vigorous in consideration of time varying betas.

For the period of September 1992 to April 2006, Iqbal and Brooks (2007) tested CAPM on the Karachi Stock exchange using two step Fama-Macbeth procedure. They tested it with both with and without riskless assets. In this study beta explained the Cross sectional variation in expected returns. Uzair and Hanif (2010) applied CAPM on Karachi Stock Exchange covering period of 6 years (2003 to 2008) selecting 60 companies from KSE-100 Index. Results showed that CAPM does not provide accurate results.

Homsud et al. (2009) replicated the F and F three factor model over the period July 2002 to May 2007 to Stock Exchange of Thailand. They found that Fama and French model is better model to describe Thailand Stock Exchange as compared to CAPM.

Bahtnagar and Ramlogan (2010) used multiple regression approach to compare CAPM, split CAPM and the three factor model to explain the Average return in the United Kingdom Market for period April 2000 to June 2007. Results indicated that three factor models provided better results as compared to CAPM and Split CAPM in explaining UK market returns.

Related studies for Kenya are by Kamau (2002) who studied the relationship between risk and return of companies listed under various market segments of the NSE. The aim of the study was to establish whether companies listed under two segments; the Main Investment Market Segment and the Alternative Investment Market segment are different in terms of risk and return. He found out that there exists no significant difference in terms of risk and return between companies listed under MIMS and those listed under AIMS. He concluded that companies listed under the two segments are the same in terms of performance as measured by risk and return. Kamau's (2002) study had cautioned against wholesome adoption of the research results on the fact that the period of research which was 1996-2000 was characterized by political activism and a depressed Kenyan economy. Further trading systems during the period of research were still manual, which could have affected the efficiency of the NSE and the pricing of the assets. A lot of reforms have taken place in the market including the adoption of the Automated Trading

Systems which allow live trading and the Central Depository System (CDS) with positive impact on the market (Otuke, 2006).

Maina (2003) studied the risk and return of investments held by Insurance companies in Kenya. He sought to establish whether there are differences in the return across companies for investments on similar assets and whether there exists a correlation between risk and return. The results of the study found a relationship between risk and return only in form of investments-secured loans.

Omogo (2011) sought to establish whether the relationship between return and risk as measured by beta is as linear as suggested by CAPM. Using regression analysis to establish this relationship, he found that non-linear relationship between risk and return existed for companies listed at the NSE.

Oliech (2002) sought to establish the relationship between size, book to market value and returns of NSE common stocks. The results of this study could not conclusively confirm the results as achieved by Fama and French in 1993 as he found that there was no relationship between size and returns and also that there was no relationship between book to market value and returns of stock listed at the NSE. However, time has elapsed since this research was done. The NSE has grown with more companies listed and many reforms have also taken place.

2.4 Conclusion

From the foregoing literature review, it is evident that a substantial body of theoretical work on risk-return relationship has emerged. However, much of the theory has difficulty capturing the actual behaviour of asset prices, as numerous persistent patterns in stock returns that contradict these rational models have been documented. A number of empirical studies conducted to test the validity of CAPM give results against the model. Results tend to support the Fama and French Three-Factor model to explain future returns. There is insufficient empirical evidence of whether the size and value premium as captured by FF3F are present in emerging equity markets such as the NSE. This study aims to provide empirical evidence of effect of market, size and value on returns at the NSE.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter includes methods to be used to test the validity of the FF3F model at the NSE. The following components are discussed: Research Design, the Population to be studied, the Sample size, the Method of Data Collection and Data Analysis.

3.2 Research Design

This study used descriptive design. Descriptive design is used by researchers in a study such as this one in explaining who, what, when, where or how of a phenomenon or characteristics associated with a subject population. It is also used in trying to discover the associations among variables. This is also known as correlational study which is a subset of descriptive study.

3.3 Population

The population of the study was made up of all the 60 quoted firms in the Nairobi Securities Exchange (NSE) as at 31st December 2012. A census was carried out therefore the research covered all 60 listed companies at the NSE for the period 1st January 2008 to 31st December 2012. The five year period was deemed appropriate in order to capture major factors in the economy that could have affected share prices. The five year period is comparable to that used by other researchers such as Gitari (1990), Muli (1991), Munywoki (1998) and Kamau (2002) in their studies of risk-return relationship at the NSE. Sharpe and Cooper (1972) used a similar period to determine the risk return classes among NYSE under similar assumptions.

3.4 Data Collection

Secondary data was used in this study for which monthly closing prices were taken from NSE for the period 2008-2012 to calculate monthly returns and the risk-free rate was proxied by the monthly return on three months treasury bonds. Five years monthly data of 60 companies listed on NSE was used in this research. Data of the 60 companies was sorted according to their capitalization which was determined by multiplying the total number of shares times the price

per share. Then companies were then grouped as high market value (big), medium market value (medium) and low market value (small) stocks.

After that grouping, securities were divided into three groups based on their book to market ratio. First group consisted of securities having high B/M ratios, second group had securities having medium B/M ratios and last group consisted of securities having low B/M ratios. This was done according to the way Fama and French classified the stocks into three groups of portfolios; one of low book-to-market equity (BE/ME) ratio, one of medium BE/ME ratio and the last being of high BE/ME ratio. The split of the stocks into different categories was arbitrary and Fama and French argued that there was no reason that tests should be sensitive to this choice.

Market risk premium was estimated by deducting the monthly T-Bill yield from monthly NSE 20 share index yield. SMB is calculated by deducting the average return of big capitalization portfolios from average return of small capitalization portfolios. HML was calculated as the difference between the return of high B/M value portfolio and the small B/M value portfolio. In order to find the market ratio book value of equity was divided to the market value of equity. Based on size and book to market value ratios nine portfolios were formed.

Where, S/M portfolio had stocks that have medium book to market ratio and small in size

B/H portfolio had stocks that have high book to market ratio and big in size

SMB is calculated as follows

$SMB = \text{Average return of (S/L, S/M, S/H) portfolio minus average return of (B/L, B/M, B/H) portfolio.}$

Similarly HML is calculated as follows:

$HML = \text{Average return of (S/H, M/H, B/H) portfolio minus average return of (S/L, M/L, B/L) portfolio.}$

The portfolio returns are the average returns of individual stock were calculated as $R_t = \ln (P_t/P_{t-1})$ where P_t and P_{t-1} were closing prices on day t and $t-1$. Similarly the return on market portfolio were calculated by using NSE 20 share Index $R_t = \ln (NSE(20)_t / NSE(20)_{t-1})$ where $NSE(20)_t$ and $NSE(20)_{t-1}$ were closing index value on day t and $t-1$

3.5 Data Analysis

Standard multivariate regression framework method was used to apply Fama and French three factors model on securities listed at the NSE. Statistical tests have been done using SPSS. Return above risk free rate on each portfolio were regressed on three factors namely value premium, size premium and market risk premium.

The model was as follows:

$$EPR = \alpha_i + \beta_i(r_{m,t} - r_{f,t}) + S_iSMB_t + h_iHML_t + \varepsilon_t$$

where:

EPR is the excess portfolio returns (in excess of risk free rate)

β_p is the coefficient loading for the excess return of the market portfolio over the risk-free rate;

s_p is the coefficient loading for the excess average return of portfolios with small equity class over portfolios of big equity class.

h_p is the coefficient loading for the excess average returns of portfolios with high book-to-market equity class over those with low book-to-market equity class.

ε_{pt} is the error term for portfolio p at time t.

SMB (Small minus Big) is the size factor.

HML (High minus Low), is the value factor.

Test of Significance

A test of the global models, that is, in which all independent variables are included, was used F-test. A test of each independent variable separately, significant test was used T test with a 95% confidence level.

CHAPTER FOUR

DATA ANALYSIS AND FINDINGS

4.1 Introduction

This chapter presents the quantitative analysis of secondary data obtained from 60 listed companies at the NSE for the period 1st January 2008 to 31st December 2012. The chapter gives the findings from the analyzed data. The data has been categorically analyzed to give clear and vivid findings of the study.

4.2 Findings

Portfolio return values and their statistical relationships are presented with regression results.

4.2.1 Summary Statistics

Table 4.1 below shows mean and standard deviations of the portfolios - returns, SMB portfolio return and HML portfolio return.

Table 4.1: Summary statistics for the portfolios, excess market portfolio return, SMB and HML

| Portfolio | Mean | Std. Deviation |
|---------------------|---------|----------------|
| S/L | 1.3409 | 8.0214 |
| S/M | 1.1934 | 9.4480 |
| S/H | 1.1401 | 10.1612 |
| B/L | 1.4655 | 10.0680 |
| B/M | 1.3942 | 10.2702 |
| B/H | 2.1655 | 8.8152 |
| M/M | 0.9634 | 8.0452 |
| M/L | 0.9452 | 8.9734 |
| M/H | 0.9867 | 8.562 |
| $r_{m,t} - r_{f,t}$ | 0.9421 | 9.0585 |
| SMB | -0.4502 | 9.2169 |
| HML | 0.4991 | 3.5650 |

Source: Research Findings

The findings on table 4.1 indicate that the mean SMB return is -0.4502. As for the three risk factors, excess-market return ($r_{m,t} - r_{f,t}$) and HML are more volatile than SMB. While the former two have positive mean returns, the latter has a negative mean return. Higher BE/ME ratios yield poor earnings as mentioned by Fama and French (1995), except in the case of the B/H portfolio.

Table 4.2: Correlation between three risk factor portfolios

| | | | |
|---------------------|---------------------|------------------|------------------|
| | $r_{m,t} - r_{f,t}$ | SMB _t | HML _t |
| $r_{m,t} - r_{f,t}$ | 1 | -0.16259 | -0.3637 |
| SMB | -0.16259 | 1 | 0.0979 |
| HML | -0.3637 | 0.0979 | 1 |

Source: Research Findings

The findings on table 4.2 show the correlation between three risk factor portfolios. Excess market portfolio return is negatively related to both SMB and HML portfolio returns. This correlation is not strong. Although SMB and HML portfolios are positively correlated, this correlation is weak

Table 4.3: Number of stocks in each nine portfolios

| Size | Book-to-Market Equity (BE/ME) | | |
|------------|-------------------------------|------------|----------|
| | Low (L) | Medium (M) | High (H) |
| Small (S) | 39 | 27 | 25 |
| Medium (M) | 31 | 33 | 28 |
| Big (B) | 21 | 32 | 38 |

Source: Research Findings

The findings on table 4.3 report the number of stocks in each of the nine portfolios. All the stocks used in the analysis were sorted by size and distributed into three groups Small (S), Medium (M) and Big (B) as shown on the table.

Table 4.4: Average monthly rate of excess returns for constructed portfolios and the standard deviations for dependent variables

| | Book-to-Market Equity (BE/ME) | | | | | |
|-----------|-------------------------------|------------|----------|---------------------|------------|----------|
| | Mean Excess Returns | | | Standard Deviations | | |
| | Low (L) | Medium (M) | High (H) | Low (L) | Medium (M) | High (H) |
| Small(S) | 1.2448 | 1.0536 | 1.2991 | 10.1768 | 9.8978 | 9.8562 |
| Medium(M) | 1.6110 | 1.3714 | 1.9939 | 10.4445 | 8.8444 | 10.4761 |
| Big (B) | 1.2609 | 1.5710 | 1.9327 | 10.3226 | 9.3001 | 8.3369 |

Source: Research Findings

Findings on table 4.4 show the average monthly rate of return for constructed nine-portfolios and the standard deviation for dependent variables. It can be inferred from Table 4.4 that there is to be a positive relation between average return and the size of the portfolios. In other words, big size portfolios (B/L, B/M, B/H) outperform small size portfolios (S/L, S/M, S/H). High BE/ME stocks (S/H, M/H, B/H) outperform low BE/ME stocks (S/L, M/L, B/L).

On the other hand, two of medium BE/ME portfolios (S/M and M/M) perform worse than low BE/ME portfolios (S/L and M/L). However, the B/M portfolio outperforms the B/L portfolio. Thus it can be concluded that there is a persistent size effect on the NSE. Value effect also exists but it is not as persistent as the size effect.

4.3 Estimation Results

A linear model was used for estimating the effects of the three risk factors on excess portfolio returns. Estimation results are summarized in Table 4.5.

Table 4.5: Regression results of Fama and French three-factor model.

| | Book-to-Market Equity (BE/ME) | | | | | |
|--|--------------------------------------|------------|----------|----------------|------------|----------|
| | Intercept | | | p-value | | |
| SIZE | Low (L) | Medium (M) | High (H) | Low (L) | Medium (M) | High (H) |
| Small(S) | 0.986* | 0.756 | 0.674 | 0.025 | 0.120 | 0.056 |
| Medium(M) | 0.888 | 0.685 | 0.960 | 0.076 | 0.117 | 0.124 |
| Big (B) | 0.330 | 0.667** | 1.011* | 0.278 | 0.005 | 0.017 |
| | Book-to-Market Equity (BE/ME) | | | | | |
| | slope (b) | | | p-value | | |
| | Low (L) | Medium (M) | High (H) | Low (L) | Medium (M) | High (H) |
| Small(S) | 0.924*** | 0.903*** | 1.026*** | 0.000 | 0.000 | 0.000 |
| Medium(M) | 1.003*** | 0.884*** | 1.020*** | 0.000 | 0.000 | 0.000 |
| Big (B) | 1.05 | 0.984*** | 0.866*** | 0.000 | 0.000 | 0.000 |
| | Book-to-Market Equity (BE/ME) | | | | | |
| | slope (s) | | | p-value | | |
| | Low (L) | Medium (M) | High (H) | Low (L) | Medium (M) | High (H) |
| Small(S) | 1.206** * | 1.211** * | 1.242*** | 0.000 | 0.000 | 0.000 |
| Medium(M) | 0.421** | 0.422** * | 0.299 | 0.003 | 0.000 | 0.088 |
| Big (B) | 0.080 | 0.056 | 0.026 | 0.348 | 0.395 | 0.809 |
| | Book-to-Market Equity (BE/ME) | | | | | |
| | slope (h) | | | p-value | | |
| | Low (L) | Medium (M) | High (H) | Low (L) | Medium (M) | High (H) |
| Small(S) | -0.140* | -0.017 | 0.434*** | 0.016 | 0.788 | 0.000 |
| Medium(M) | -0.066 | 0.085 | 0.415*** | 0.316 | 0.138 | 0.000 |
| Big (B) | -0.062 | 0.003 | 0.234*** | 0.121 | 0.920 | 0.000 |
| ***: 0.1% significance, **: 1% significance, *: 5% significance. | | | | | | |

The findings on Table 4.5 shows that for the significance level of 0.1% all portfolio intercept terms are zero, meaning that the Fama and French three-factor model performs well in terms of explaining excess portfolio returns. At the significance level of 1%, the three factor model performs well in terms of explaining excess portfolio returns except the portfolio B/M. At the significance level of 5% the three factor-model performs well on explaining excess portfolio returns except the portfolios S/L, B/M and B/H. The Fama and French three-factor model has explanatory power on six portfolios out of nine at the significance level of 5%.

Table 4.5 gives that market factor slope (b) is close to 1 for all portfolios and these slopes are also close to each other. This means that in addition to market risk factor the other two risk factors are essential for explaining the differences in excess portfolio returns. Closeness of slope values also implies that market risk premium increases average returns on all portfolios by approximately the same amount.

Table 4.6: Adjusted-R square values of each of the portfolio regressions.

| | Book-to-Market Equity (BE/ME) | | |
|------------|-------------------------------|------------|----------|
| | Low (L) | Medium (M) | High (H) |
| Small (S) | 0.8301 | 0.7801 | 0.8894 |
| Medium (M) | 0.7902 | 0.7769 | 0.6763 |
| Big (B) | 0.9203 | 0.9412 | 0.8018 |

Source: Research Findings

Table 4.6: presents the findings of the adjusted-R square values of each of the portfolio regressions. The R-squared values on the table reflect that three risk factors together can explain the considerable part of the variation on excess portfolio monthly returns for each portfolio.

Table 4.7: F-statistics values

| F-Statistics | | | |
|--------------|---------|------------|----------|
| | Low (L) | Medium (M) | High (H) |
| Small (S) | 0.8301 | 0.7801 | 0.8894 |
| Medium (M) | 0.7902 | 0.7769 | 0.6763 |
| Big (B) | 0.9203 | 0.9412 | 0.8018 |

Source: Research Findings

The findings on table 4.7 shows the F-statistics values for each of the portfolios. The p-values associated with these F-statistics are very low which indicates that the model fits to the data using Ordinary Least Squares method.

4.4 Interpretation of the Findings

As was the case in the previous studies of Fama and French the SMB slope (s) is higher for small stock portfolios than the others. They conclude that SMB captures the size effect in portfolio returns. Table 4.1 indicates that the mean SMB return is -0.4502. Table 4.5 shows that all portfolios have a positive size slope (s) coefficient and this value is higher when the size is lower. However, big size portfolios and M/H portfolio have insignificant slopes, This means that the size effect is not measured on big size portfolios and on the portfolio M/H.

High minus low (HML) is the risk factor capturing the book-to-market effect of stocks on average excess portfolio returns. Table 4.1 shows that the mean HML return is 0.4991. Table 4.5 shows that, at the significance level of 1%, HML has statistically strong explanatory power only on high BE/ME stock portfolios because low and medium BE/ME stock portfolios have statistically insignificant slope coefficients (h) at 1% significance level. Three portfolios out of nine have statistically significant slope coefficients (h) at 1% significance level. In other words, there is no BE/ME effect for the portfolios S/L, S/M, M/L, M/M, B/L and B/M at this significance level. The effect is significant also for the portfolio S/L at 5% significance level. For the portfolios S/H, M/H and B/H, BE/ME risk factor has positive slope (h) coefficients while it is negative for the portfolio S/L. Since HML has a positive value for high BE/ME portfolios it is expected that $(S/H) > (M/H) > (B/H)$ on average excess portfolio returns, putting everything else constant. It is clear from Table 4.4 that this is not a consistent expectation with the realized average excess portfolio returns on the NSE during the study period. Realized average returns are $(M/H) > (B/H) > (S/H)$. This inconsistency does not have a powerful explanation on the basis of book-to-market values. In short, book-to-market value is effective for high BE/ME stock portfolios, but this effect is ambiguous meaning that BE/ME ratio effects average excess portfolio returns in an un-systematic and un-explained manner.

The findings on the table 4.5 show that all portfolios have a positive size slope (s) coefficient and this value is higher when the size is lower. However, big size portfolios and M/H portfolio have insignificant slopes, This means that the size effect is not measured on big size portfolios and on the portfolio M/H. It can be concluded, therefore, that medium size portfolios (M/L and M/M) lose less than small size portfolios operating on NSE or small size portfolios win less than medium size portfolios (M/L and M/M). This also means that positive exposure to size risk

reduces the average excess return while negative exposure to size risk increases the average excess return concerning medium and small size portfolios.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter provides a discussion of the findings reported in chapter four, the conclusions of the study are drawn and recommendations made. The chapter further presents the suggestions for future research.

5.2 Summary

The aim of this study was to explain the excess portfolio return variations by the Fama and French three-factor model. For this purpose market risk factor, $RM-R_f$, size risk factor (SMB) and BE/ME risk factor (HML) were used as the explanatory variables. Estimation results show that the Fama and French three-factor model has a limited potential to explain variations on the return of portfolios which are constructed by using stocks operating on NSE during the years from 1st January 2008 to 31st December 2012. The findings of the study is based on monthly excess return on each stock. Portfolios were constructed in order to test the model.

If the intercept term is significantly indifferent from zero, than the three factor model is correct. Fama et.al (1993) mention that if the expected excess portfolio return is different from zero, it must be compensation for risk. The model is based on the fact that risk premium is captured by $RM-R_f$, SMB and HML. Thus the intercept should be close to zero. Residuals are normally distributed for each portfolio. Table 4.5 shows that for the significance level of 0.1% all portfolio intercept terms are zero, meaning that the Fama and French three-factor model performs well in terms of explaining excess portfolio returns. At the significance level of 1%, the three factor model performs well in terms of explaining excess portfolio returns except the portfolio B/M. At the significance level of 5% the three factor-model performs well on explaining excess portfolio returns except the portfolios S/L, B/M and B/H. The Fama and French three-factor model has explanatory power on six portfolios out of nine at the significance level of 5%.

Fama and French found that at the existence of SMB and HML risk factors in the model, slope (b) of market risk factor, $RM-R_f$, is close to 1. Fama et al. (1993, p.40) point out that similar

slopes imply that sensitivity to the market factor does not explain much of the variation in average returns across stocks. The job is left to the size and book-to-market factors.

5.3 Conclusions

Based on the findings it can be concluded, therefore, that medium size portfolios (M/L and M/M) lose less than small size portfolios operating on NSE or small size portfolios win less than medium size portfolios (M/L and M/M). This also means that positive exposure to size risk reduces the average excess return while negative exposure to size risk increases the average excess return concerning medium and small size portfolios. The result shows that medium size portfolios outperform small size portfolios. In short, the size factor SMB plays a vital role in explaining portfolio returns for medium and small size portfolios but it has no effect on large-scale portfolio returns

The BM and momentum effects appear robust in NSE as significant BM and momentum effects are documented. The size effect was not as strong, however, probably because most stocks are small. These findings are consistent with those of Pinfeld et al. (2001), Bryant and Eleswarapu (1997) and Griffin et al. (2003). The study found that high BM portfolios earn a premium over low BM portfolios for both small and big size categories. Small firms on the other hand, have higher returns than big firms only in the high BM category but as a group, small firms earn a return premium over big firms as shown by the positive small minus big (SMB). The FF model can explain the BM and size effects. The findings have obvious implications for cost of capital estimation, portfolio selection, portfolio performance evaluation, as well as on market efficiency. Based on the findings it can be concluded that portfolios containing large firms have higher average excess returns than portfolios containing smaller sized firms. Generally, portfolios containing low book-to-market ratio firms perform better than those containing high book-to-market ratio firms. Size factor has no effect on portfolios having big-size firms but can explain the excess return variations on portfolios having small and medium-sized firms. Finally, Book-to-market ratio factor has an effect on portfolios with high book-to-market ratio firms. Fama and French three-factor model has power on explaining variations on excess portfolio returns but this power is not strong throughout the test period at the NSE.

5.4 Recommendations for Policy

Based on the findings, the study recommends that the cost of capital estimates would be more accurate using the four-factor model rather than the FF model; portfolio managers should increase portfolio returns by investing in small and high BM firms that have performed well over the past 12 months; portfolio performance evaluation should take into account the size, BM, and momentum effects; and the existence of size and BM return premia appear to be rewards to risk bearing rather than due to market inefficiency, however the inability of the Fama and French model to explain the momentum effect casts some doubt on the efficient market hypothesis.

5.5 Limitations of the study

The study used secondary data from the NSE and therefore as a concern when working with secondary data, a similar study with the same data set may yield different or conflicting results.

Another limitation of this study is that the data obtained from the NSE for the research may have contained some errors and therefore the study might not have produced accurate results.

Finally, a study on a wider scale in the African stock markets aimed at the investigation of the validity and Fama and French Model may provide different results.

5.6 Areas for future Research

Future research should examine the implications of industry classification on the Fama and French Model or whether additional pervasive factors explain stock returns by using other portfolios belonging to other sectors or industries such as the property and construction industry or just financial sector alone to a firm a suitable Fama and French Model.

Future research should also compare the Fama and French model with other model such as CAPM (Capital Asset Pricing Model), APT (Arbitrage Pricing Theory) or Model at the NSE and provide important policy recommendations for the NSE.

Finally, given that the Fama and French Model is unable to explain the globally pervasive momentum effect while leaving a large part of the variation in the market returns unexplained, a study should be done to establish a more suitable model for the NSE.

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