THE APPLICABILITY OF THE FAMA-FRENCH THREE FACTOR MODEL ON THE NAIROBI SECURITIES EXCHANGE

BY

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DECLARATION

I, Lilian Mwango Ondieki.hereby declare that this project is my own work and effort, and that it has not been submitted for any award of a degree in any other university

Signed: ..... .Date. l o i j . m o R
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This research project has been presented for examination with my approval as University Supervisor

Signed . . . . . Date.P. T?.. ^^ ^ f . . 7 - °

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DEDICATION

I dedicate this project to my late father, Mr. Johnson. R. Ondieki who inspired and taught the virtue of perseverance, humility and hard work.

I further, dedicate this project to my husband Ken and my kids Vanessa, Abby and Eli who have been a great source of motivation and inspiration. And also to my sister Irene who believe in the gains of learning.

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ACKNOWLEDGEMENT

For the success of this research I am heavily indebted to various people and organization without whose material and non material support this research would have come to naught. 1 take this opportunity to express my sincere thanks to each of these people and organizations.

The staff of the Jomo Kenyatta Library provided the opportunity to use the facilities especially in the MBA and the Electronic Library section. From these able staff I was able to access not only research reports from earlier MBA research findings but 1 was able to access scholarly publication from the wider academic sphere.

Much of the direction on what to do at each stage of this research from the generation of the research idea, to its conceptualization, to the drafting of the research proposal, to the analysis of samples and preparation of the report was provided by my supervisor Mr. James Ng'ang'a.

The data of analysis was got from the Nairobi Stock Exchange. It would not have been possible to conduct an analysis and extract out the relevant finding if the data was not available in the first place. This data was well kept by the staff of the NSE who then availed it to me when 1 needed it to conduct this research.

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

Finally I would wish to thank my family that provided me with encouragement throughout the period 1 was conducting this research.

The objective of this study was to determine the applicability of the Fama-French Three Factor Model (FFTFM) on the Nairobi Stock Exchange (NSE). In specific terms, this study aimed at determining whether the variation in the three independent factors of the Fama-French Three Factor Model explain the variation in the returns of the stocks on the NSE and whether model was applicable on the NSE. This study found that the FFTFM was not applicable on the NSE for the period of study. Though the relationship between the three variables in the FFTFM variables was significant, the independent variables provided a weak explanation for the variation in the dependent variable. The independent variables as given by the FFTFM did not strongly explain the variability in the dependent variable. This study, further, found that the applicability of the model, with the three factors, was not possible. The model therefore has to be enhanced with specific respect to the NSE by finding out which are the other variables that the model seems to leave. The F-Tests on the regressions at company level showed that the regressions at company level were all significant. This indicated that the relationships between the independent variables and the dependent variables were significant. However, the coefficients of determination indicated that the independent variables did not greatly explain the variation in the dependent variable, as all the companies had coefficients of determination of less than 0.355. This study, therefore, showed that, though the factors identified by Faina and French contributed to variation in market premium and therefore returns, but, there was a lot of explanation to be done by seeking to find out which other factors caused variation in the returns on the NSE. This study, consequently, recommends that the FFTFM is not applicable on the NSE

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ABBREVIATIONS AND ACRONYMS

APT	Arbitrage Pricing Theory
CAPM	Capital Asset Pricing Model
CMA	Capital Market Authority
EMH	Efficient Market Hypothesis
GNP	Gross National Product
HML	High Minus Low
ICAPM	Intertemporal Capital Asset Pricing Model
JSE	Johannesburg Stock Exchange
NSE	Nairobi Stock Exchange
SMB	Small Minus Big
TFM	Three Factor Model
UK	United Kingdom
US	United States

CHAPTER ONE

INTRODUCTION

1.1 Background of the study

Pricing models provide a mechanism of analysis of the returns of assets especially on the stock market. Pricing models have developed and improved continually over the years. Formal asset pricing through models was started when Sharpe (1964), Lintner (1965) and Mossin (1966) presented Capital Asset Pricing Model (CAPM) which shows how to relate the average return of stock and market risk factors. Some other researchers did not agree as a result of their belief that there are other risk factors that determine a stock return and not just one factor as suggested by the CAPM. There were therefore many subsequent asset pricing models that attempted to provide what the authors felt were better estimators of a stock's return and the risk factors in the market (Estrada, 2002).

Since Merton (1973) it has been clear that the empirically challenged single period Capital Asset Pricing Model (CAPM) is unlikely to provide reliable guidance in asset pricing in reality. However, as Cornell *et al.* (1997) pointed out, the CAPM is the only asset pricing model that has been applied widely in practice. The CAPM model is a single factor model that operates within the efficient market and relates the return of an asset to the market premium. The relation is such that the return of an asset is partly constant and partly varies as the market premium. The Efficient Market Hypothesis (EMH) which defines the environment within which the CAPM operates postulates that the stock markets are efficient and the prices of the stocks are an embodiment of the information about the products (Fama, 1965).

The Fama-French three factor model on the other hand was viewed by the Merton (1973) analysis as a more successful asset pricing model. Brennan, Wang, & Xia (2001) suggest that it is possible that the empirical success of the Fama-French three factor model is due to the ability of this model to capture time variation in investment opportunities. Unlike the CAPM the Fama-French added two more factors on the CAPM in order to come up with a more accurate model they called the Three Factor Model (TFM). The TFM operates within the same environment as the CAPM and was a reaction to both the CAPM and the Arbitrage Pricing Theory (APT) of Ross (1976). The APT had not specified the number of factors to be considered when pricing assets. The TFM suggested three factors (Fama & French, 1993).

The TFM relates the return of an asset with a set of variables namely the market premium, SMB, and HML. The return of a stock is the change in the price of the stock expressed as a percentage of the price before the change. The market premium is the difference between the return of a stock on a particular trading day and the market return. This market premium varies directly with the return of a stock witli beta being the coefficient of variation. This beta is itself the quotient of the covariance of the stock's returns and the market return as the numerator and the variance of the market return as the denominator. This part of the model makes the first factor of the TFM (Fama & French, 1993).

The second factor of the TFM is the High Minus Low (HML). This refers to High book to market Minus Low book to market. It is the difference between the return on a portfolio of high book to market value stocks and the return on a portfolio of low book to

market value stocks, sorted to be neutral with respect to size. The third factor, Small Minus Big (SMB), is the difference between the equal-weight averages of the returns on the three small stock portfolios and the three big stock portfolios. The relationship connecting the factors is expected to be linear (Homsud, Wasunsakul, Phuangnark & Joongpong, 2009).

1.1.1 The Nairobi Securities Exchange

This study will be carried out based on firms quoted on the Nairobi Securities Exchange (NSE). The NSE was originally as a voluntary association of stockbrokers in 1954. It was exclusively for the Kenyan white community until after the attainment of independence in 1963. In 1988 the first privatization through the NSE was realized, as the successful sale of a 20% government stake in Kenya Commercial Bank was done (NSE, 2012). February 18, 1994 recorded the highest 20-Share Index in NSE history (NSE, 2012). More improvements have been taking place on the NSE and now there is a computerized delivery and settlement system (DASS).

According to the NSE (2012), securities are divided into Agricultural investments market Segment made up of firms in the Agricultural sector, Commercial and Services sector, the Telecommunication and Technology Segment, Automobiles and Accessories, Banking, Insurance, Investment, Manufacturing and Allied, Construction and Allied, and Energy and Petroleum Segments. The other segment (not relevant to this study) deals with Fixed Income Securities like bonds (NSE, 2012). The NSE is overseen by the Capital Market Authority (CMA). Among other things the Capital Market Authority is charged with the role of protecting investor interests (NSE, 2012). Trading on the NSE is

done on a five-day basis with Saturday, Sunday and the holidays making the non-trading days.

1.2 Statement of the Problem

The Three Factor Model can be viewed either as a reduction of the Arbitrage Pricing Theory (APT) from the undefined many factors or an extension of the CAPM from one factor to three. This model was meant to provide solutions to the perceived weaknesses of the CAPM which seamed not to provide an accurate prediction of the returns based on what Ross (1976) thought was due to the single factor in the CAPM. Quite a number of research findings like Fama & French (1992, 1993, 1996), Xuc (2003), Anyika, Wekc, & Achia (2009), Barber & Lyon (1997), Connor & Sehgal (2001), and Drew, Tony & Veeraragavan (2005) have conducted researches that have demonstrated that the Three Factor Model has superior performance as compared to the CAPM. Maroney & Protopapadakis (2002) tested the Three Factor Model on the stock markets of Australia, Canada, Germany, France, Japan, the UK and the US an concluded that the size and Book Value/Market Value (BV/MV) effects are international in character.

The Three factor model itself has been subject to investigation and criticism. Kothari, Shanken & Sloan (1995) found that there was a data selection in the model making its finding doubtful. They used an alternative data source (Standard & Poor's industry level data) from 1947 to 1987 to find that BV/MV of equities was weakly related to average stock returns. Further, Black (1993) and Mackinlay (1995) suggested that the results presented by Fama & French (1993) may have been based on data snooping given the variable construction for the characteristics based portfolios. Coleman (2005) pointed out that the model did not even have the required theoretical background that would plausibly

lead to the three identified factors. The study by Eom & Park (2011) found the Three Factor Model accurate rejected by data in their full sample period and in most sub-periods samples, bolstering the argument that the model is sample dependent.

On the Kenya scene much of the studies like Mogunde (2011) focused on studying the relationship between return and risk based on the CAPM, Akwimbi (2003) studied the relationship between return and risk using the APT model, while Gitari (1989) studied the relationship between return and risk among listed firms to determine whether there is over-compensation or under-compensation using the CAPM. There is lacking an investigation of the risk-return relationship among the listed firms using the Three Factor Fama-French Model. Further, there seems to be an issue arising out of the effect of data on the feasibility of the Three Factor Model. Some findings tend to confirm this model while some other findings confirm the arguments against it. This is an indication that the model is context dependent and not necessarily universal. Further, it is not clear what the results would be when the study is conductcd on the NSE in the stipulated period. The question that this research, therefore, seeks to answer is: does the Fama-French Three Factor Asset Pricing model prediction of the risk-return relationship hold among firms on the NSE during the period January 2007 to December 2011?

1.3 Objective of the Study

1.3.1 Main Objectives

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To determine the applicability of the Fama-French Three Factor Model on the Nairobi Stock Exchange

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1.3.2 Specific Objectives

i. To determine whether the variation in the three independent factors of the Fama-French Three Factor Model explain the variation in the returns of the stocks on the NSE.

ii. To determine whether generally the Fama-French Three Factor Model is applicable on the NSE.

1.4 Significance of the study

The findings of this research are important to the following parties in the identified ways.

i. Investors are interested in a model that will help them to accurately predict the behaviour of returns on the stock exchange. Despite the CAPM being widely used there is a general agreement its low level of accuracy, reason notwithstanding. The other available models are either too cumbersome to be used by investors or even more unreliable. In case the results find a more accurate level of performance of the Three Factor Model on the NSE then investors will have evidence to back their use of this model in asset pricing forecasting and analysis.

ii. Listed firms will have a better model that better predicts investor sentiment. Assuming the findings arc that the Three Factor Model is an accurate predictor of the behaviour of returns in the stocks quoted at the NSE, it will provide the listed firms an accurate tool to enable a more precise study of the results of the information released on the returns. This will therefore provide a deeper and

evidence-based understanding of the investor sentiment on the NSE. The listed firms will therefore come up with better methods of mitigating risk.

Future researchers will also use the findings of this research to further academic dialogue on risk-return relationship. The dialogue on asset pricing is still alive and accuratc methods of asset pricing are still being sought for. This research is providing contribution to this dialogue by presenting the argument of whether the Three Factor Model provides accurate or inaccurate measure of returns on the NSE. This will provide evidence for those who wish to lay out their argument that they feel can be enhanced by the findings of this research.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

In this section, the paper discusses first the four theories that provide framework to the research. The theories are Fama's Efficient Market Hypothesis, Sharpe's Capital Asset Pricing Model, Ross' Arbitrage Pricing Theory, and the Fama-French Three Factor Model. The paper discusses, secondly, the literature, the empirical tests and earlier findings involving the Fama-French Three Factor Model.

2.2 Review of theories

2.2.1 Fama's Efficient Market Hypothesis (1965)

The Efficient Market Hypothesis (EMH) is based on the random walk theory that suggests stock prices are randomly decided upon on the stock market and it's therefore not possible to predict tomorrow's prices (Malkiel, 1973) Random walk theorists usually start from the premise that the major security exchanges are good examples of efficient markets (Fama, 1965). In an efficient market there are large numbers of rational, profit-maximizers actively competing, with each trying to predict future market values of individual securities, and where important current information is almost freely available to all participants (Fama, 1965). In an efficient market, competition among the many intelligent participants leads to a situation where actual prices of individual securities is reflects past, present and future information. In other words, in an efficient market the actual price of a security will be a good estimate of its intrinsic value. (Fama, 1965). The

efficient market hypothesis provided the groundwork for the CAPM whose criticisms led to the FFTFM (Fama and French (1993). .

2.2.2 Sharpe's Capital Asset Pricing Model (1964)

The Capital Asset Pricing Model is a model that describes the relationship between risk and expected return and that is used to price risky securities. The general idea behind CAPM is that investors need to be compensated in two ways: in time value of money and in risk. The time value of money is represented by the risk-free rate in the model and it compensates the investors for placing money in any investment over a period of time. The other part of the formula represents risk and calculates the amount of compensation the investor needs for taking on additional risk. This is calculated by taking a risk measure (beta) that compares the returns of the asset to the market over a period of time

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and to the market premium (Sharpe, 1964). The criticisms against the CAPM led to the rise of the FFTFM (Fama and French (1993).

2.2.3 Ross' Arbitrage Pricing Theory (1976)

The idea behind the Arbitrage Pricing Theory is that two things can explain the expected return on a financial asset: the macroeconomic/security-specific influences, and the asset's sensitivity to those influences. This relationship is linear. The theory postulates that there are an infinite number of security-specific influences on any given security. The influences include inflation, production measures, investor confidence, exchange rates, market indices, changes in interest rates among many others. It is up to the analyst to decide which influences are relevant to the asset being analyzed (Ross, 1976).

Once the analyst derives the asset's expected rate of return from the APT model, he or she can determine what the "correct" price of the asset should be by plugging the rate into .a discounted cash flow model. The APT can be applied to portfolios as well as individual securities. After all, a portfolio can have exposures and sensitivities to certain kinds of risk factors as well. The APT was a revolutionary model because it allows the user to adapt the model to the security being analyzed. And as with other pricing models, it helps the user decide whether a security is undervalued or overvalued and so he or she can profit from this information. APT is also very useful for building portfolios because it allows managers to test whether their portfolios are exposed to certain factors (Khan & Sun, 1997)

APT may be more customizable than CAPM, but it is also more difficult to apply. It is not easy determining which factors influence a stock or portfolio. It can be virtually impossible to detect every influential factor much less determine how sensitive the security is to a particular factor. Getting close enough, though, is often good enough. In fact studies find that four or five factors will usually explain most of a security's return. The factors are: surprises in inflation, GNP, investor confidence, and shifts in the yield curve (Rasia & Kim, 2011). The shortening of the APT led to the rise of the FFTFM (Fama and French (1993).

2.2.4 Fama-French Three Factor Model (1993)

Fama & French (1992, 1993) extended the basic CAPM to include size and book-to-market as -explanatory factors in explaining the cross-section of stock returns. SMB, which stands for Small Minus Big, is designed to measure the additional return investors

have historically received from investing in stocks of companies with relatively small market capitalization.. This additional return is often referred to as the size premium. HML, which is short for High Minus Low, has been constructed to measure the value premium provided to investors for investing in companies with high book-to-market values (Allen, Singh & Powell, 2009).

SMB is a measure of "size risk", and reflects the view that, small companies should-be expected to be more sensitive to many risk factors as a result of their relatively undiversified nature and their reduced ability to absorb negative financial events. On the other hand, the HML factor suggests higher risk exposure for typical value stocks (high BV/MV) versus growth stocks (low BV/MV). This makes sense because companies need to reach a minimum size in order to execute an IPO and if later they are observed in the group of high BV/MV, it is usually an indication that their public market value has fallen because of hard times or doubt regarding future earnings. On the other hand, the HML factor suggests higher risk exposure for typical value stocks (high BV/MV) versus growth stocks (low BV/MV). This risk has to be factored in expected returns (Allen et al, 2009). The return on a stock is expressed as a linear regression of the market premium, the SMB and the HML (Fama & French, 1993).

2.3 Review of Empirical Studies

Finance theory has produced a variety of models that make available some insight into the environment within which financial decisions are made. Empirical finance typically approaches a theoretical model by testing whether its implications are supported by the data (Pastor, 2000). Based on the result of a hypothesis test, the model is either rejected

or not rejected. However it is not clear the implication of the results about the usefulness of the model for decision making. If the model is not rejected, does this make it the gospel truth? And if it is rejected, should it be discarded as worthless? Such a simplistic approach, based solely on the result of a hypothesis test, fails to capture many aspects of both the model and the data that could potentially be useful to a decision maker. Instead, it might be reasonable to assume that financial models are neither perfect nor useless. In any case, every model is a simplification of reality. Hence, even if the data fail to reject the model, the decision maker may not necessarily want to use the model as a dogma. At the same time, the notion that models implied by finance theory could be entirely worthless seems rather extreme. Hence, even if the data reject the model, the decision maker may want to use the model at least to some degree (Pastor, 2000).

The capital asset pricing model (CAPM) of William Sharpe (1964) and John Lintner (1965) marks the birth of asset pricing theory. Four decades later, the CAPM is still widely used in applications, such as estimating the cost of capital for firms and evaluating the performance of managed portfolios. It is the centrepiece of Management and investment courses. Indeed, it is often the only asset pricing model taught in these courses. The attraction of the CAPM is that it offers powerful and intuitively pleasing predictions about how to measure risk and the relation between expected return and risk. Unfortunately, the empirical record of the model is poor—poor enough to invalidate the way it is used in applications. The CAPM's empirical problems may reflect theoretical failings, the result of many simplifying assumptions. But they may also be caused by difficulties in implementing valid tests of the model (Fama & French, 2004).

Empirical research has identified several anomalies relating to pricing assets using the CAPM. The small firm effect and the value effect, amongst other anomalies, are the most prominent anomalies documented in empirical literature. The small firm effect, known as the size anomaly, refers to the phenomenon where firms with smaller market capitalization generally outperform larger firms. The value effect refers to the phenomenon where firms with lower price-to-fundamental multiples (such as the price-to-eamings ratio or the price-to-book value ratio) are found to outperform firms with higher price-to-fundamental multiples. According to empirical literature, the abnormal returns earned by small firms and value stocks cannot be explained by the market risk premium alone using the CAPM (Hsieh & Hodnett, 2012).

Fama and French (1993) argue that small caps and value stocks are riskier compared to large, more established firms with good growth prospects. Based on this argument, Fama and French (1993) incorporate the small firm risk premium and the value risk premium in addition to the market risk premium to explain returns on portfolios formed based on various empirical anomalies. The Three Factor Model is found to explain most of the anomalies adequately.

Although the validity of the Fama French Three Factor Model in explaining portfolio returns is well documented by empirical literature, tests of the Fama French Three Factor Model have not yet been conducted on the sector-based portfolios. The coefficients obtained from the 3-factor model provide valuable information regarding the influences of the market risk premium, small firm premium and value risk premium on different sector returns. The joint influences of the market risk, firm size and value effect can thus

be established and compared to the univariate results of Hsieh & Hodnett (2011) on sector portfolios of global equities.

In their influential empirical paper, Roll & Ross (1980) state, "We think that in many discussions of the CAPM, scholars were actually thinking of the APT and of process with just a single factor." In light of recent developments in the asset pricing literature, Shanken (1985) argued it could then be meaningfully suggested that, in many discussions of the APT, scholars may have actually been thinking of a multi-beta interpretation of the CAPM. Indeed, much can be said in support of each of these perspectives, for a single paradigm is emerging which integrates fundamental aspects of both the CAPM and the APT.

Though riddled with a lack of proper theoretical background, Fama and French (1993) reduced the many factors suggested by the APT to three: the market return, the HML and the SMB. The Fama and French Three Factor asset pricing model was developed as a result of increasing empirical evidence that the Capital Asset Pricing Model performed poorly in explaining realised returns. In fact, Fama and French studied the joint roles of market beta, size, Earnings/Price (E/P) ratio, leverage and book-to-market equity ratio in the cross-section of average stock returns for NYSE, Amex and NASDAQ stocks over the period 1963-1990. In that study, the authors find that beta has almost no explanatory power. On the other hand, when used alone, size, E/P, leverage and book-to-market equity have significant explanatory power in explaining the cross-section of average returns. When used jointly however, size and book-to-market equity are significant and they seem to absorb the effects of leverage and E/P in explaining the cross-section

average stock returns. Therefore Fama and French argued that if stocks are priced rationally, risks must be multidimensional (Bandoo, 2011).

Their findings of Fama and French have ever since been challenged as the subject of a series of papers. The arguments around the Fama and French three-factor model could be classified as that its explanatory power is an illusion arising from survivorship bias in the data; data mining is the reason and the size effect is simply a sample period effect; and that the model is a particular form of APT or ICAPM, and size and book-to-market factors represent fundamental risks. While the debate on its validation is on-going, the strong performance of this model in describing asset returns - not only for U.S. data, but also for international data brings about more and more application of it in the real world (Hu, 2003).

Fama and French (1992) find that the main prediction of the CAPM, a linear cross-sectional relationship between mean excess returns and exposures to the market factor, is violated for the US stock market. Exposures to two other factors, a size based factor and a book-to-market-based factor, often called a 'Value" factor, explain a significant part of the cross-sectional dispersion in mean returns. If stocks are priced rationally, then systematic differences in average returns should be due to differences in risk. Thus, given rational pricing, the market, size and value exposures must proxy for sensitivity to pervasive risk factors in returns. Fama and French (1993) confirm that portfolios constructed to mimic risk factors related to market, size, and value all help to explain the random returns to well-diversified stock portfolios.

Many studies have been conducted to test the Three Factor Model at global, national and stock market levels. Moerman (2005) conducted a study whether the Three Factor Model was applicable only to national the level of stock or also applicable to the integrated European regional stock markets. The three factors were constructed at both European level and at national stock market levels separately and same regression analyses carried out. The countries studied were Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal and Spain. The samples covered the period July 1991 till August 2002. When the study compared the international Three Factor Model with the country Three Factor Model the differences were less pronounced. First of all, the adjusted R^2 values of the international model were marginally higher. This meant that the foreign factors hardly had any extra explanatory power compared to the domestic factors, which was in line with expectation, since these factors are highly correlated. However, the international version of the Three Factor Model is not necessarily better in explaining the portfolio returns. The results therefore meant the Three Factor Model is local and not global (Moerman, 2005).

Mirza & Afzal (2011) conducted a similar study in fifteen European countries with the aim of finding out whether the Three Factor Model was global or local given that there was international diversification of stock investment. Daily returns were employed for a period of five years from January 2002 to December 2006. The countries studied included Austria, Belgium, Finland, France, Germany, Greece, Italy, Netherlands, Poland, Portugal, Spain, Sweden, Switzerland, Turkey, and United Kingdom. The empirical results and evidence that was obtained would not enable them to reach an unambiguous conclusion. However, as also pointed out by Moerman (2005), the Fama-

French Three Factor Model was found to be poor in explaining international returns due to the varying cross-section of returns across borders.

Homsud et al (2009) conducted a similar study Stock Exchange of Thailand with the objective of measuring the efficiency of the Fama and French Three Factors Model over the period July 2002 to May 2007. The population used in this research consisted of 421 companies and were divided into 6 groups; Big High (BH), Big Medium (BM), Big Low (BL), Small High (SH), Small Medium (SM), and Small Low (SL). Big and Small was meant the size effect which measured from market capitalization of each company while High, Medium and Low meant the value effect which measured book to market value.

Homsud et al (2009) study found that Fama and French Model was more appropriate to describe in Stock Exchange of Thailand better than CAPM but Fama and French Three Factors Model has not financial theory support in new variable effect to return rate and risk of both variable that put in CAPM but only found from study that keep the relation of both variable and return rate. Moreover, the risk in Stock Exchange might have other variable that appropriate or involve more than size effect and value effect.

In the Indian stock market the empirical results, were reasonably consistent with the Fama- French Three-Factor model. This result was the conclusion of Connor & Sehgal (2001) for the period from 1989 to 1998. Their share price data consisted of month-end adjusted share prices of 364 companies (out of 8000). A maximum of 117 observations was available for each monthly return series based on those prices. The sample companies formed part of the CRISIL-500 list. CRISIL-500 is a broad-based and value weighed stock market index in India constructed along the lines of the S&P index in the

US. The CRISIL-500 covered 97 industry groups and gave a representation to companies of varying levels of size and trading activity. The sample companies accounted for a major portion of market capitalization as well as average trading volume for the Indian equity market. The bulk of the Indian shares not included in the sample were either thinly traded or did not have accounting and financial information on a continuous basis.

The first study in Pakistan that explores the Three Factor Model was done by Hassan & Javed, 2011) by employing a large sample of more than 250 stocks listed at the Karachi Stock Exchange. An analysis of the results reveals that size and book to market ratio were priced by market. Size factor was found significantly positively related to portfolio returns at 95% confidence interval. Book to market factor was also found significantly positively related to portfolio returns. Traditional CAPM was found valid as market factor was a significant factor in explaining portfolio returns. However, explanatory power of Fama and French three factor model was 15% higher than explanatory power of conventional capital asset pricing model (CAPM). The findings of the study further revealed that the Fama French Three Factor Model substantially explained the portfolio returns and its explanatory power ranged from 63% to 82% for various portfolios (Hassan & Javed, 2011).

The study of the Fama French Three Factor Model was extended to Africa through a study by Basiewicz & Auret (2010) who studied the feasibility of the Fama and French Three Factor Model on the Johannesburg Stock Exchange (JSE). The sample period spanned from June 1992 to July 2005, yielding 156 monthly observations. However, the study included into its dataset each and every firm listed between December 1989 and July 2005. On analysis the loadings on the SML were larger for portfolios containing

smaller firms and loadings on the Value minus Growth were greater for portfolios containing firms with high BE/ME ratios. Curiously, not all of the assets that contained large firms loaded negatively on the size factor. In fact, in tests that used equal-weighted assets, these loadings were positive and statistically different from zero. This result was an indication of the skewness in the distribution of market values on the JSE; there were few large firms and the rest of the firms were medium or small. In addition, the same loadings on assets that included growth firms were not reliably negative, but were never significant. The tests have provided support for these models for returns on the JSE (Basiewicz & Auret, 2010).

On the Kenyan scene little has been done to establish the performance of the Fama-French Three Factor Model among firms on the NSE despite several studies having been done to study the relationship between risk and return. A study conducted by Mogunde (2011) used simple regression to study whether the relationship between risk and return is linear. Using stock betas as the proxy for risk, the study found the relationship not to be significantly linear.

Akwimbi (2003) studied how the return and risk related among firms listed on the NSE using the APT and concluded that the APT which is a linear model was more successful in explaining the expected return in the NSE hence holding in this emerging market in East Africa.

Gitari (1989) also found the relationship between risk and return not linear as predicted by the CAPM. This study in fact provided the suggested the possibility that there was evidence of investors being under compensated or on the other being over compensated

for taking on high risks. This meant that the single factor model was not properly predicting the compensation for investors taking on higher risk.

2.4 Conclusions

The literature review demonstrates the rivalry between the CAPM and the Fama French Three Factor Model with the latter claiming to resolve the weaknesses riddling the earlier. However, the Fama French Three Factor Model has had mixed results when tested in different markets, at different times. Issues have also been raised on whether the Fama French Three Factor Model is country specific or global. The mixed findings make it relevant for a research to be done on the NSE as a contribution to this academic dialogue.

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CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter is an explicit discussion of the methodology of this research. The research was basically a linear regression with three independent factors providing the independent variables. The procedure of data collection, population, data processing, regression and objective achievement are discussed.

3.2 Research design

This was a linear regression study on the behaviour of returns on of the listed firms on the NSE based on the Three Factor Model proposed by Fama and French in 1993. All the firms on the NSE listed between 2007 and 2011 were used for the regression analysis as has been done by others like Connor & Sehgal (2001), Eom & Park (2011) and Homsud et al (2009) in the testing of the model in different stock markets.

3.3 Target Population

All the fifty-eight listed firms on the NSE (see appendix) make up the population for this study.

3.4 Sample

All the fifty-eight firms, continuously listed on the NSE between January 2007 and December 2011, were considered for the study. Wednesday data on stock prices and their

corresponding stock volumes for each listed firm were considered. According to Fama (1965) and French (1980) Wednesday prices are the most representative of stock prices for they are least affected by investor emotion. The 91-day T-Bill rates from the central banks for the same period were used.

3.5 Data collection

This research utilized secondary data from all the listed firms on the NSE. The data were collected from the database of the NSE. The data required were the Wednesday stock prices for each of the listed firms, the Wednesday stocks turnover, the book values and the market values of the listed firms. The data was electronically collected from the NSE. The data on the 91-Day T-Bill rates were collected from the Central Bank of Kenya database.

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3.6 Data Analysis

The returns for the firms were found by the Miller & Modigliani (1961) model. The dividend values were reduced to weekly values by multiplying each firm's dividend by the factor (—) to get a value $D_{i.w}$. The weekly return were then calculated by the model,

$$R_{i.w} = \frac{Dj.w}{P_0} + \frac{Pi - Po}{n}$$

Where $R_{i.w}$ is the return of company i in week w, $D_{i.w}$ is the dividend of company i in week w, P_o is the Wednesday price of shares in the week in reference, P_x is the price of the same stocks one week later. This was done for the 256 weeks and for each firm. The

market return was found by calculating the weighted average return for all the trading firms on every one of the 260 Wednesdays. The model to be used was:

$$R_m = \sum_{i=1}^{i=X}$$

Where R_M is the market return on every Wednesday, w_i is the weight of company i based on the stocks of that company sold so that:

$$w_i = \frac{St}{\sum_{i=1}^{i=x} Vt}$$

The 91 day T-Bill rate was turned into weekly risk-free rates using the model:

$$r_{f,w} = (r_T + 1)^4 - 1$$

where is the risk-free rate of week w, r_T is the 91-day T-Bill rate during the week in question. The value 4 is found by 365 -r 91.

The Book Value to Market Value of the stocks were calculated for the companies on every Wednesday and their annual average determined so as to enable the ranking from those with high ratios to those with low ratios. The equally weighted average return of top 30% and the equally weighted average return of the lower 30% were used to proxy the High and Low. The difference between the two values provided the data for the HML

to be used in the regression model. Based on the market value of stocks the companies were ranked from the biggest to the smallest. The equally weighted average return of the three largest firms and the equally weighted average return of the three smallest firms were used to find the data for SMB by finding the difference.

The Wednesday processed data on stock returns, risk-free rates, betas, HML and SMB were regressed at company level using the Three Factor Model

$$E(Ri) - R_f = di + Pi\{E[R_M] - R_f\} + SiE(SMB) + hiE(HML) + e_i$$

Where:

£"(/?[]): is the expected stock return.

Rf\ is the risk free rate proxied by the 91 -day Treasury Bill rates

$E(R_M)$\ is the expected return of market portfolio.

E(SMB): is the expected difference between the equal-weight averages of the returns on the three small stock portfolios and the three big stock portfolios.

E(HML)\ is the expected 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, sorted be neutral with respect to size.

Si is the sensitivity of the asset returns to return of SMB

h_i is the sensitivity of the asset returns to return of HML

is the residual term of any asset *i*

The T-statistics was be used to test the significance of difference from zero in a_i, ft, s_i and h_i while the F-test was used to test for the significance of the regression. The tests were carried out at a 95% confidence level. The coefficient of determination, R^2, was used to test to what extend the variation in the independent variables explain the variation in the dependent variable.

CHAPTER FOUR

DATA ANALYSIS AND PRESENTATION OF FINDINGS

4.1 Introduction

This chapter discusses the findings of the research. The objective of this research was to find out whether the TFM is applicable on the NSE. The chapter therefore discusses how variables were operationalized, it provides a statistical description of the data on the variables and how the variables related. Further the regression analysis findings are presented. An interpretation of the results is presented in the last subtitle of this chapter.

4.2 Analysis and Presentation of Findings

4.2.1 Sampling

This research conducted an analysis based on 48 companies listed on the NSE during the period 2007 January to 2011 December. Due to data reasons 12 companies did not have enough data to enable the kind of analysis. As a result only 36 were studied. The data collected from the NSE included Wednesday stocks exchanged per company, their corresponding average prices, and dividends. Data on 91-Day T-Bill rates were collected from the Central Bank of Kenya.

4.2.2 Calculation of Returns

The returns for each company were calculated based on Wednesday prices and stocks and the dividend values of the listed firms. The dividend values were divided by 52 for each company and these together with stock prices were used to calculate the weekly returns. This was done using the model

$$\frac{-}{\text{—}} \quad {}_{r}{}^{p}{}_{0} \quad + \quad \frac{\hat{\ } \ \tilde{\ }}{p_{r}{}_{0}}$$

The weekly market return was the weighted average return of the stock returns on the market. The volumes of stock of companies provided the weighting mechanism. The values of these market returns for the study period are presented in Table.

4.2.3 Calculation of Company Betas -

Company betas were calculated according to the Sharpe (1964) model. This was done by dividing the covariance between market returns in a year with the corresponding company returns in the numerator and the market return variance in the denominator. The resultant values of beta for each company for the five years of study are presented in Table 1 below. The highest beta covering all companies was 0.005924 in 2009 while the least was 0.000694 in 2011.

Table 1 Annual Betas Covering all Companies

YEAR	MARKET BETAS
2007	0.002946
2008	0.002719
2009	0.005924
2010	0.001665
2011	0.000649

(Source: Prepared by Researcher)

The company betas were calculated and the results are presented in Table 2 below. The highest value of positive beta was 2.7633 achieved by Diamond Trust in 2007. During that year it means the rate of reward of extra risk by Diamond trust was highest. The highest negative beta was -0.4583 by KCB in 2008. Some companies like TPS Serena

had returns that were insensitive to extra risk for they maintained betas of zero throughout the study period.

Table 2 Annual Betas per Companies

COMPANY	2007	2008	2009	2010	2011
Athi River Mining	0.4517	0.2699	0.5294	0.5171	-0.0463
B.O.C Kenya	0.0000	0.4513	0.0000	-0.0389	0.1156
Bamburi Cement	0.0802	0.3568	0.1511	0.4052	-0.1349
Barclays Bank Ltd	0.6512	0.2075	0.6250	0.6505	0.3841
BAT Kenya	-0.0381	-0.2604	0.0895	0.1018	-0.2159
C.F.C Bank	0.1648	0.6878	0.4347	0.0605	-0.3110
Car and General (K)	0.2704	0.4851	0.0353	0.0392	-0.3280
CMC Holdings	0.1318	1.2845	1.0441	1.1263	0.0298
Crown Berger	-0.0035	0.6466	0.2575	0.5584	1.1584
Diamond Trust Bank	2.7633	0.2469	0.9940	0.6010	0.4237
E.A Cables	0.5857	0.5284	0.7312	0.6257	0.6406
E.A Portland	-0.0080	0.2636	0.0183	-0.1433	0.0500
EA Breweries	0.1429	0.0852	0.9267	0.6105	-0.0176
EAAGARD	-0.2385	-0.2175	0.0180	-0.1403	0.4770
Express	0.0341	-0.3155	0.3717	-0.0981	0.0591
Housing Finance	0.3012	0.7003	1.7191	0.3692	0.3503
Jubilee	0.3119	0.3432	0.1400	0.4388	0.1529
Kapchorua	0.0572	0.0235	-0.0040	-0.0422	0.3352
KCB	0.3559	-0.4583	1.0923	0.6791	0.9303
Kenya Airways Ltd	0.3393	0.4481	0.4871	0.8885	1.1768
Kenya Power	0.1722	0.5590	0.9505	0.9493	-0.4397
Limuru Tea	0.0003	-0.0672	0.0059	0.0111	-0.0606
Marshalls (E.A.)	0.1483	-0.0087	-0.2064	0.0000	-0.0874
Mumias Sugar	0.2147	1.7554	0.9106	0.8182	0.1289
National Bank	3.0311	0.9759	0.9099	0.7617	0.3402
NIC Bank Ltd	-0.3585	0.5174	0.7841	0.4867	0.5798
NMG	0.1551	0.3137	0.9306	0.3994	0.2077
Olympia Capital	-0.1063	-0.0781	0.2568	0.0183	0.2272
Pan Africa Insurance	-0.3307	0.1255	0.2661	0.2145	0.1477
Rea Vipingo	0.3631	0.2971	0.3688	0.0922	0.6524
Sameer Africa	1.4289	0.5014	0.8600	-0.0602	0.7026
Sasini	0.6316	0.4136	0.6775	0.4357	0.7889
Standard Chartered	-0.0404	0.2719	0.2915	0.2089	-0.1859
Total Kenya	0.0513	-0.3150	2.5023	0.3045	0.0282
TPS (Serena)	0.0000	0.0000	0.0000	-0.0228	0.0000
Unga Group	0.9225	0.2725	0.2104	0.4781	-0.4169

(Source: Prepared by Researcher)

4.2.4 Calculation of the Small Minus Big (SMB) Variable

The Small Minus Big (SMB) variable was found by first ranking the 48 listed firms according to their sizes from the smallest to the biggest. The equally weighted average return of the biggest 30 % of the listed firms was subtracted from the equally weighted returns of the 30 % small listed firm. This was done for each Wednesday in the period of study. The results are presented in Tables 5a to 5e in the appendix.

4.2.5 Calculation of the High Minus Low (HML) Variable

The High Minus Low (HML) variable was calculated by taking the equally weighted average of the returns of the three listed firms with the highest book value to market value ratio less the equally weighted average of the three listed firms with the least book value to market value ratio. The values are presented in Tables 5a to 5e in the appendix.

4.2.6 Regression of the Variables

Table 3 and Table 4 in the Appendix provide the summary of the regression analysis of the three independent variables and the dependent variable for each of the studied companies. In Table 3 the constants terms, and the coefficients for each of the independent variables are given. In the same table the T-Values for each of the regression coefficients have been given. In Table 4 the P-Values for each of the coefficients in Table 3 are given.

The companies that had the highest constant terms were Diamond Trust Bank (0.0170) National Bank (0.0143) and Express (0.0064). Each of the coefficient terms was significant as they had T values of 1.4321, 1.2228 and 0.3700 with corresponding P-

Values of 0.1533, 0.2225 and 0.7117 respectively showing that the coefficients were not significantly different from zero. The coefficients for the market premium of the three companies were 1.3574, 1.6023 and 1.3621 respectively. These coefficient terms had their T-Values as 5.4249, 6.5032 and 4.3969 respectively. The P-values were 0.0000, 0.0000 and 0.0000 indicating that the coefficients were significantly non-zero.

For the three companies the coefficients for the HML were 0.1961, -0.0722 and -0.0849 respectively. Each of the coefficients had the T-values as 1.5524, -0.5815 and -0.5431 respectively with corresponding P-values as 0.1218, 0.5614 and 0.5876 respectively showing that the coefficients were not significantly different from zero. The SMB coefficients were 0.4324, 0.6179 and 3.5585 with the T-values being 1.2569, 1.8240 and 8.3781 respectively. The P-values were 0.2099, 0.0693 and 0.0000 respectively. While Express had the coefficient of SMB significantly different from zero, Diamond Trust Bank and National Bank had coefficients of SMB that were not significantly different from zero.

The F-Values for each of the three companies were 2982.901, 3820.87 and 6011.83 each having the P-value of zero indicating that the regression analysis was significant. However, they had weak values of R^2 of 0.12014, 0.14887 and 0.21581 respectively which showed that there was little of the variation in the dependent variable explained by the independent variables. This is confirmed by the low levels of the adjusted R^2 values of 0.10983, 0.13889 and 0.20662. The Durbin-Watson values for the three companies were 2.451, 2.532 and 2.45891 showing a negative correlation among successive error terms indicating an underestimation of the level of statistical significance of the regression.

The companies with the highest negative constant terms were Limuru Tea (-0.0147), Marshal Is E. A. (-0.0149) and B.O.C Kenya (-0.1210). These companies had F~Values of 46.494 (p=0), 703.36 (p=0) and 1580.538 (p=0) respectively showing that the regressions were significant. However, their R^2 values of 0.00212, 0.03119 and 0.06747 showed there was low percentage of the variation in the dependent variable explained by the independent variables. Their Durbin-Watson values were 1.9017, 1.81012 and 2.00468.

All the companies showed significant regressions. They showed large values of the F-statistics with P-values of zero. However, the coefficients of determination were very low indicating that the variation in the dependent variable was explained by the independent variables to a low degree.

4.3 Summary and Presentation of Findings

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This study found that there is significant relationship between the variables of the study in the regression analysis. All the listed companies found significant values of the F-Values. The F-Values show that the identified variables are significantly related or not. In this study the three variables $E[R_M] - RF$, $E(SMB)$ and $E(HML)$ had a significant regression relationship with the dependent variable $E(R_T) - RF$. However, the coefficient of determination showed that the variability of the dependent variable is not strongly explained by the independent variables. There are, therefore, some sources of variation not explained by the three variables. The findings seem to be in consonance with the finding of the study by Eom & Park (2011 which found the Three Factor Model to be sample dependent and not universal.

CHAPTER FIVE: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary

The Fama-French three factor model was viewed by the Merton (1973) analysis as a more successful asset pricing model. Unlike the CAPM the Fama-French added two more factors on the CAPM in order to come up with a more accurate model they called the Three Factor Model (TFM). The TFM operates within the same environment as the CAPM and was a reaction to both the CAPM and the Arbitrage Pricing Theory (APT) of Ross (1976). Later studies have tended to agree with the TFM. This study was an investigation of the performance of the TFM on the NSE for the period 2007 to 2010.

The contribution to this dialogue concerning the performance of the TFM provided the motivation for this study with the NSE providing context. The prices and the dividends of the various listed stocks were found and the returns calculated. The company and the market betas were calculated in order to fit the CAPM-like part of the TFM. The HML variable was calculated by taking the average return of the three companies with the highest Book Value/Market Value ratios less the average return of the three companies with the lowest Book Value/Market Value ratios for each of the Wednesdays during the study period. The three variables were then regressed with the market premium at company level.

The regressions at company level were all significant as was shown by the F-Tests. This showed that the relationships between the independent variables and the dependent variables were significant. However, the coefficients of determination showed that the

independent variables did not explain the variation in the independent variable to a large extent. Not a single company had a coefficient of determination of more than 0.355. this shows that, though the factors identified by Fama and French contribute to variation in market premium and therefore returns, there is a lot of explanation to be done by seeking to find out which other factors cause variation in the returns on the NSE.

5.2 Conclusions

This study finds that the Fama-French TFM is not applicable on the NSE for the period of study. This is because, though the relationship between the variables is significant, the independent variables provide a weak explanation for the variation in the dependent variable. The first objective of this study was to investigate whether the variability in the dependent variable is well explained by the three independent variables. The research results show that this is not the case. The independent variables as given by the TFM do not explain the variability in the dependent variable. This then leads to the second objective of whether the TFM is applicable on the NSE. This study finds that this is not possible with the three factors only. There is need to enhance the model with specific respect to the NSE by finding out which are the other variables that seem to be left out by the TFM and which should be added to the model as it is.

5.3 Policy Recommendations

The TFM should be improved in order to be responsive to the sources of variations in returns before being applied as the model of analysing and projecting .returns on the NSE. The study has shown that the three variables are significant but do not provide complete

explanation of variability in returns. This problem should be solved before the use of the model for return analysis on the NSE.

5.4 Limitations of the Study

The data covers a period of five years from 2007 to 2011 and for only the firms listed on the NSE. Despite the period being long enough the research has not delved into the periods before 2007 and further the results are time and NSE specific. This in itself raises the question of the generalizability of the findings across time and across other stock markets.

The strength of the findings of this research is weakened by the nature of the data. Some companies were disqualified from analysis due to the fact that data was not enough to provide enough numbers of observations to enable regression. Further the data is historical which raises the question of whether the results are applicable in any other time and circumstances other than those in the sample period and population.

The research has not provided an indication as to why the independent variables are not strongly explaining the dependent variable. The best it has don is to show that the explanation is weak, but the source of the weakness has not been explained.

5.5 Suggestions for Further Studies

To embolden the findings of this study, the following recommendations are suggested for further studies on this subject. The period of study can be extended to times earlier than 2007 and analyses conducted to see whether the inclusion of data for earlier periods will improve the findings and make them more accurate.

A study can be conducted to involve more than on stock market. The study can be extended to East Africa, or the whole of Africa to find out if the results will be the same or different. This will strengthen the findings in order to enable generalization.

A study should be done to investigate which variables are not being captured by the model. The low values of the coefficients of determinations are indicating that the independent variables captured by the model are not properly explaining the "Variation in the dependent variable. It can be studied why this is so and which variables are missing.

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APPENDICES

Table 3 Regression Coefficients and their T-Values per Company

	REGRESSION COEFFICIENTS				T-VALUES			
	CONSTANT	Rm-Rf	HML	SMB	Tc	T(Rm-Rf)	T(HML)	T(SMB)
Athi River Mining	-0.0019	0.4547	0.0333	0.0020	-0.6016	6.6995	0.9721	0.0212
B.O.C Kenya	-0.1210	0.1428	0.1215	0.1452	-3.8223	2.1384	3.6025	1.5068
Bamburi Cement	-0.0101	0.1843	0.0139	-0.0603	-4.5660	3.9426	0.5907	-0.9380
Barclays Bank	-0.0093	0.3720	0.0038	-0.5058	-2.2458	4.2502	0.0852	-4.2040
BAT Kenya	-0.0126	-0.0390	-0.0879	-0.1044	-0.4608	-0.6758	-3.0189	-1.3171
C.F.C Bank	-0.0087	0.3270	0.037S	-0.1014	-0.1891	3.9097	0.9972	-0.8822
Car & General (K)	-0.0071	0.2355	-0.0104	0.1598	-0.7360	2.7169	-0.2373	1.3411
CMC Holdings	-0.0103	0.0883	-0.0326	0.1935	-1.7298	0.7021	-0.5127	1.0089
Crown Berger	-0.0086	0.4875	0.1196	0.3814	-1.5707	4.2316	2.0566	2.4081
Diamond Trust Bank	0.0170	1.3574	0.1961	0.4324	1.4321	5.4249	1.5524	1.2569
E.A.Cables	-0.0084	0.6396	0.0416	-0.0377	-1.5107	5.4407	0.7010	-0.2330
E.A.Portland	-0.0135	0.0787	0.0194	0.1184	-3.5747	0.9909	0.4841	1.0840
Eaagads	-0.0036	0.3202	0.1010	1.0195	-0.5236	2.1824	1.3637	5.0545
EA Breweries	-0.0062	0.4090	0.0171	-0.3137	-2.4262	7.5937	0.6303	-4.2352
Express	0.0064	1.3621	-0.0849	3.5585	0.3700	4.3969	-0.5431	8.3781
Housing Finance	0.0032	0.8874	-0.0133	-0.4063	0.5830	7.6559	-0.2268	-2.5495
Jubilee Insurance	-0.0056	0.3533	0.0091	0.1714	-1.4825	4.4130	0.2257	1.5569
Kakuzi	-0.0075	0.3151	0.0019	0.2865	-0.7513	3.5041	0.0424	2.3174
Kapchorua	-0.0123	0.1661	0.0067	0.3954	-3.2476	2.0770	0.1649	3.5960
Kenya Airways	-0.0079	0.5766	-0.0294	0.0724	-1.9905	6.9176	-0.6988	0.6277
KCB	-0.0076	0.4312	-0.0071	-0.4931	-1.5809	4.2733	-0.1400	-3.5544
Kenya Oil	-0.0141	0.2565	-0.0384	-0.3943	-2.8967	2.5056	-0.7427	-2.8013
Kenya Power	-0.0077	0.6319	0.0399	0.0683	-1.5271	5.9189	0.7407	-0.4652
Limuru Tea	-0.0147	0.0007	-0.0008	0.0191	-14.6991	0.0337	-0.0785	0.6576
Marshalls (E.A.)	-0.0149	0.0377	0.0073	0.2445	-4.8349	0.5789	0.2202	2.7282
Mumias Sugar	-0.0043	0.7599	0.1528	-0.3678	-0.7947	6.7147	2.6749	-2.3636
NMG	-0.0072	0.4467	0.0041	-0.3533	-2.3485	6.9392	0.1275	-3.9922
National Bank	0.0143	1.6023	-0.0722	0.6179	1.2228	6.5032	-0.5815	1.8240
NIC Bank	-0.0057	0.1929	0.0257	-0.8028	-0.9592	1.5510	0.4100	-4.6958
Olympia Capital	-0.0114	0.3742	-0.1300	0.7284	-0.9027	2.9592	-2.0360	4.1892
Pan Africa Insurance	-0.0082	0.1645	0.0312	0.9009	-1.6264	1.5393	0.5784	0.6130
Rea Vipingo	-0.0077	0.5346	-0.0270	0.5209	-1.9458	6.4050	-0.6408	4.5390
Sameer Africa	-0.0055	0.7811	-0.0148	-0.0844	-1.0416	7.0009	-0.2627	-0.5504
Sasini	-0.0024	0.7331	-0.0734	0.2369	-0.4098	5.8644	-1.1621	1.3780
Standard Chartered	-0.0089	0.1105	-0.0380	-0.2648	-4.0053	2.3610	-1.6057	-4.1151
Total Kenya	0.0020	0.7525	0.0067	-0.8156	0.2496	4.3535	0.0765	-3.4319
TPS (Serena)	-0.0085	0.3863	0.0142	-0.1274	-2.2871	4.9261	0.3578	-1.1819
Unga Group	0.0027	1.1646	-0.0141	2.1276	0.2234	4.5896	-0.1099	6.0982

Table 4 Regression P-Values and Statistics

	P-VALUES				REGRESSION STATISTICS				
	Pc	P(Rm-Rf)	P(HML)	P(SMB)	F	P(F)	RSQ	ADJ R SQ	DW
Athi River Mining	0.5480	0.0000	0.3319	0.9831	512.39	0.00	0.1900	0.1805	2.430
B.O.C Kenya	0.0002	0.0334	0.0004	0.1152	1580.54	0.00	0.0675	0.0565	2.005
Bamburi Cement	0.0000	0.0001	0.5553	0.3491	2282.49	0.00	0.0946	0.0840	2.121
Barclays Bank	0.0256	0.0000	0.9322	0.0000	5943.74	0.00	0.2139	0.2047	2.014
BAT Kenya	0.0000	0.4998	0.0028	0.1890	942.04	0.00	0.0413	0.0301	2.307
C.F.C Bank	0.0295	0.0001	0.3758	0.3785	2258.68	0.00	0.0937	0.0309	1.857
Car & General (K)	0.0838	0.0070	0.8126	0.1811	631.62	0.00	0.0281	0.0167	1.948
CMC Holdings	0.0849	0.4833	0.6086	0.2642	129.60	0.00	0.0069	-0.0058	2.087
Crown Berger	0.1175	0.0000	0.0407	0.0167	1958.22	0.00	0.0823	0.0715	2.347
Diamond Trust Bank	0.1533	0.0000	0.1218	0.2099	2982.90	0.00	0.1201	0.1098	2.451
E.A.Cables	0.1321	0.0000	0.4839	0.8159	3519.64	0.00	0.1388	0.1287	2.362
E.A.Portland	0.0004	0.3227	0.6287	0.2794	147.59	0.00	0.0067	-0.0049	2.307
EA Breweries	0.0160	0.0000	0.5291	0.0000	12015.50	0.00	0.3549	0.3473	2.317
EAAGADS	0.6010	0.0300	0.1739	0.0000	2371.53	0.00	0.0979	0.0874	1.742
Express	0.7117	0.0000	0.5876	0.0000	6011.83	0.00	0.2158	0.2066	2.459
Housing Finance	0.5604	0.0000	0.8208	0.0114	9404.49	0.00	0.3010	0.2928	2.277
Jubilee	0.1394	0.0000	0.8217	0.1207	1713.03	0.00	0.0727	0.0619	2.326
Kapchorua	0.0132	0.0388	0.8691	0.0004	1120.88	0.00	0.0488	0.0377	1.767
KCB	0.1151	0.0000	0.8888	0.0005	5107.29	0.00	0.1895	0.1800	2.306
Kenya Airways	0.0476	0.0000	0.4853	0.5277	4938.01	0.00	0.1844	0.1748	2.078
Kenya Power	0.1280	0.0000	0.4696	0.6422	4315.10	0.00	0.1650	0.1552	1.994
Limuru Tea	0.0000	0.9732	0.9396	0.5114	46.49	0.00	0.0021	-0.0096	1.902
Marshalls (E.A.)	0.0000	0.5632	0.8259	0.0068	703.36	0.00	0.0312	0.0198	1.810
Mumias Sugar	0.4275	0.0000	0.0080	0.0189	8102.54	0.00	0.2706	0.2620	2.045
National Bank	0.2225	0.0000	0.5614	0.0693	3820.87	0.00	0.1489	0.1389	2.532
NIC Bank	0.3384	0.1221	0.6822	0.0000	3543.24	0.00	0.1396	0.1295	2.338
NMG	0.0196	0.0000	0.8987	0.0001	10190.16	0.00	0.3181	0.3101	2.024
Olympia Capital	0.0582	0.0034	0.0428	0.0000	1906.10	0.00	0.0803	0.0695	1.689
Pan Africa Insurance	0.1051	0.1250	0.5635	0.5404	238.39	0.00	0.0108	-0.0008	2.151
Rea Vipingo	0.0528	0.0000	0.5223	0.0000	3740.98	0.00	0.1462	0.1362	2.544
Sameer Africa	0.2986	0.0000	0.7930	0.5825	5933.55	0.00	0.2136	0.2044	2.115
Sasini	0.6823	0.0000	0.2463	0.1694	3257.50	0.00	0.1298	0.1196	2.053
Standard Chartered	0.0001	0.0190	0.1096	0.0001	3779.50	0.00	0.1475	0.1375	2.064
Total Kenya	0.8031	0.0000	0.9391	0.0007	5065.44	0.00	0.1882	0.1787	1.847
TPS (Serena)	0.0230	0.0000	0.7208	0.2384	3525.42	0.00	0.1390	0.1289	2.166
Unga Group	0.8234	0.0000	0.9126	0.0000	3468.03	0.00	0.1370	0.1269	2.063

TABLE 4: MARKET RETURNS

Table 4a (2007)

DATES	RETURN	DATES	RETURN
1	0.03791	27	0.03803
2	0.02964	28	0.03842
3	0.03152	29	0.02250
4	0.03568	30	0.02656
5	0.03063	31	0.04480
6	0.01968	32	0.09352
7	0.03605	33	0.07961
8	0.03286	34	0.13142
9	0.06952	35	0.10113
10	0.04422	36	0.16309
11	0.02064	37	0.14341
12	0.03955	38	0.11425
13	0.04588	39	0.05318
14	0.01977	40	0.06998
15	0.01825	41	0.03610
16	0.06306	42	0.03300
17	0.04516	43	0.04236
18	0.11058	44	0.14991
19	0.06383	45	0.07371
20	0.02216	46	0.03187
21	0.04650	47	0.03734
22	0.05210	48	0.00673
23	0.07889	49	0.04185
24	0.02014	50	0.03545
25	0.03965	51	0.01695
26	0.01752	52	0.12468

Table 4b (2008)

DATES	RETURN	DATES	RETURN
1	0.05528	27	0.05234
2	0.04105	28	0.07111
3	0.01416	29	0.02801
4	0.05410	30	0.04442
5	0.02290	31	0.10781
6	0.04618	32	0.02688
7	0.04106	33	0.02505
8	0.09891	34	0.03786
9	0.05654	35	0.13371
10	0.06692	36	0.01769
11	0.04597	37	0.05453
12	0.04460	38	0.04755
13	0.11350	39	0.04779
14	0.03325	40	0.01143
15	0.04997	41	0.00000
16	0.10982	42	0.05584
17	0.02596	43	0.02020
18	0.03876	44	0.16682
19	0.03598	45	0.01622
20	0.03617	46	0.02680
21	0.03111	47	0.04382
22	0.08050	48	0.02284
23	0.04487	49	0.01020
24	0.03262	50	0.00000
25	0.03565	51	0.01087
26	0.06034	52	0.00000

Table 4c 2009)

DATES	RETURN	DATES	RETURN
1	0.02731	27	0.02040
2	0.02485	28	0.01094
3	0.01429	29	0.01397
4	0.02095	30	0.03207
5	0.03406	31	0.01312
6	0.03337	32	0.03584
7	0.01820	33	0.02852
8	0.01258	34	0.01632
9	0.03496	35	0.03526
10	0.02119	36	0.00771
11	0.03854	37	0.02677
12	0.01490	38	0.01928
13	0.00835	39	0.00326
14	0.02667	40	0.00000
15	0.03511	41	0.02048
16	0.03875	42	0.03051
17	0.04212	43	0.03594
18	0.03555	44	0.06701
19	0.07289	45	0.02110
20	0.02886	46	0.03017
21	0.02040	47	0.02787
22	0.03939	48	0.03329
23	0.02332	49	0.03096
24	0.02861	50	0.02739
25	0.01147	51	0.02279
26	0.01619	52	0.01280

Table 4d (2010)

DATES	RETURN	DATES	RETURN
1	0.03151	27	0.01822
2	0.03711	28	0.00533
3	0.01749	29	0.01682
4	0.05868	30	0.00959
5	0.01423	31	0.01112
6	0.02892	32	0.02391
7	0.01883	33	0.01524
8	0.01630	34	0.00716
9	0.02008	35	0.02445
10	0.05877	36	0.04606
11	0.04125	37	0.00494
12	0.01937	38	0.00905
IB	0.03729	39	0.01202
14	0.04414	40	0.01074
15	0.00880	41	0.02196
16	0.02240	42	0.00812
17	0.03323	43	0.00864
18	0.01210	44	0.01514
19	0.01864	45	0.02656
20	0.00982	46	0.04449
21	0.04728	47	0.00271
22	0.00980	48	0.00000
23	0.06503	49	0.01043
24	0.05577	50	0.00344
25	0.01190	51	0.00000
26	0.03063	52	0.04199

Table 4e (2011)

DATES	RETURN	DATES	RETURN
1	0.02961	27	0.02364
2	0.02010	28	0.01130
3	0.02742	29	0.01575
4	0.00935	30	0.00170
5	0.00234	31	0.00000
6	0.02518	32	0.00129
7	0.01482	33	0.00000
8	0.02270	34	0.02047
9	0.02820	35	0.02017
10	0.01781	36	0.01941
11	0.00560	37	0.02645
12	0.01615	38	0.01978
13	0.00324	39	0.02230
14	0.01373	40	0.01775
15	0.01604	41	0.00212
16	0.03735	42	0.00000
17	0.02507	43	0.01850
18	0.01125	44	0.02296
19	0.02253	45	0.00988
20	0.02110	46	0.04357
21	0.00175	47	0.03678
22	0.00826	48	0.00751
23	0.01835	49	0.01853
24	0.04858	50	0.01312
25	0.01686	51	0.01909
26	0.02064	52	0.01296

TABLE 5: SMB AND HML VALUES

Table 5a 2007

WEEK	HML	SMB	WEEK	HML	SMB
1	-0.041830	0.007764	27	0.086852	-0.012636
2	-0.001739	0.004720	28	0.004881	0.002606
3	-0.014216	0.012996	29	-0.010144	-0.008878
4	0.017802	-0.001808	30	-0.030766	-0.004766
5	0.051957	-0.004389	31	-0.014288	-0.015195
6	-0.009214	0.010172	32	0.047428	0.086253
7	0.283902	-0.006374	33	0.008024	0.031649
8	0.040230	-0.004658	34	-0.017483	0.012076
9	0.051106	0.018096	35	-0.006557	-0.056111
10	-0.041742	-0.017596	36	-0.007592	-0.052601
11	0.032477	-0.000580	37	0.002360	0.034169
12	-0.045105	-0.015792	38	0.017326	0.030436
13	-0.056263	0.020942	39	0.031298	-0.000863
14	0.004466	0.002269	40	-0.000300	0.038233
15	-0.001333	-0.012594	41	-0.018627	0.012731
16	0.007936	-0.003939	42	-0.018429	-0.014182
17	0.002144	0.017892	43	0.033728	-0.015840
18	0.031638	0.008994	44	-0.177153	0.027697
19	-0.010450	-0.009750	45	0.009555	-0.000051
20	-0.016626	-0.011358	46	-0.036368	-0.019992
21	0.035171	-0.023656	47	-0.027093	0.033544
22	-0.043553	0.061369	48	-0.004869	0.075838
23	-0.000449	-0.042421	49	-0.000247	0.038188
24	0.006458	-0.010272	50	-0.008633	0.112753
25	-0.008649	0.003298	51	-0.000247	0.006082
26	-0.003624	0.009614	52	0.050810	-0.097409

Table 5b 2008

WEEK	HML	SMB	WEEK	HML	SMB
1	-0.000554	-0.027122	27	0.026832	0.016368
2	0.017872	0.065041	28	0.010525	0.002495
3	0.018139	0.016842	29	-0.038519	-0.008352
4	-0.025160	0.016129	30	-0.001536	-0.030776
5	0.007212	-0.017734	31	0.011388	0.013460
6	-0.063221	-0.014265	32	-0.011037	-0.022533
7	0.006937	0.022501	33	0.031462	-0.001725
8	-0.002521	0.061649	34	-0.011316	-0.020480
9	-0.030802	-0.035308	35	-0.012302	-0.059086
10	0.028759	-0.013448	36	-0.028691	-0.014747
11	-0.027266	0.033868	37	-0.018261	0.013060
12	-0.020982	0.237765	38	0.025030	-0.000046
13	-0.001237	-0.028756	39	-0.007696	0.041195
14	0.008146	0.067590	40	-0.106505	-0.000487
15	-0.022669	0.041966	41	-0.011906	0.001620
16	-0.028395	-0.080076	42	0.181617	-0.007212
17	-0.009462	-0.013290	43	-0.046048	-0.008840
18	-0.007844	0.008724	44	-0.537477	-0.003395
19	-0.016023	-0.027053	45	-0.022420	-0.013266
20	-0.000787	0.014919	46	-0.041842	-0.016166
21	0.012279	0.012801	47	-0.000502	0.003685
22	0.026400	0.023921	48	-0.029382	0.017348
23	0.031572	-0.009618	49	0.036785	-0.000543
24	0.023130	0.002679	50	-0.031562	0.038716
25	-0.035609	0.022711	51	-0.056152	-0.000557
26	-0.014909	-0.037007	52	-0.002108	0.005116

Table 5c 2009

WEEK	HML	SMB
1	0.035302	-0.011188
2	0.021786	0.011884
3	0.039590	0.012390
4	0.016858	0.017939
5	-0.033874	0.004253
6	0.016352	-0.037291
7	-0.000645	0.022766
8	-0.051832	0.000404
9	-0.089613	-0.067073
10	-0.079822	0.005514
11	0.019506	0.021490
12	0.013401	0.007901
13	-0.009846	0.009215
14	-0.056186	-0.011922
15	0.004242	-0.017660
16	0.006900	-0.015678
17	-0.006873	-0.029608
18	-0.003858	-0.003569
19	-0.006247	0.027279
20	0.011831	-0.016797
21	0.031845	-0.015034
22	0.015349	-0.013657
23	-0.042359	-0.019082
24	0.072805	0.001517
25	-0.086301	0.018957
26	0.025467	0.003343

WEEK	HML	SMB
27	-0.038666	-0.003470
28	-0.018910	-0.016471
29	0.044882	0.011081
30	-0.029660	0.019009
31	0.002496	0.013988
32	0.010266	0.019957
33	0.004202	-0.035897
34	0.006999	0.006503
35	-0.016401	-0.035905
36	0.024188	0.089741
37	-0.001534	0.023431
38	-0.017620	-0.045701
39	0.083451	-0.000397
40	-0.012320	0.038441
41	-0.013096	-0.023596
42	-0.061323	0.068655
43	0.017322	0.052374
44	0.028151	-0.271114
45	-0.040309	0.067677
46	0.006770	0.003244
47	-0.021830	0.009593
48	-0.007753	0.044584
49	0.198594	-0.026969
50	0.006620	-0.038034
51	-0.007760	-0.002063
52	-0.035344	0.012131

Table 5d 2010

WEEK	HML	SMB	WEEK	HML	SMB
1	0.024183	-0.012527	27	-0.002368	0.013929
2	-0.012707	-0.012192	28	0.014359	0.024356
3	0.008718	0.046174	29	-0.029063	-0.011657
4	0.030233	-0.009084	30	0.042714	0.014700
5	-0.037797	0.062621	31	-0.000266	0.019615
6	0.008755	-0.004063	32	-0.974277	0.006437
7	-0.025003	0.019455	33	-0.000067	0.008576
8	0.030458	0.044307	34	0.286016	0.016431
9	-0.035521	0.014823	35	-0.021892	0.002455
10	-0.022077	0.005060	36	-0.034323	-0.006634
11	0.046640	-0.102656	37	-0.014722	0.007545
12	-0.009960	0.045104	38	0.058497	-0.007792
13	-0.020124	-0.007921	39	-0.016579	0.012690
14	-0.015066	-0.008460	40	0.022919	0.011125
15	0.021602	0.025021	41	-0.027973	0.012857
16	0.021321	-0.031554	42	-0.000248	0.003312
17	-0.031258	-0.030994	43	0.015701	-0.022427
18	-0.018928	0.014442	44	0.031844	-0.002939
19	0.001058	0.006021	45	-0.010982	-0.016524
20	0.019949	0.018864	46	0.010755	-0.009750
21	0.052025	0.021653	47	-0.010403	-0.022621
22	-0.015807	-0.017275	48	0.017426	-0.000757
23	0.002397	-0.015136	49	0.015262	0.034313
24	0.030078	-0.030547	50	-0.015870	-0.020587
25	-0.021861	-0.051483	51	0.003714	-0.000749
26	0.028078	-0.006741	52	-0.035109	-0.020846

Table 5d 2011

WEEK	HML	SMB	WEEK	HML	SMB
1	0.000000	0.010701	27	0.000215	-0.014229
2	0.014504	-0.022823	28	-0.005372	-0.001191
3	0.007212	-0.071219	29	0.017070	0.002528
4	-0.013528	0.029309	30	0.038887	-0.000953
5	-0.020710	-0.051749	31	0.000205	-0.000022
6	0.007418	-0.016765	32	0.037439	0.171397
7	-0.006819	0.015122	33	0.000197	-0.000053
8	0.035989	-0.015629	34	0.138659	-0.029325
9	0.020955	0.046779	35	-0.017845	0.008134
10	0.088098	0.064500	36	0.009351	0.037062
11	0.000239	0.093127	37	0.000175	-0.015488
12	-0.024606	-0.019121	38	-0.008916	-0.007913
IB	0.006614	0.046390	39	0.000176	-0.003056
14	-0.018744	-0.022584	40	0.064397	-0.011485
15	0.013151	-0.009030	41	0.008786	-0.004867
16	0.076678	-0.035266	42	0.000164	-0.000013
17	0.000228	-0.021465	43	0.111275	-0.009012
18	0.006145	0.030524	44	0.577071	0.017145
19	-0.005656	0.027185	45	-0.004784	-0.003220
20	-0.005690	-0.040592	46	-0.024416	-0.007360
21	-0.029533	-0.020657	47	-0.020004	-0.077541
22	0.073856	0.050683	48	-0.333235	-0.024637
23	-0.022637	-0.002158	49	0.015533	-0.010529
24	0.011921	0.003143	50	-0.015006	-0.015875
25	0.017563	-0.011649	51	0.000148	-0.006464
26	0.017264	0.029162	52	-0.007544	0.006033

Listed Companies

(Source: NSE)

AGRICULTURAL

1. Eaagads Ltd
2. Kapchorua Tea Co. Ltd
3. Kakuzi
4. Limuru Tea Co. Ltd
5. Rea Vipingo Plantations Ltd
6. Sasini Ltd
7. Williamson Tea Kenya Ltd

COMMERCIAL AND SERVICES

8. Express Ltd
9. Kenya Airways Ltd
10. Nation Media Group
11. Standard Group Ltd
12. TPS Eastern Africa (Serena) Ltd
13. Scangroup Ltd
14. Uchumi Supermarket Ltd
15. Hutchings Biemer Ltd

TELECOM AND TECHNOLOGY

16. AccessKenya Group Ltd
17. Safari com Ltd

AUTOMOBILES AND ACCESSORIES

18. Car and General (K) Ltd
19. CMC Holdings Ltd
20. Sameer Africa Ltd
21. Marshalls (E.A.) Ltd

BANKING

22. Barclays Bank Ltd
23. CFC Stanbic Holdings Ltd
24. Diamond Trust Bank Kenya Ltd
25. Housing Finance Co Ltd
26. Kenya Commercial Bank Ltd
27. National Bank of Kenya Ltd
28. NIC Bank Ltd
29. Standard Chartered Bank Ltd
30. Equity Bank Ltd
31. The Co-operative Bank of Kenya Ltd

INSURANCE

32. Jubilee Holdings Ltd
33. Pan Africa Insurance Holdings Ltd
34. Kenya Re-Insurance Corporation Ltd
35. CFC Insurance Holdings
36. British-American Invest (K) Ltd

INVESTMENT

37. City Trust Ltd
38. Olympia Capital Holdings ltd
39. Centum Investment Co Ltd
40. Trans-Century Ltd

MANUFACTURING AND ALLIED

41. B.O.C Kenya Ltd
42. British American Tobacco (K) Ltd
43. Carbacid Investments Ltd
44. East African Breweries Ltd
45. Mumias Sugar Co. Ltd
46. Unga Group Ltd
47. Eveready East Africa Ltd
48. Kenya Orchards Ltd
49. A.Baumann CO Ltd

CONSTRUCTION AND ALLIED

50. Athi River Mining
51. Bamburi Cement Ltd
52. Crown Berger Ltd
53. E.A.Cables Ltd
54. E.A.Portland Cement Ltd

ENERGY AND PETROLEUM

55. KenolKobil Ltd
56. Total Kenya Ltd
57. KenGenLtd
58. Kenya Power & Lighting Co Ltd