ASSET PRICING RISK PREMIA, INVESTOR SENTIMENT AND STOCK RETURNS IN KENYA

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Investor Sentiment and Stock Returns in Kenya

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DECLARATION

This thesis is my original work and has not been presented for a degree in any other University.

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DEDICATION

To my wife Rhodah, my sons, Albert and Reagan and my daughter Patience.

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ACRONYMS AND ABBREVIATIONS

ADF	Augmented Dickiey-Fuller
ADR	Advancing Declining Ratio
AIC	Akaike Information Criterion
ANOVA	Analysis of Variance
APM	Arbitrage Pricing Model
APR	Asset Pricing Risk
AR	Autoregressive
ARDL	Auto-Regressive Distributed Lag
ASTG	Asset Growth
B/M	Book-to-Market
BE	Book Value of Equity
BG	Breusch-Godfrey
CAPM	Capital Asset Pricing Model
CCAPM	Consumption-based Capital Asset Pricing Model
CLRM	Classical Linear Regression Model
CMA	Conservative minus Aggressive/Capital Markets Authority
DPS	Dividend per Share
DVM	Dividend Valuation Model
EBIT	Earnings before Interest and Tax
ECM	Error Correction Model
ECT	Error Correction Term
EMH	Efficient Market Hypothesis

FF3FM Fama and French Three Factor model

FF5FM Fama-French Five Factor Model

FF5FP Fama-French Five Factor Premia

GARCH-M Generalized Auto-Regressive Conditional Heteroskedasticity in Mean

GDP Gross Domestic Product

GEMS Growth Enterprise Market segment

GMM Generalized Method of Moments

GRS Gibbons, Ross and Shanken

HML High Minus Low

HQ Hannan-Quinn information criterion

ICAPM Intertemporal Capital Asset Pricing Model

IPO Initial Public Offering

JSE Johannesburg Stock Exchange

MAE Mean Absolute Error

MC Market Capitalization

ME Market Value of Equity

MEVM Modified Equity Valuation Model

MIMS Main Investment Market segment

MPT Mordern Portfolio Theory

MRP Market Risk Premium

MSCI Morgan Stanley Capital International

NSE Nairobi Securitie Exchange

NYSE New York Stock Exchange

OLS Ordinary Least Squares

OP	Operating Profitability
OPROF	Operating Profit
PCR	Put-Call Ratio
PPE	Property Plant and Equipment
PRF	Population Regression Function
RBC	Return on Big-Conservative stocks
RMSE	Root Mean Squared Error
RMW	Robust Minus Weak
ROE	Return on Equity
RSL	Return on Small-Low B/M stocks
SC	Schwarz Information Criterion
SENT	Investor Sentiment
SEO	Seasoned Equity Offering
SIC	Schwarz Information criterion
SMB	Small Minus Big
SSA	Sub-Saharan Africa
TA	Total Assets
TL	Total Liabilities
UK	United Kingdom
US	United States
VEC	Vector Error Correction
VIF	Variance Inflation Factor
WBG	World Bank Group

DEFINITION OF KEY TERMS

Asset Growth Risk Premium:	The spread in average return between conservative investment portfolios and portfolios invested under the aggressive investment policy (Sundqvist & Toni, 2017; Titman, Wei & Xie, 2004).
Asset Pricing Risk Premia:	Firm level fundamental variables that proxy for risk in equilibrium models (Fama & French, 2015).
Investor Sentiment:	The tendency by individuals to trade on the basis of emotions and noise rather than fundamentals, resulting in securities mispricing (Baker & Wurgler, 2007).
Market Risk Premium	Return above the risk-free rate which is required by investors as the reward for investing in a risky market portfolio (Cochrane, 2011).
Moderating Variable:	A variable that changes the direction or magnitude of the relationship between two variables (Namazi & Namazi, 2016)
Profitability Risk Premium	The spread between average return on a well-diversified portfolio of stocks with robust and weak operating profitability (Sundqvist & Toni, 2017).
Size Risk Premium	Additional returns historically received from investment in stocks of companies with comparatively small market capitalization. (Fama & French, 2006)
Stock Returns:	Market value weighted average of the return on each equity stock in a portfolio for a particular period (Arabi, 2014).
Value Risk Premium	The spread in returns between portfolios with high and those with low book-to-market ratios (Karp & Vuuren, 2017).

ABSTRACT

Stock returns form an essential element in capital allocation and investment decisions across the economy by providing an approximation of the cost of capital for a project, division or firm. In a stock market where return generation process is well established, investors are able to quantify risk and translate it into expected returns for the purpose of making right investment choices. Returns at Kenyan market are however generally depressed and experience high volatility arising from changes in overall market risk. Consequently, investors have often suffered heavy losses in terms of unrealized market valuation whenever foreign investors exit the market to seek other safer investment options with guaranteed returns in developed markets. This has consequently ignited a long-standing debate over the ability of the Kenyan equity market to correctly price securities and hence predict returns. This study investigated the pricing effect of premium on market, size, value, profitability and asset growth. It also explored the moderating effect of investor sentiment on the relationship between Asset Pricing Risk (APR) premia and stock returns in Kenya. The study was underpinned by the Modified Equity Valuation Model, Noise Trader Theory and principles underlying the Capital Market Theory. Quantitative causal time series design was applied in the analysis of cause-effect relationship among the study variables. The study was a census all listed the 64 listed firms at the NSE as on 31st December 2019. Analysis was on monthly time series data on variables spanning the period 2011-2019. The results of Augmented Dickey Fuller (ADF) and Philips-Perron (P-P) tests indicated a mix of variables stationary at level and 1st difference. The F-bounds cointegration test revealed long-run relationship among the variables and therefore the Auto-Regressive Distributed Lag (ARDL) and Error Correction Models (ECM) were used for estimation. Residual diagnostic tests were conducted to ensure stability of estimates. The findings indicated that market and size had positive significant coefficients while profitability was negative and significant. This implies that investors require higher rate of return for increases in market-wide risk and for exposure to small stocks. Investors however require low rate of return on profitability investment strategy. The coefficients on value and asset growth were not significant. The study further established that investor sentiment moderates the individual effect of market, value and asset growth. The study did not however find evidence for moderating effect of sentiment on APR premia and stock returns relationship. This implies that overall, the effect of asset pricing risk premia on stock returns does not vary with level of sentiment at the Kenyan market. The study recommended an optimal model that incorporates market, size, profitability and sentiment as proxies for systematic risk in the investment decisions by market players in Kenya.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Stock returns refer to the market value weighted average of the return on each stock in a portfolio (Arabi, 2014). Cochrane (2011) distinguished between stock returns in a time series and in a cross-section. Time series stock returns relate to how the returns change over time whereas cross-sectional variation is concerned with how the returns change across different stocks or portfolios (Cochrane, 2011). Stock returns have inspired the interest many researchers in finance due to the fact they provide useful signals regarding the future state of the economy and financial status (Shafana, et al., 2013). They form an essential element in capital allocation and investment decisions across the economy by providing an approximation of the cost of capital of a project, division or firm. The stochastic behavior of expected stock returns also provides information concerning expectations and risk attitudes of investors in the market. Rising stock returns provide a stimulus to the confidence of households and firms and reduces the uncertainty about future economic situation. Declining stock returns, on the other hand, imply loss of wealth for investors and may, at extreme levels, lead to a financial crisis in a country like that which hit the US markets in 1929, 1987 and 2008 (Arabi, 2014).

1.1.1 Perspectives on Asset Pricing Risk and Stock Returns

Equity markets play a significant role in driving economic growth and wealth creation around the world. It is estimated that equity markets account for US Dollars (USD) 1372.12 billion of the global wealth (World Bank Group [WBG], 2020). This wealth is however, according to the WBG report, disproportionately distributed in favor of developed economies owing to favorable stock returns in those markets. The globaleconomy.com database for the year 2021 averaged annual stock market return at 32.21% for developed markets, 18.26% for emerging economies and 15.48% for Africa. The return was 25.67% for the emerging frontier markets as measured on Morgan Stanley Capital International (MSCI) Index. The MSCI index (2021) ranked

Venezuela highest globally at 991.39%, Iceland (52.66%) in Europe, Argentina (54.64%) among the emerging economies and Nigeria (47.63%) in Africa. Kenya's stock market returns averaged 12.37% over the same period. The effect of large variation in cross-section of stock returns therefore implies that risks and potential for both upside and downside consequences of investment choices are substantial

Over the past decade, investors seeking to improve risk-return tradeoff of their portfolios have turned towards developing markets as avenues of new opportunities for global diversification. Ochenge and Muiru (2017) indicated that frontier regions are increasingly becoming an avenue for growth prospects. These markets are however prone to high sentiment, low liquidity and non-normally distributed equity returns across the countries and listed stocks. Basiewicz and Auret (2010) posit that in many African equity markets, the return generating process is not well established making it difficult to price assets. The authors further note that African markets are more concentrated in a few stocks which tend to trade irregularly and infrequently and equity returns are non-normally distributed the authors further indicate that African markets experience high uncertainties arising from lack of effective regulation and weak surveillance systems thereby contributing to low investor morale

The Kenyan equity market plays a key role in channeling finance to the corporates and other strategic sectors of economy which contributed 30.8% of the Kenyan Gross Domestic Product (GDP) in 2017 (Forbes Survey, 2017). The MSCI Kenyan index for the year 2021 placed an average annual stock market return of 12.37% for Kenya, way below 18.26% for emerging economies, and 15.48% for Africa. Overseas investors on this market have an average participation rate of between 60% and 70%. Just like other African and Sub-Sahara countries, corporate earnings at the NSE are generally depressed with frequent instances of profit warnings from the listed firms (CMA Annual Report (2016). In this regard, foreign investor flights is a common phenomenon at the Kenyan equity market as investors seek other safer investment options with guaranteed returns in developed markets.

In stock markets where return generation process is well established, investors are able to attach correct prices on stocks and hence make right investment choices that would earn them higher risk adjusted returns. Basiewicz and Auret (2010) posit that many African equity markets are sentiment prone with less established return generation process thereby making it difficult for investors to price assets correctly. As cited in Ochenge and Muiru (2017), Kenya ranks among the economies with high cost of raising equity (Hearn & Piesse, 2009). For this reason, determination of a benchmark model for predicting expected return in a dynamic risk environment is a subject that has occupied a central position in the financial economics literature and continues to draw attention of researchers and finance practitioners across the world (Taha & Elgiziry, 2016). A section of asset pricing studies show that cross-sectional variation in stock returns can be explained by exposure to macro-economic factors and firm level fundamental characteristics that capture part of the systematic risk (Kubota & Takehara, 2018; Karp & Vuuren, 2017).

Fama and French (2015) identified size, value, operating profitability and asset growth as the most prevalent firm level fundamental variables both with respect to time and number of securities markets where they had been identified. The Fama-French 5-Factor (FF5F) risk premia is a combination of risk factors identified through a series of asset pricing studies seeking to establish a reliable model for describing the relationship between a financial asset's risk and expected return (Kubota & Takehara, 2018). The risk premia in the model represent asset exposure to systematic risk where firm level profitability and investment factors are added to their earlier three-factor model developed in 1993 which incorporated market, size and value factors. The FF5F model is believed to be superior in describing return patterns in the US market (Kubota & Takehara, 2018). There has been, however, concern among scholars as to whether asset pricing models developed in mature contexts are arguably relevant for explaining cross-sectional variation of stock returns in sentiment prone frontier and emerging market settings. In light of the differences between the developed and frontier markets, zivkovic (2012) advocated for development of context specific asset pricing model that would take into account the unique features of the market under consideration.

Consequently, studies particularly after the 2008 global financial crisis emphasize the role of market imperfections in the study of equilibrium models (Zhang, 2010; Yang & Chen, 2014). Whereas traditional finance theorists assume that investors are rational, a contrasting perspective rooted in behavioral finance, however, maintains that investors are not fully rational and that stock returns may be affected by factors other than fundamentals (Schmeling & Shiller, 2009). Thus, a new strand of literature has revealed a possible impact of investor irrationality in explaining stock returns. Researches documenting the magnitude and direction of the impact of investor irrationality on asset pricing decisions are however scarce. Thus, for over half a century, academicians and practitioners have sought to develop an accurate asset pricing model under relaxed assumptions of the traditional finance theory (Basiewicz & Auret, 2010).

1.1.2 Asset Pricing Risk Premia and Stock Returns

According to Efficient Market theory, an asset's return is proportional to its exposure to overall market risk if the model is properly specified and security markets are information efficient. Studies from the developed and emerging markets however show that the market premium alone fails to capture all relevant risks associated with asset returns (Fama & French, 2006; Lind & Sparre, 2016; Kubota & Takehara, 2018; Karp & Vuuren, 2017). Subsequent empirical studies on asset pricing have unearthed returns apparently not explained by the market risk premium called anomalies. According to Keim (2008) anomalies can be categorized as time-series (calendar related), technical (trend related) or fundamental based anomalies (financial statement related). Fama and French (2015) identify size, value, operating profitability and investment as the most prevalent fundamental anomalies both with respect to time and number of securities markets where they have been identified.

Size risk premium, initially reported by Banz (1981) and affirmed by Berk (1997) relates returns on a share to its market value. It refers to the tendency by small firms to generate higher risk-adjusted returns than large firms. At equilibrium, a firm's market value is determined by discounting expected future cash flows at the firm's appropriate discount rate. Thus, size effect has foundation in the fundamental valuation theory. Size effect has been extensively studied across major stock markets in the world. Selected global studies that observe significant but weak size effect include Faff (2017) and Gaunt (2004) in Australia, Sundqvist and Toni (2017) in Nodic countries and Griffin (2002) in the UK. In Sri Lanka, size premium was found to explain highly stock returns of financial firms than when full sample was considered (Shafana et al., 2013). On the flip side, Anuradha (2007) reported negative size effect to return relation on the Colombo Stock Exchange. In the African context, Hearn and Piesse (2013) documented a positive significant size effect in Nigerian while Njogo, Simiyu and Waithaka (2017) found inverse relationship between size risk and returns at the Kenyan stock market. The absence of a general consensus on the direction and magnitude of size effect as evidenced in the foregoing conclusions could be attributed to unique characteristics of the markets studied and methodology choices adopted, which provided motivation for further research into this factor.

The value effect is the link between a firm's current book-to-market (B/M) ratio and forecasted stock returns (Karp & Vuuren, 2017). Firms judged by markets as having poor prospects will be signaled by low stock prices and high book-to-market ratios (Artmann, Finter, Kempf & Theissen., 2012). Therefore, such firms are considered risky and will tend to have high expected stock returns or high cost of capital. Value effect is attributed to expectation errors made by investors in terms of over and undervaluation of stocks. This argument is supported by Li, Brooks and Miffre (2009) who opines that professional arbitrageurs are risk averse and will tend to avoid stocks with high B/M ratio. Further, non-professional investors, being more sensitive to transaction costs will not trade to take up advantage of this anomaly to earn abnormal profits thereby causing the anomaly to persist. Significance of value premium in asset pricing studies is found to be strong in the developed global markets such as United Kingdom (UK), Canada and Japan (Griffin, 2002). Whereas a section of asset pricing literature in emerging markets show that returns on individual stocks tend to be an increasing function of the B/M ratio (Kubota & Takehara, 2018, Kilsgard & Wittorf, 2011) other studies find a significant negative book-to-market factor (Shafana et al., 2013). Auret and Sinclair (2006) found a significant value effect in South Africa, similar to Njogo et al. (2017) at the Kenyan equity market under the momentum augmented FF5F model. It was therefore necessary to establish if value effect is priced at the NSE when studied within the FF5F model approach under market imperfection.

Firm investment, commonly referred to as asset growth anomaly (Cooper, Gulen & Schill., 2008) or investment intensity (Yao et al., 2017) is the persistent pattern in stock returns where corporate events associated with asset expansion (contraction) tend to be followed by periods of abnormally low (high) returns, in line with fundamental valuation theory. Cooper et al. (2008) findings show that firms with low asset growth rate outperform those with high asset growth rate. These findings have elicited new interest among researchers to seek explanation for why asset growth effect on stock returns occurs. Constantinou, Karali and Papanastasopoulos (2017) argued that asset growth effect is due to either the risk that investors take on when they invest in a firm or to mispricing by investors during the investment-making process. Other factors held constant, an increase in the cost of funding is likely to lead to a decline in level of investment the reason being that high cost of funding would limit accessibility to funding sources by investors. A decrease in the cost of capital, on the other hand, tends to stimulate investment. It is therefore reasonable to conjecture an inverse relationship between a firm's expected return (cost of capital) and its level of investment.

A section of empirical studies attributes much variation in expected stock returns to asset growth premium (Aharoni, Grundy & Zeng., 2013). Other studies conclude that adding investment premium to equilibrium models considerably worsens the Gibbons, Ross and Shanken (GRS) statistic suggesting that investment does not add value to asset pricing (Chan, et al., 2008; Cooper et al., 2008). Titman and Xie (2004) found that financing choices for US firms that are associated with increase in capital investments results in negative stock returns. On the other hand, Njogo et al. (2017) found that investment premium captures the exposure of a portfolio of stocks with low rate of investment at the NSE. In view of different interpretations from scholars, further investigation on investment-return relation was necessary so as to offer solution to the conflicting results in prior literature.

The level of profitability reflects a firm's productivity in the current competitive environment for its product markets (François & Théoret, 2016). Over time, firms experience swings in their performance due differences in their competitive position and operating environment. Cochrane (2011) contends that profit is a cyclical variable which is related to macroeconomic and financial shocks. Profitable firms are considered by investors as possessing strong fundamentals for future growth which would imply low required rate of return (Hou, et al., 2015). The modified dividend valuation model illustrates that holding constant the net book value of equity, market value of equity and growth in total assets, high expected future earnings would warrant higher expected return. The explanation is that profits are the reward for growth and innovation, which exposes entrepreneurs to greater business risk and therefore investors would demand higher expected returns (Fama & French, 2008). The findings by Basiewicz and Auret (2010) in South Africa indicate that less profitable firms yield lower returns than their profitable counterparts. These findings are similar to the intuition in Novy-Marx (2013) who observed significant higher average returns from profitable firms (despite having high valuation ratios) than unprofitable firms. Results of a study by Mosoeu and Kodongo (2017) showed that profitability premium is significant in explaining average returns across the selected emerging markets. Research documenting the effect of profitability risk premium as a determinant of future stock returns in Kenya is however scanty thus justifying the current study.

1.1.3 Investor Sentiment

From the perspective of Baker and Wurgler (2007), investor sentiment is a belief influenced by emotion regarding future cash flows and investment risks which has no justification of facts at hand. Behaviourists hold the view that investors are not fully rational and that stock prices (hence returns) may be influenced by factors other than fundamentals. Schmeling and Shiller (2009) opined that investors have a tendency to extrapolate previous experience into the future and thus make investment decisions based on their beliefs. Key proponents of behavioral asset pricing (Baker & Wurgler, 2007) argued that all investors do not hold a common view about the fundamental price due to inherent psychological biases. This may induce demand shift due to irrational speculation.

Zouaoui, Nouyrigat and Beer (2011) opined that when investors are pessimistic about stocks characterized by series of earnings lower than expected, they tend to avoid them and as a result, such stocks will command higher expected returns. Optimistic beliefs, on the other hand, boost investor confidence which in turn drives investors to underestimate risk leading to low expected returns. Whereas classical finance theorists believe that mispricing caused by irrational traders can be offset by rational arbitrageurs, behaviorists however, argue that there exist limit to arbitrage in exploiting the irrational trader's misperceptions and that investor sentiment may not be fully countered by arbitrageurs thereby affecting stock returns. Thus, it is conjectured that variations in investor sentiment may either induce systematic risk which could impact the formation of stock prices and overall trading decisions or may modify the effect of firm level fundamental characteristics on stock returns (Lee & Swaminathan, 2002).

Application of investor sentiment variable may have practical implication on investment decisions in securities markets. Baker and Wugler (2006) opined that adding sentiment variable to equilibrium asset pricing models would significantly impact the determination of fundamental value of stocks with certain attributes. This argument arises from the knowledge that due to wide variations in IS, mispricing is bound to set in. Supporting this line of thought, Stambaugh, Yu and Yuan (2012) noted that mispricing can occur for many stocks during periods of high sentiment which may potentially have effect on the investor's wealth and overall market stability. The authors further suggest that systematic mispricing in the market arising from investor psychological biases might cause resource misallocation in the economy due to investors' wrong beliefs about discount rates and hence wrong approximation of the required rate of return on investments.

Existing empirical studies on cross-sectional tests of asset pricing models (APMs) are, according to Iqbal, Brooks and Galagedera (2010), increasingly coming to a consensus that IS augmented APMs explain stock return behavior better than specifications without investor sentiment variable. Results of a study by Bathia and Bredin (2012) showed that sentiment augmented asset pricing models help to capture the predictive ability of firm size, value, liquidity and momentum in explaining risk-adjusted returns of individual stocks at the New York Stock Exchange (NYSE). Dash and Mahakud (2015) found evidence to suggest the importance of sentiment risk as the missing risk factor in explaining the stock return variations in India. Tran and Nguyen (2013) observed inverse connection between investor sentiment and stock returns in a study conducted in Norway and Vietnam. Contrary findings were however noted by Chuang, Ouyang and Lo (2010) who observed a direct relationship.

More recent strand of asset pricing studies have redirected research focus towards the role of sentiment risk on pricing effect of a set of anomalies in a cross-section of stock returns. For instance, Stambaugh, Yu, and Yuan (2012) document stronger anomalies following high levels of sentiment. Yao, et al. (2017) observed that investment risk factor is not only statistically positive but also has an asymmetry that is higher during market downturn but lower under bull market in China. From the foregoing review, it suffices to note that there is little research evidence on the role of investor sentiment on pricing effect of equity risk factors. Studies on sentiment augmented asset pricing are a rarity in developing countries. A study by Dalika and Seetharam (2015) revealed a strong negative relationship between investor sentiment and stock returns in South Africa, among highly volatile growth and young stocks. This study, therefore, bridged a significant contextual research gap in asset pricing literature.

1.1.4 Advances in Asset Pricing Models

The foundation work in finance research seeking to explain risk and return relationship was laid by Markowitz (1952) who proposed the idea of how investors aiming to maximize returns can construct efficient portfolios depending on their risk preferences. The Markowitz argument, variously referred to as Modern Portfolio Theory (MPT) defines the expected return and risk respectively as mean and variance. The MPT reveals the relationship between expected return and risk (variance) based on the assumption that all the investors are risk averse. According to the MPT, diversification strategy can reduce a portfolio's risk given the same expected return. Arguably, if the investors expect higher returns, they need to take greater risk. Thus Markowitz provides new enlightenment for investment behavior.

On the basis of MPT, Sharpe (1964), Lintner (1965) and Mossin (1966) individually developed a model built around a single market factor under uncertainty herein referred to as the Capital Asset Pricing Model (CAPM). The model is an extension of the theory of portfolio choice developed by Markowitz (1952), which assumes that the market portfolio is efficient and that expected returns on stocks are a positive linear function of their relative market risk. Besides estimating the expected return on equity, the single premium model CAPM provides a framework for quantitatively finding out the association between the beta of an asset and its expected return, where beta is defined as the index of sensitivity of asset returns to the systematic risk of that asset. The coefficient of the market factor in model illustrates the extent to which the return on a stock moves in relation to the market portfolio. At equilibrium, the hypothesis is that the true intercepts (alphas) are indistinguishable from zero. In case they are different from zero, it is argued that the performance measure (Jensen's alpha) is due to a portfolio manager's skill to forecast security prices. The model is built on the insight that unsystematic risk can be eliminated by investing in a diversified portfolio and hence investors only require to be compensated for bearing systematic risk measured by beta. In this regard, all investors will hold the same risky portfolio but vary the riskiness of their investment by increasing or reducing their investment in the risk-free asset. The investor can reduce portfolio risk by choosing stocks that are negatively correlated. A lot of empirical researches have indicated that the stock return cannot be entirely explained only by the market premium. There still exist a number of patterns in stock return behavior observed on the stock market which cannot be explained by CAPM and some of the model assumptions are in some was problematic. Hence, CAPM cannot therefore represent perfectly the investor behavior in financial markets.

The theoretical underpinnings of the standard CAPM and its inability to fully explain variations in average returns has given researchers incentive to create extensions and alternative models that would capture better the risk-return relationship. Some noteworthy extensions to the standard CAPM include intertemporal CAPM (ICAPM) which considers multi-period maximization of return while hedging firm specific risk (Merton,1973) and consumption-based CAPM (CCAPM) developed by Rubinstein (1976), Lucas (1978) and Breeden (1979), creating a connection between stock returns and aggregate consumption. Ross (1976) developed Arbitrage Pricing Model (APM) to address the equilibrium asset pricing problem. The APM postulates that a security's expected return is influenced in a linear relationship by a variety of factors. According to APM, arbitrage opportunities exist momentarily but in efficient markets, the price should adjust quickly as the arbitrage opportunities are exploited. Further, the model assumes that there are multiple system wide risk factors that may cause variation in asset returns, and sufficient assets in the market to diversify away the non-systematic risk. Thus, various multi-factor models can be developed out of APM due to existence of multiple number of unidentified factors.

Fama and French (1992) analyzed the performance market beta, market value of equity (ME), Book-to-Market (B/M) ratio, Earnings to Price (E/P) ratio and firm leverage using cross-sectional regression approach on US firms. They found that the market beta cannot fully explain risk-return relationship among equity stocks and that size effect and B/M ratio have good explanatory power on stock returns. Further, the study established that the effect of leverage and E/P ratio can be explained adequately by the market equity and B/M ratios. Building on their earlier empirical work, Fama and French (1993) established the three-factor model to explain the cross-section of average stock returns. The model assumes that the variation in stock returns can be explained by three factors viz., excess market return, size factor and book-to-market equity factor. They showed that these two firm characteristics proxy for sensitivity to risk factors in returns, proposing a three-factor model that is consistent with these anomalies. Although their three-factor model is reliable with for rational-pricing, they admit that size and B/M ratio (value factor) remain arbitrary indicator variables that, for unexplained economic reasons, are related to risk premia in average returns (Fama & French, 1995). They only give a vague explanation, in which they state that size and value proxy for risk factors that might capture the risk of financial distress (Fama & French, 1996).

Further input in the search for an accurate asset pricing model is the seminal work by Jegadeesh and Titman (1993) who discovered a temporary pattern in prices referred to as prior return or momentum anomaly. According to their findings, past stock returns were seen to have explanatory power in the cross section of equity stock returns. Jegadeesh and Titman observed that stocks whose prices were on an upward (downward) trajectory over the past 3 to 12 months have a higher probability of continuing on that upward (downward) trajectory over the next 3 to 12 months. Jegadeesh and Titman (1993) demonstrated that investment strategy that involves simultaneously buying (taking long position) in past winners and selling (taking short position) in past losers generates significant abnormal returns over subsequent holding periods of 3 to 12-months. Such abnormal returns generated by the offsetting long and short positions appear to be independent of market risk premium, size risk or value factors and has persisted in the data for many years. To this end, Carhart (1997) estimated an extension of model that includes a momentum factor (in addition to market, size and value premia).

Fama and French (2015) introduced a five-factor asset pricing model that augments their three-factor model by adding the profitability and investment factors to improve the interpretation of market anomalies. The two new factors are defined as the difference between robust and weak profitability and the difference between conservative and aggressive investment portfolios. Based on US market data the results in their study indicate that the five-factor model has better performance than the three-factor model in explaining the variation in expected stock returns. Moreover, the value premium becomes redundant after adding these two new factors. The five-factor model is still unable to account for a wide range of anomalies in asset pricing and cannot successfully explain the portfolio return of small stocks with aggressive investment and low profitability. Thus, the search for an extended multi-premium model, which would be able to capture additional risk premia, is still ongoing.

1.1.5 The Kenyan Equity Market

The NSE was constituted in 1954 as a mutual association of stock brokers registered under societies Act with the objective of facilitating mobilization of resources to provide long term capital for financing investments. In 2011, the stock market transitioned into a full-service securities exchange supporting trading in equities, debt and derivatives. In the same year, the business segments were reclassified into ten (10) equity and three (3) debt categories (CMA Annual Report, 2011). There were sixty-four firms listed across thirteen counters of the Exchange as on December 31st 2019 with about two thirds (65.6%) of the firms categorized as non-financial. The bourse is characterized by predominance of blue-chip companies with top five acccounting for 67% of the total market capitalization (Capital Markets Authority Annual Report, 2019). The NSE deals in both variable and fixed income securities. Trade at the exchange is facilitated by licensed market intermediaries who offer investment services to the investors. Investors pay a brokerage commission of up to 2.1 percent per trade at the bourse with a capital gains tax chargeable at the rate of 5%. Currently, NSE publishes daily statistics on five market indices to help investors in performance evaluation of the key segments of the exchange.

The NSE 20 share index tracks the performance of 20 blue chip firms at the Kenyan equity market. The index reached a peak of 5,491 points with a market capitalization of Ksh. 2.3 Trillion in 2014; a pattern associated with strong foreign investor activity and increased investor confidence (CMA Annual Report, 2014). In 2015/2016 review period, cumulative returns on investments fell by 20.9% as measured by NSE 20 share index to close at 3641 points. The highest decline was in January 2017 when the index dropped to 2,794.27 points. In 2016, the Sub-Saharan Africa (SSA) experienced a bear market cycle coupled with a decline in GDP growth of 1.4%. During that period, all the SSA equity markets registered negative returns except Zimbabwe and South Africa. The CMA Annual Report (2016) attributed the decline to depressed performance of listed companies as reflected in the high instances of profit warnings and the uncertainty arising from the central bank decision to cap interest rates. The observed volatility in traded volumes, market capitalization and prices in response to changes in market conditions necessitated the need to establish if investor sentiment could influence asset pricing in emerging and frontier markets.

1.2 Statement of the Problem

In stock markets where return generation process is well established, investors are able to attach correct prices on stocks and hence make right investment choices that would earn them higher risk adjusted returns. Basiewicz and Auret (2010) posit that many African equity markets are sentiment prone with less established return generation process thereby making it difficult for investors to price assets correctly. The bearish market sentiment in 2018 occasioned by increased market risk saw the Kenyan equity market index shed off 23.7% leading to Ksh.149 billion paper loss in unrealized market valuation (Cyton Market Review, 2018). Consequently, the market suffered massive foreign investor exists as they sought other safer investment options with guaranteed returns in developed markets. Questions linger over the ability of Kenyan equity market to correctly predict asset prices so as to guarantee investors higher risk-adjusted returns than the cost of invested capital.

The focus of researchers in emerging and developing stock markets has for decades shifted towards determination of a benchmark model for predicting expected return in a dynamic risk environment (Arabi, 2014). The process of estimating expected return is straight forward in stock markets where there are no frictions, investors are rational and the return generation process is efficient. This is however, not the case with developing markets which are prone to high volatility, thin trading, illiquidity, strong sentiment, and non-normally distributed equity returns (Schoenfeld, 2011; Syed, Mohsin, Khalil & Zulfiqar., 2017). Lack of efficient asset pricing framework implies that prices do not reflect their fundamental value and investors cannot make decisions that could enhance their overall wealth.

There exist divergent theoretical views that attempt to explain the nexus between APR premia and stock returns. According to the capital market theory, investors seeking to maximize returns require compensation for accepting non-diversifiable risk often expressed in equilibrium asset pricing model. The standard CAPM provides a framework for quantitatively finding the association between systematic risk of an asset and its expected return. The single factor model however does not adequately explain variations in average returns which has motivated the development of alternative models that would capture better the risk-return relationship. Fama and French (2015) applied a modified Equity Valuation Model framework that includes size, value, profitability and investment as the most prevalent firm level fundamental variables that proxy for systematic risk. The model has since been widely tested in the US, Europe, Japan and Asian Pacific countries. The results however revealed lack of consistency in the magnitude and direction of the influence of individual predictors across the capital markets. Questions also emerge as to whether asset pricing models developed in other contexts are arguably appropriate for estimating cost of equity by investors looking to diversify their portfolios in developing markets.

Conceptually, asset pricing researchers in developing markets have tended to incorporate market imperfections in their efforts towards establishing a benchmark model for explaining equity returns. There are however notable inconsistencies in their conclusions around model predictability mostly attributable to diverse nature of focus and methodological choices. Mosoeu and Kodongo (2017) concluded that the FF5F model's performance differs substantially according to the state of the market. Zhou, Tang and Wu (2022) noted that ignoring investor profile would considerably lead to failure of pricing models. Other studies adjust stocks for thin trading before analysis (Basiewicz & Auret (2010); Mohamed & Khairy (2014); Hearn & Piesse, 2013). In Kenya, Adam, Achola and Muiru (2016) concluded that asset pricing risk premia holds at NSE after adjusting for thin trading implying that the findings could not be inferred to the entire market. Opuodho, Olweny and Nasieku (2018) established a significant market and value factor but insignificant liquidity and size factors. Whereas Njogo et al. (2017) found weak but positive effect of profitability on equity returns, the authors however, did not take note of investor irrationality in their modelling.

This study represented a paradigm shift from the traditional theoretical assumption of investor rationality, and reckoned that investor irrationality may play a significant role in determining the interplay between asset pricing risk premia and equity stock returns in Kenya. Behaviorists argue that investor prospects about the future could trigger irrational trading and thereby induce mispricing in the market. The focus of the study was on fundamental-based asset pricing risk premia derived from financial statements within the FF5F model framework. Further, the study sought to establish if the effect of asset pricing risk premia on stock returns would significantly vary at different levels of investor sentiment. To improve on reliability of model parameters, this study brought on board robust methodology for analysis of asset pricing data using Auto-Regressive Distributed Lag (ARDL) and Error Correction (ECM) estimation models, as opposed to time series regression using OLS techniques.

1.3 Research Objectives

1.3.1 General Objective

The main objective of this study was to establish the effect of asset pricing risk premia on equity stock returns of listed firms on the NSE.

1.3.2 Specific Objectives

The specific objectives were:

i. To establish the effect of market risk premium on stock returns of firms listed at the NSE.
ii. To determine the effect of size risk premium on stock returns of listed firms at the NSE.
iii. To establish the effect of value risk premium on stock returns of listed firms at the NSE.
iv. To establish the effect of profitability risk premium on stock returns of listed firms at the NSE.
v. To determine the effect of asset growth risk premium on stock returns of listed firms at NSE.
vi. To test whether Investor Sentiment moderates the effect of APR premia on stock returns of listed stocks at NSE.

1.4 Statistical Hypotheses

$\mathbf{H_0 1}$: There is no significant effect of market risk premium on stock returns of listed firms at the NSE.

$\mathbf{H_0 2}$: There is no significant effect of size risk premium on stock returns of listed firms at the NSE.

$\mathbf{H_0 3}$: Value risk premium has no significant effect on stock returns of listed firms at the NSE.

$\mathbf{H_0 4}$: Profitability risk premium has no significant effect on stock returns of listed firms at the NSE.

$\mathbf{H_0 5}$: Asset growth risk premium has no significant effect on stock returns of listed firms at the NSE.

$\mathbf{H_0 6}$: Investor sentiment has no significant moderating effect on APR premia and stock returns relationship at the NSE.

1.5 Significance of the Study

The outcome of this study is expected to provide insightful information to various market players which could enhance their understanding of the dynamics of asset-pricing.

1.5.1 Investors

The link between risk and return is a fundamental concept to any investor or portfolio manager who aims at maximizing return while simultaneously minimizing risk. In practice, corporate appraisers and financial analysts use asset pricing models to determine cost of equity, which is essentially what investors require as minimum compensation in order to invest in a company's equity. A reliable asset pricing model would therefore help individual and institutional investors in making predictions about the future which also affects their investment choices and profit opportunities.

1.5.2 Investment Advisors

Investment advisors engage in research and analysis of investment strategies and market conditions to guide investors on most appropriate options. To achieve this, they need to have good understanding of investment dynamics and also access relevant information that can assist them to give informed investment advice. The outcome of this study therefore provides useful information that could serve as basis for advising investors on how to formulate financial goals and create strategies to achieve the goals taking into consideration financial risks. This is because the risk-return relationship is regarded as essential part for many financial applications and a key component for different asset pricing models.

1.5.3 Capital Markets Authority

Market integrity is a core regulatory objective of any securities regulator, and is critical for the well-functioning of any capital market. The Kenyan equity market is regulated by the Capital Markets Authority which provides surveillance of both listed companies and licensed intermediaries to ensure provision of fair, orderly and efficient market. The authority undertakes to establish transparent set of trading rules which are effectively enforced to ensure that parties have equal access to relevant information at the same time. The information on asset pricing is therefore useful for guiding the capital markets regulator in formulating policy for effective monitoring of the markets with a view of protecting market players.

1.5.4 Academicians

The search for explanation on cross-sectional variation in stock returns continues to dominate the interest of academic researchers. Efforts have been put to identify important and consistent firm level fundamental variables which proxy for systematic risk through the construction of multi-index models, but researchers fail to reach a consensus. Academicians have often neglected the role of different states of investor sentiment, if any, in assessing market volatility. It is expected that investigation of this kind would extend the growing literature in the emerging market context by investigating the nexus between asset pricing risk premia and variation in expected stock returns under conditions of irrational investor behavior at the NSE. Research on asset pricing of Kenya's stock market does not only deepen the understanding of the market pricing mechanism but also gives guidance for the growth of other emerging markets.

1.6 Scope of the Study

This study encompassed all stocks of listed firms at the NSE between 1st January 2011 and 31st December 2019. The choice of NSE as the study location was due to its significant role in channeling finance to the corporates and other strategic sectors of Kenya's economy which stood at 30.8% of the Kenyan Gross Domestic Product (GDP) in 2017 (Forbes Survey, 2017). The year 2011 is an important turning point in the development of the Kenyan capital market as it transitioned into a full-service securities exchange supporting trading in equities, debt and derivatives. In the same year, the business segments were reclassified into ten (10) equity and three (3) debt categories (CMA Annual Report, 2011). The year 2019 was selected to ensure availability of current data. The variable focus was on fundamental-based anomalies derived from financial statements data under the FF5F model framework. The choice of FF5F model was motivated by the arguments in Mardy, Angel and Song (2016) that the FF5F model outperforms other empirical models when pricing a large cross-section of stock returns. Unlike past studies, the current study recognizes that noise traders may induce mispricing and therefore affect risk-return decisions in a stock market. In this regard, investor sentiment variable was included in the modeling as a moderator in hierarchical multiple regressions.

1.7 Limitations of the Study

The study assumed that investors hold their portfolios for only 12 months after which portfolio revision is done. Investors are however not homogeneous and comprise a broad spectrum of shareholders who differ in many respects including investment horizon. Some studies have shown that some empirical findings are inconsistent with capital market theory are as a result of discrepancy between observed data periods and true investment horizons. Future research can therefore focus on multi-period investment analysis to see if results would be different.

Additionally, it was not possible to obtain data of sufficient size and time-period, as is the case with mature markets whose sample periods span over several decades. In this light, making comparison of the findings in this thesis with those of other related studies may not be feasible. As a remedy however, regression portfolios in this thesis were constructed on a 2 X 2 sorting instead of the most commonly used 2 x 3 sorts in order to keep the portfolios well diversified.

Next, the study conceptualized the predictor variables within the FF5F model framework. There are however multiple suggestions both in Theory and practice of potential risk premia sources which could proxy for systematic risk. This means that calendar and trend related anomalies were ignored. It was necessary to limit the study within a given conceptual scope for concise interpretation and pragmatic consideration.

Finally, on 31st December of every year t, stocks were rebalanced according to their 12-month past profitability, book-to-market ratio and asset growth regardless of the actual date of reporting of a company's financial results. This was done so as to avoid the need for frequent re-composition of portfolios during the period of analysis. This limitation provides room for extension of future research on this topic allowing for monthly or quarterly rebalancing of portfolios using more recent information to see if results could be different.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

The focus of this chapter was first on the critical appraisal of theories linking FF5F premia and stock returns. Subsequently, research gaps in empirical literature were identified along the contextual, conceptual and methodological dimensions. A conceptual framework was then extracted illustrating the conjectured relationship among the study variables and finally an explanation was given on the network of association among the variables.

2.2 Theoretical Review

The response of stock returns to macro-economic factors and other firm level characteristics that proxy for systematic risk can be explained by the following theories: Efficient Market Hypothesis (Fama, 1970), The Capital Market Theory (Sharpe, 1964; Lintner, 1965 & Mossin, 1966); Dividend Valuation Model (Gordon, 1956), Noise Trader Theory (Black, Jensen, & Scholes., 1996; De-Long, Shleifer, Summers & Robert., 1990; Shleifer & Summers, 1990).

2.2.1 The Capital Market Theory

The Capital Market theory provides a foundation for establishing relationships between required return on an investment and risk in the context of efficient capital market. These relationships are expressed in form of linear equilibrium asset pricing models. The standard Capital Asset Pricing Model (CAPM) independently developed by Sharpe (1964), Lintner (1965) and Mossin (1966) was built from the mean-variance optimization framework of Markowitz (1952). The standard CAPM is a single premium linear equilibrium pricing model that provides a framework to specify and measure investment risk and to develop relationship between expected security return and risk in an efficient capital market. The model is built on the insight that unsystematic risk can be eliminated by investing in a diversified portfolio and hence investors only require to be compensated for bearing systematic risk measured by beta. In this regard, all investors will hold the same risky portfolio but vary the riskiness of their investment by increasing or reducing their investment in the risk-free asset. The investor can reduce portfolio risk by choosing stocks that are negatively correlated.

The CAPM is predicated on the assumptions that all investors prefer less risk and more return, have the same expectations about the state of the economy, that borrowing and lending rates are equal, that there are no transaction costs or taxes; and that the market portfolio chosen for comparison is appropriate. Further, expected returns and standard deviation are the only two variables that need to be considered in an investment decision. The use of a single risk factor has attracted criticism as researchers argue that a single risk factor is not enough to completely capture systematic risk (Merton, 1973). Also put to doubt is the notion of mean-variance efficiency and the actual components of the market portfolio (Uzair & Hanif, 2010). The assumptions of investor rationality and homogeneous investor expectations have also been challenged by empirical studies which have found significant influence of noise traders and heterogeneity in price formation (Shleifer & Vishny, 1997). CAPM cannot therefore represent perfectly the investor behavior in financial markets.

The theoretical underpinnings of the standard CAPM and its inability to fully explain variations in average returns has given researchers incentive to create extensions and alternative models that would capture better the risk-return relationship. Some noteworthy extensions to the standard CAPM include intertemporal CAPM (ICAPM) which considers multi-period maximization of return while hedging firm specific risk (Merton,1973) and consumption-based CAPM (CCAPM) developed by Rubinstein (1976), Lucas (1978) and Breeden (1979), creating a connection between stock returns and aggregate consumption. Ross (1976) developed Arbitrage Pricing Model (APM) to address the equilibrium asset pricing problem. The APM postulates that a security's expected return is influenced in a linear relationship by a variety of factors. According to APM, arbitrage opportunities exist momentarily but in efficient markets, the price should adjust quickly as the arbitrage opportunities are exploited. Further, the model assumes that there are a number of systematic risk factors causing the variation in asset returns, and enough assets in the market to diversify away idiosyncratic risk. The APM can be extended into various multi-factor models due to existence of multiple number of unidentified factors.

Researchers have further developed other benchmark models to address shortcomings of CAPM. The Fama-French (1993) three factor model which captures size and value premium (in addition to the market premium) is one of the milestones in the development of multi-premium asset pricing models. The model was however not able to explain a significant portion of cross-section of returns in double sorted size-growth stocks. Subsequently, researchers proposed other models in an attempt improve the predictive power of the three-premium model by introducing additional pricing premia that proxy for non-diversifiable risk. Carhart (1997) added one-year momentum premium to the FF3F model in a bid to explain cross-section of stock returns for mutual funds. Momentum trading refers to a trading strategy that involves buying past winning and selling past losers (Novy-Marx, 2012). Subsequent investigations reach conclusion that the momentum augmented model adds explanatory value to portfolios based on the momentum effect only. Empirical research particularly in the post global financial crisis of 2008 have augmented asset pricing models with liquidity, trading frictions and default risk as possible proxies for systematic risk. Fama and French (2015, 2016b) tested if investment (asset growth) and operating profitability would add more explanatory power to FF3F model. The model however failed to account for average returns on weak profitability and aggressive investment small stocks in the US. This study therefore tested if the FF5F premia are predictors of stock returns at the Kenyan equity market.

2.2.2 Efficient Market Hypothesis

Fama (1970) described an efficient market as one in which security prices always fully reflect all available information and the prices change randomly reacting to new information that arrives randomly. Allen, Brealey and Myers (2011) posit that a market is efficient when investors cannot earn a return higher than the market return. In this regard, the value of an asset reflects the fair value of the firm obtained by discounting of future cash flows at an appropriate discount rate. A consequence of this argument is that future price changes should be random and unpredictable; if they could be predicted, the prediction would be part of today's information.

EMH is premised on the assumptions that: all market participants are accessible to information at the same time; the information is quickly and fully incorporated in stock prices; investors value securities rationally and markets are frictionless. The postulations of EMH therefore presupposes that no investment strategy will earn average returns greater than what is warranted for a given level of systematic risk. This implies that investors will take additional risk if they are compensated with higher returns. As a result, investors should not be able to generate consistent risk-adjusted abnormal returns based on historical data, since prevailing prices should already reflect all historical data.

The most enduring critique of EMH comes from psychologists and behavioral economists who argue that EMH assumptions may not be consistent with facts in reality. Kathleen and Heng-Hsing (2012) posit that information has a cost associated with it as there is usually an incentive for investors to spend resources to obtain it implying that prices do not reflect all available information. For that reason, return on investment must be therefore higher than the cost of information; otherwise, the propensity to invest would disappear. Schmeling & Shiller (2013) noted that there are certain patterns in stock prices, which the EMH fails to explain. Although the notion of continuously efficient markets might seem unrealistic, studies have found varying results when testing the efficient market hypothesis.

In order to test the EMH, an asset pricing model is needed. The EMH has been widely tested, most often using the CAPM or using different multi-factor models. Hence, if a test is rejected, the inference could be tied to either theory or the model. Ever since, empirical tests on asset models have yielded a number of potential return patterns which do not find explanation in a chosen asset pricing theory, referred to as anomalies (Fama & French, 2008). A wide range of anomalies have since been incorporated in improved asset pricing models as risk factors (Berk & Van, 2016).

The current study incorporated size, value, operating profitability and investment anomalies as additional explanatory risk factors to the market risk. It was conjectured that modelling fundamental-based anomalies derived from financial statements would adequately account for cross-sectional variation in average stock returns. A well specified equilibrium model is one with the highest GRS statistic and whose intercept term is indistinguishable from zero which would imply that the endogenous variables are important in explaining of returns.

2.2.3 Modified Equity Valuation Model

The fundamental valuation principle states that in a market where investors are rational, the intrinsic value of an asset is the discounted value of all future cash flows that will accrue to an investor. This principle is expressed in the Equity Valuation Model (EVM) of Gordon (1956) that relates quantitatively the value of equity to the present value of all future dividends, assuming that there is constant growth in dividends forever as illustrated in equation 2.1.

$$ME = \sum_{t=1}^{\infty} E(DPS_t) / (1 + Ke)^t \qquad (2.1)$$

Clubb and Naffi (2007) are among recent theorists who have given further impetus to the application of fundamental valuation approach to asset pricing literature. This approach is based on the assumption that stocks are rationally priced. The distinction between risk-factor approach and fundamental valuation approach is that the latter does not assume the existence of a relation between a firm's particular characteristic and its risk. Fundamental valuation seeks to demonstrate that most anomalies observed in the market are nothing but regularities in the relations across the input variables of the model. Therefore, regardless of which process generates the firm return, the empirically demonstrated relation between variables and returns will always be observed.

The key inputs in the model are expected dividend per share in period *t* and required rate of return (Ke) demanded by the shareholders to compensate them for the time value of money and variability in stock's future cash flows. Conceptually, the model stipulates that at any given time, if two stocks have different prices but same expected future dividends, the stock with a higher price will intuitively have a low expected return. Consequently, future dividends on low priced stocks will have higher risk

Fama and French (2015) developed a modified equity valuation model by combining the EVM of Gordon (1956) with the Miller-Modigliani valuation model (Miller & Modigliani, 1961). The Miller-Modigliani (1961) formula explains basic assumptions about the relationship between stock returns, book-to-market ratio, expected profitability and investment. The modified EVM equation is shown in equation 2.2.

$$ME = \sum_{t=1}^{\infty} E(Y_t - \Delta B_t) / (1 + ke)^t \qquad (2.2)$$

In equation 2, Y_t indicates total net earnings for period t while $\Delta B_t = B_t - B_{t-1}$ represents the change in total book value of equity. Identically, book-equity can also be expressed as excess of total assets over total liabilities. The change in book value of equity for any period is the investment (if positive) or disinvestment (if negative), for an all equity financed firm. Dividing book equity by market value yields equation 3.

$$\frac{B_t}{\mathrm{ME}} = \frac{B_t}{\sum_{t=1}^{\infty} E(Y_t - \Delta B_t)/(1+Ke)^t} \qquad (2.3)$$

The theoretical linkage of variables in the MEVM inferred out of equation 2.3 has implication on asset pricing framework. By holding constant every input in equation 2.3 except for the current price (ME) and required return (ke), a lower value of current price (implying high B/M ratio) would suggest a high expected return. Therefore, low stock prices (implying small firm size) would be associated with high expected returns. Next, by fixing everything else except for future earnings (Y_t) and required rate of return, higher future earnings would imply high expected return. Finally, holding book value of equity, current stock price and expected future earnings constant, a higher expected growth in book equity (also referred to as investment intensity) would imply a low expected return. Applying to the current study, if the interrelationships in the MEVM hold, then expected returns should bear an inverse relationship with firm size and investment but a positive association with firm value and operating profitability factor.

While the MEVM is widely used, it has two well-known shortcomings. The model assumes a constant dividend growth rate to perpetuity. This assumption is generally safe for very mature companies that have an established history of regular dividend payments. However, MEVM may not be the best model to value newer companies that have fluctuating dividend growth rates or no dividend at all. The model also fails when a company earns lower rate of return (r) compared to the dividend growth rate (g). This may happen when a company continues to pay dividends while incurring a loss or earning relatively lower returns.

2.2.4 Noise Trader Theory

Noise trader theory is an attempt to give behavioral explanation to market anomalies. Based on psychology and the limits-to-arbitrage concept, the behavioral approach considers that the causes of anomaly reside in investor irrationality. Propounded by De Long, Shleifer, Summers and Waldmann (1990), the Noise Trader theory has been used to explain investor irrationality in trading on capital markets. According to De Long et al. (1990) model, informed investors possess higher information processing skill and base their decisions on fundamentals while noise traders are assumed to rely on sentiment or noisy signals to convey relevant information. Under the noise trader theory, some features of asset prices are interpreted as deviations from fundamental value, and that these deviations are brought about by the presence of traders who are not fully rational.

Friedman (1953) arguing from EMH perspective opined that a group of irrational traders (noise traders) who become excessively pessimistic about future prospects of a stock will engage in panic selling and thereby push its price downwards. Sensing an attractive opportunity, rational traders (arbitrageurs) will begin to buy the security at its bargain price and equally hedge their bet by shorting a substitute security that has similar cash flows in futures market. The buying pressure, according to Friedman, will bring the price back to fundamental value. In the perspective of Shleifer and Vishny (1997), strategies designed to restore prices of mispriced assets toward their correct values are both costly and risky in the sense that noise traders' beliefs and their impact on prices might not revert, even in long timeframes. Therefore, arbitrage cannot fully eliminate the noise effects on prices through trading and noise itself creates a price-risk (De Long et al., 1990). Accordingly, the mispricing will remain unchallenged.

The present study took cognizance of the fact that investors are not fully rational and that stock prices may be affected by factors other than fundamentals. These irrational or noise traders affect the level of asset prices by trading when they are unusually bullish or bearish. Investors' optimism (bullish trend) or pessimism (bearish trend) may induce the occurrence of mispricing in the securities market and thereby drive prices well above or below the fundamental value. Hence, investor sentiment is a potential source of systematic risk which could impact asset prices at equilibrium and overall trading decisions (Schmeling & Shiller, 2009).

2.3 Conceptual Framework

From the foregoing theoretical review, a conceptual model was derived based on intensive review of concepts and ideas from literature. The configuration of the relationships among the variables was informed by theoretical arguments in the EMH, The Capital Market Theory, Dividend Valuation Model and Noise Trader Theory. Stock returns is the outcome variable, while FF5F risk premia are the independent variables, comprising premium on the market portfolio, size, value, operating profitability and asset growth. The study also conceptualizes investor sentiment as a moderator variable whose inclusion in the model would cause the magnitude of association between FF5F risk premia and returns on the stocks to change. The diagrammatic presentation of the hypothesized relationships among the variables is presented in Figure 2.1.

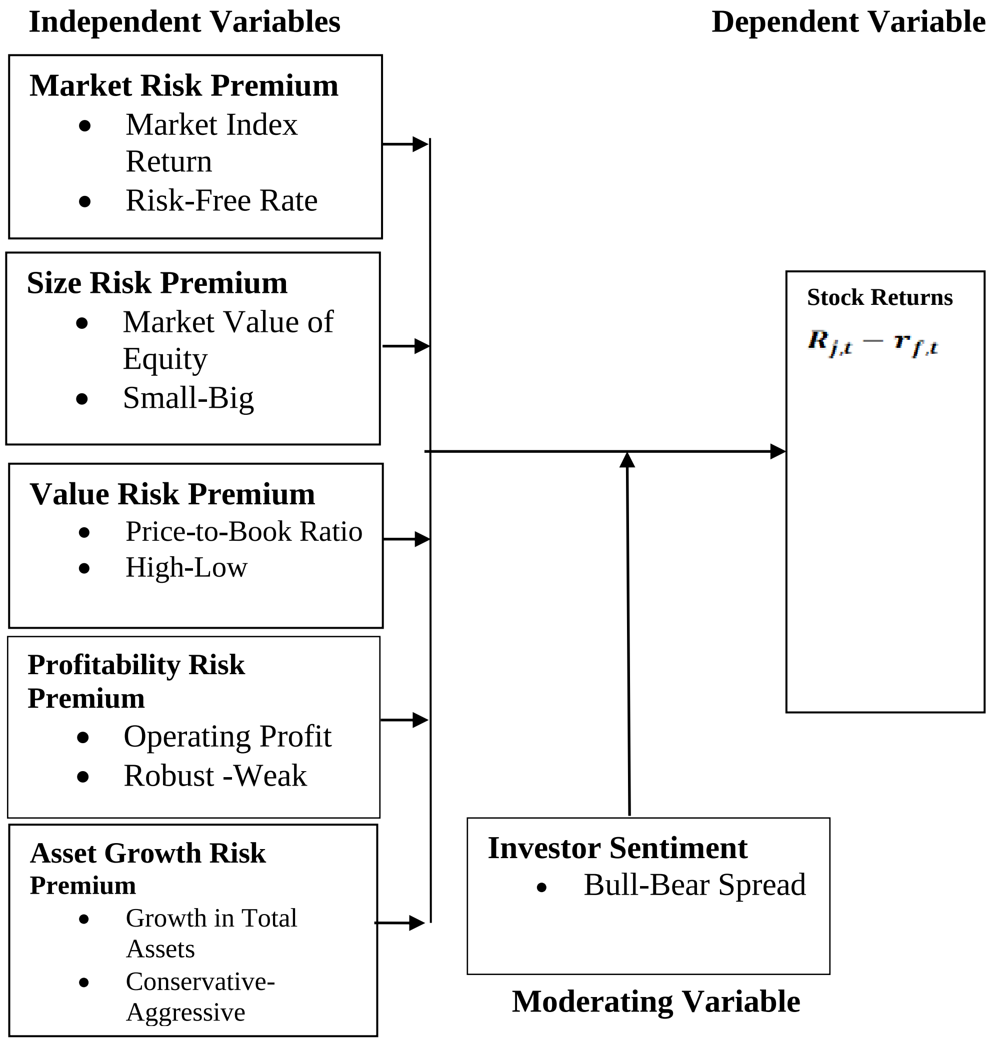

Figure 2.1: Conceptual Framework

2.3.1 Market Risk Premium

The market risk premium also referred to as market factor is the extra return an investor expects to earn from investments made in riskier asset class rather than holding risk-free assets (Cochrane, 2011). It represents the percentage of total returns attributable to variability in the stock market index returns. Berk and Van (2016) described market risk premium as the excess of expected return on diversified risky market portfolio over the risk-free rate with a duration same as that of the market portfolio. According to the capital market postulations, investors require compensation for accepting non-diversifiable risk in form of a risk premium which is dependent on an individual assets or portfolio's sensitivity to changes in the market index (beta). It is therefore reasonable to conjecture a relationship between excess stock returns and market risk premium of an asset which is proportional to its beta. Under the assumption that investors are risk averse, market risk premium tends to differ among investors and across time. According to Cochrane (2011), the market risk premium tends to be higher in times of high volatility and lower in times of low volatility.

Relating market risk premium to stock returns, a number of studies find weak support for market risk as modelled in standard CAPM (Alexander & Einar, 2017; Taha & Elgiziry, 2016; Iqbal & Brooks, 2010), other studies however, find increasing explanatory power of the market risk in up and down-market states (Lind & Sparre, 2016; Blumberg, Cooper, & Schindler., 2005). The FF5F model considers share volatility relative to the market as representation of compensation for non-diversifiable risk. Acknowledging the inability of market risk premium to fully explain asset returns, the FF5F model retains the market premium in its formulation to test the predictive power of the model. In this study, market risk premium was measured as the difference between market return and the risk-free rate. The market return is the value weighted monthly return on NSE 20 index computed as logarithmic price index relatives. The risk-free interest rate was computed from the Kenyan 91-day T-bill rates obtained from central bank data stream. The null hypothesis of the study was thus formulated as follows:

$H_0 1$: Market risk premium does not significantly explain stock returns at the NSE

2.3.2 Size Risk Premium

Size anomaly, uncovered by Banz (1981) is the inverse relationship between returns on a stock and its market value. According to the notion of market efficiency, firms should provide returns to investors commensurate with risk exposure. Researchers however document intriguing findings whereby small stocks generate excess returns even after adjusting for risk, inconsistent with theory of market efficiency. There have been divergent views on the theoretical explanation for size effect with some theorists such as Yi, Liu, He, Qin and Gan (2006) linking it to the illiquid nature of small stocks which implies a higher liquidity risk for investors. Consequently, investors in firms with small market value will need to be compensated with a higher average return since such firms are perceived as riskier. Jianguo, Kwong and Hamish (2007) explain that firms with small market capitalization have low fixed assets and low returns causing them to have low recovery rates in the event of default. This implies that investors will demand an extra premium for small growth firms to compensate for low earnings thereby yielding higher mean excess returns. Shafana et al. (2013) attribute size effect to higher estimation risk and low supply of corporate information regarding small firms. In view of the foregoing attributions, returns on small stocks should significantly outperform that of big firms.

Size effect has been empirically tested over numerous sample periods and across major securities markets around the world (Faff, 2001 & Gaunt, 2004; Hawawini & Keim, 2008; Hearn & Piesse, 2013; Shafana et al., 2013; Sundqvist & Toni, 2017). Scholars hold divergent views on the relationship between size factor and stock returns. Whereas some studies (Faff, 2001 & Gaunt, 2004; Griffin, 2002; Hearn & Piesse, 2013; Sundqvist & Toni, 2017) postulate a significant relationship between firm size effect and variation in expected stock returns, other studies (Hawawini & Keim, 2008; Hearn & Piesse, 2013; Shafana et al., 2013) report insignificant effect of firm size on stock returns. The most commonly used market measure for firm size is market value of equity (ME). The non-market measures cited in Leledakis et al., (2018) include book value of total assets, book value of gross fixed assets, annual sales and staff size. In the current study, the proxy for firm size was market capitalization (MC). Following the Fama-French (1993) methodology, the size factor was measured as the additional returns historically received from investment in stocks of companies with comparatively small market capitalization. This additional return is known as the size premium.

From the conceptual model, it was hypothesized that:

$H_0$2: Size risk premium does not significantly explain stock returns of firms listed at the NSE.

2.3.3 Value Risk Premium

Value effect is the apparent positive association between an asset's B/M ratio and forecasted returns (Fama & French, 2006). Stocks with relatively high B/M ratios should, in the perspective of Fama and French (1992), be given higher premium. Similar argument is advanced by Chan, Chen and Lakonishok (2008) who posit that returns on value stocks are higher relative to glamour stocks due of investment behavior, not because of risk. In their view, market participants have consistently overestimated future growth rates of glamour stocks relative to value stocks. They further argued that value stocks appear to be riskier relative to glamour stocks by conventional risk measures, and state that the reason for a significant value effect is likely connected to behavioral biases. Also, Fama and French (1996) suggested that value strategies are fundamentally riskier and therefore a higher average return on value stocks reflects the reward for bearing this risk. In the current study, B/M ratio was calculated by dividing book equity of a stock by its market capitalization. Book equity was calculated as yearly total assets minus total liabilities. The value construct that was adopted follows the methodology developed by Fama and French (1993) which measures value factor as the spread in returns between high and low book-to-market portfolios.

To test the value effect, it was hypothesized that:

$H_0$3: Value risk Premium does not significantly explain stock returns of firms listed at the NSE

2.3.4 Profitability Risk Premium

Firm profitability anomaly is the tendency by profitable firms to obtain higher return than unprofitable firms (Haugen & Baker, 1996). The level of profitability reflects a firm's current productivity in competitive environment for its product markets (François & Théoret, 2016). Cochrane (2011) contends that firms have ups and downs in their earnings performance due to swings in the macroeconomic and financial environment in which they operate. The trend in this path may serve as an indicator on future prospects and performance. The importance of profitability as a significant predictor of future returns has also been highlighted by Novy-Marx (2013) and Fama and French (2015). Profitable firms are thus considered by investors as possessing strong fundamentals for future growth which would imply low required rate of return.

Previous empirical studies have operationalized profitability risk premium in multiple ways. For instance, Novy-Marx (2013) operationalized profitability as a ratio of a firm's gross profit (computed as total revenue minus cost of sales) to total assets. Other studies employ operating income to book value of equity (French, 2016b; Sundqvist & Toni, 2017); Return on Equity (Hou et al., 2015) and operating profitability, measured as operating profit per unit of book value of equity (Fama-French, 2015) or simply by subtracting cost of sales, selling, general and administrative expenses from a firm's total revenue (Ball, Gerakos, Linnainmaa, & Nikolaev., 2014). Portfolios sorted on the basis of gross profit to total assets have been observed to earn higher returns than unprofitable firms. Using US data from 1990-2009, Novy-Marx (2013) attributed this finding to the fact that grosss profitability is less affected by a firm's actions that eventually change the net income. The current study adopted the measurement of firm's profitability in Fama and French (2015) where operating profit was computed as annual revenues minus the cost of goods sold, interest expense, selling, and general and administrative expenses for a particular fiscal year. Profitability risk premium was then measured as the spread between average return on a well-diversified portfolio of stocks with robust operating profitability and average return on a well-diversified portfolio of stocks with weak operating profitability, denoted as Robust Minus Weak (RMW).

To test the profitability effect, it was hypothesized that:

$H_0 4$: Profitability risk premium does not significantly explain stock returns of firms listed at the NSE

2.3.5 Asset Growth Risk Premium

Investment effect, also referred to as asset growth anomaly in Cooper et al. (2008) is the negative relation between annual percentage change in total assets and future stock returns. According to Cooper et al. (2008), asset growth anomaly is a pattern of stock returns in which corporate events associated with asset expansion (contraction) tend to be followed by periods of abnormally low (high) returns respectively. Tobin (1969) advanced the Tobin's Q theory as an alternative proposition for relating the market value of a stock and firm investment. Under this theory, Q is the ratio of the market value of an asset to cost of producing that asset. If this proposition holds, then the level of investment will be inversely related to cost of capital since a decrease in the cost funding tends to stimulate investment. Intuitively, investment intensity would predict returns because high cost of capital implies low net present values of new capital and hence low investment while and a lower cost of capital signifies high net present values of new capital and hence high investment.

Cooper et al. (2008) are among the early theorists who used risk-return relationship to advance the risk-based interpretation of firm investment effect in asset pricing research. According to the standard risk-return models, investors who seek to put their investible wealth in a firm require a rate of return that is proportionate to the firm's risk. In other words, in order to invest in high-risk firms, investors require higher returns as compensation for the additional risk they take on. Similarly, investors would require low returns as compensation for investing in low-risk firms. Taking into consideration this positive relation exhibited in return models, Cooper et al. (2008) concluded that low asset growth firms yield higher returns than high asset growth firms and by implication, firms with low asset growth tend to be riskier than those with high asset growth. The risk-based interpretation of firm investment effect is contrary view to theoretical linkage initially propounded by the authors Berk (1997). According to the authors, assets can be put into two categories, assets in place and options to make profitable investments in the future (growth options), which the authors assumed are inherently riskier than assets in place. When a firm makes new investments (high asset growth firm), the riskier growth options are replaced with less risky assets in place. Therefore, the average risk of the firm decreases and, considering the positive relation between risk and return, the firm exhibits lower stock returns in the future. Conversely, if a firm loses an asset in place (low asset growth firm), its average risk increases, resulting in higher future stock returns.

Alternative interpretation of firm investment effect on stock returns is built upon theoretical propositions formulated by different researchers popularly referred to as mispricing-based explanation. According to Chan et al. (2008), asset growth effect can be explained by four hypotheses, namely, the acquisition hypothesis, the managerial agency cost hypothesis, the extrapolation hypothesis and the market timing hypothesis: The proponents of acquisition hypothesis hold the view that firms acquire other firms in order to expand their assets and by extension, increase the shareholder's wealth. However, previous researchers, such as Moeller, Schlingemann and Stulz (2005) have shown that firms' acquisitions may have a negative impact on shareholders' wealth. This often occurs because managers may engage in acquisitions so as to serve their own personal interests and not necessarily because these acquisitions are valuable investments for the firm. As a result, the stock price of acquirers tend to decline the years following an acquisition due to the poor business practices of managers. Therefore, the negative relation between asset growth and future stock returns may arise possibly be due to the underperformance of acquirers.

The managerial agency cost hypothesis explains why managers may act in such a way. According to this hypothesis, managers and shareholders have conflicting interests regarding the future of their firm. While shareholders are interested in high profitability and efficiency, managers may have incentives to cause their firms to grow beyond the optimal size at the expense of the firm's efficiency. This is because growth increases managers' power and prestige as it increases the resources under their control. Moreover, growth in firm size is directly associated with managers' compensation, since their compensation is positively related to the growth in sales (Jensen, 1986). Consequently, if high asset growth is due to empire-building, which is likely to have a negative effect on future earnings performance, then investors who fail to evaluate managers' true motives will overvalue firms with high asset growth, leading to negative future stock returns for these firms.

The extrapolation hypothesis is yet another perspective providing interpretation as to why firms that grow rapidly tend to have a poor performance the years following a large expansion in their assets. Investors have the tendency to rely on a firm's past performance in order to make predictions for its future earnings performance. In other words, investors assume that firms with high past earnings will continue on their profitability trajectory in the future. As a result, investors may overvalue high asset growth firms, since they are more likely to have high past profitability. However, a possible decline in the earnings performance of these firms may surprise investors, who are likely to sell their stocks, resulting in negative future stock returns. Under the market timing hypothesis, the asset expansion of a firm may occur when managers issue stocks at a time when they believe the stocks are overvalued in order to eliminate market mispricing. In this case, total assets increase either because the firm receives cash from the stock issue or because the firm uses cash received to purchase fixed assets. When a firm issues stocks, investors realize (possibly with a lag) that the firm's stock is overvalued and, thus, sell their stocks to benefit from the mispricing. As a result, high asset growth firms tend to experience negative abnormal returns.

Previous studies (Cooper et al., 2008; Fama & French 2008; Chan et al., 2008; Constantinou et al., 2017) investigating investment-return relationship adopt change in total assets as a proxy for asset growth and find evidence to support the assertion that companies with low asset growth out-perform companies with high asset growth. Other scholars such as Hou, et al. (2015) however measured investment effect as the the ratio of annual change in total assets to lagged total assets. This study measured asset growth following the methodology suggested by Fama and French (2015) and cited in Yao et al. (2017) as year-to-year percentage change in total assets. The asset growth risk premium was then computed as the excess of average returns on conservative investment portfolios over the average returns on stocks following aggressive investment policy.

To test the asset growth effect, it was hypothesized that:

$H_0 5$: Asset growth risk premium does not significantly explain stock returns of firms listed at the NSE

2.3.6 Investor Sentiment

The proponents of behavioral asset pricing argued that investors do not hold similar beliefs about the fundamental price of a stock because of inherent behavioral biases. This could trigger shifts in demand induced by irrational speculations which generates sentiment risk. Baker and Wurgler (2006) describes investor sentiment as the systematic error or biases in investors' belief about future cash flows and investment risks that are not consistent with the fundamental facts. When most investors are optimistic in their irrational beliefs, and think that firms have good prospects for the future, they tend to over-value and invest in the stocks thus increasing the demand. On the flipside, when most investors consider that firms have bad fundamentals, they tend to sell or stop buying the stocks thus lowering the demand. Lee and Swaminathan (2002) reckoned that a positive change in demand (or upward movement in market index) indicates a bullish change in investor sentiment, while a negative change in demand (or downward movement in the market index) indicates a bearish change in sentiment. Berger and Turtle (2012) concluded that investor optimism (or pessimism) may induce mispricing in the stock market thereby drive prices well above or below that warranted by the fundamental value. Thus, investors in equity markets will bear not only systematic risk but also sentiment risk which limits the arbitrage activities and hence the ability of an investor to behave as a rational trader. It is therefore reasonable to assume that there is association between sentiment risk and excess stock returns.

A section of studies find correlation between investor sentiment and stocks with certain characteristics. For instance, small stocks and stocks with high volatility are more subject to sentiment than others (Baker & Wurgler, 2007); Stocks that are harder to value and arbitrage are expected to be sentiment-prone (Berger & Turtle, 2012); Firm profitability when measured as return on equity (ROE) is noted to be inversely related to sentiment sensitivities (Hou et al., 2015). Ho and Hung (2012) argued that IS reflects investor expectations about the current and future prospects of financial markets and hence it can be a useful variable for conditional specification of APMs which can influence the effects of firm risk characteristics on risk-adjusted stock returns. Xu (2011) found that IS alters the coefficients of fundamental risk premia in the rational based FF3F model. Motivated by the findings in Ho and Hung (2012) and Hou, et al. (2015), this study tested whether investor sentiment would moderate the effect of APR premia on stock returns and further explore how cross section of stock returns would differ between periods of low and high investor sentiment at the NSE. Overall, systematic risk exposure is expected vary between periods of high and low investor sentiment. Different sentiment studies utilize varied proxies for measuring investor sentiment. There is however no consensus among researchers as to which proxy would provide accurate results (Baker & Wugler, 2007).

Prior literature on behavioral dimension to asset pricing agree to the fact that there is no single definitive proxy for investor sentiment (Finter, Niessen-Ruenzi & Ruenzi., 2011). Some scholars have utilized direct opinion surveys (Brown & Cliff, 2005) while others have employed market-based proxies to measure sentiment (Kumar & Lee, 2006, Ritter, 2003; Brown & Cliff, 2005; Dash & Mahakud, 2015). Other studies use trend in trade indicators such as volume of trade (Baker & Wurgler, 2007; Chuang, et al., 2010; Brown & Cliff, 2005) and Advance Decline Ratio (ADR) (Dash & Mahakud, 2015; Yao, et al., 2017) for measuring fluctuations in investor sentiment. Researchers in markets that have well established derivative trading platforms use put-call ratio (PCR) as indicator for investor sentiment. PCR is computed as the ratio of trading volume of put options to call options, and a lower (higher) ratio suggests bullishness (bearishness) sentiment in the market (Brown & Cliff, 2005; Finter et al., 2011). Their findings lead to a general conclusion that negative changes in sentiment have negative effect on stock returns and vice versa. This study adopted bull-bear spread as as a novel measure of IS computed by subtracting the proportion of stocks that closed lower from the proportion that closed higher than their previous period’s closing prices. A positive (negative) spread implies bullish (bearish) trend in the market while a zero difference is an indicator of market correction (Brown & Cliff, 2005; Dash & Mahakud, 2015).

To test the sentiment risk effect, it was hypothesized that:

H_06: Investor sentiment does not moderate the effect of APR premia on stock returns at the NSE

2.4 Empirical Review of Related Literature

2.4.1 Market Risk Premium and Stock Returns

Mohamed and Khairy (2014) employed Ordinary Least Squares (OLS) regression analysis to study applicability of market risk factor on the Egyptian Stock market using CAPM model on a sample of 55 stocks. The study utilized monthly data ranging from January 2003 to December 2007. The dataset consisted monthly return on the market portfolio, excess return on each portfolio and 91-days T-bill rate as risk-free rate of return. In each year over the sample period, stocks were categorized as big and small based on their market capitalization. The results on GRS test did not support the capital asset pricing model. This implies that the use of market risk factor as the sole risk premium fails to explain the relationship between return and risk in Egypt. Similar conclusions were made by Iqbal and Brooks (2010) and Ajlouni and Khasawneh (2017) and in Pakistan and Italian markets respectively by discerning that risk-return relationship cannot be described by beta only. On the contrary, other empirical studies conclude that market risk is the single most important source of systematic risk (Syed, 2017; Coffie & Chukwulobelu, 2013; Rustam & Nicklas, 2010).

Applying the Fama and MacBeth (1973) methodology, Jónsson and Ásgeirsson (2017) analyzed the predictive power of CAPM in the European stock market. The time period for the study was 1998-2015. Betas were estimated for individual stocks and portfolios were formed based on the ranked betas. Portfolio betas were then regressed against actual portfolio returns to determine the nature of association between market risk and average return. The results suggested poor predictive power of the market factor since the model failed to give significant positive results either for the overall period or any of the sub periods examined. Using similar procedure, Iqbal and Brooks (2010) discerned that beta is adequate in explaining stock returns on Karachi stock exchange. The same study replicated by Uzair and Hanif (2010) on the same market over the period 2003 to 2008 however showed that CAPM does not provide accurate results.

Karp and Vuuren (2017) tested market beta and excess returns in South Africa using CAPM. The sample period spanned six years, 2010 to 2015 and included 46 companies quoted on the Johannesburg's Stock Exchange (JSE). The study adopted Fama-French (1993) approach in constructing portfolios of stocks using a 3×2 annual sorting procedure, based on firm size and value metrics respectively. The JSE All-Share index comprising 164 companies, which represents 99% of the JSE was used as a proxy for market index while the rate on 3-month T-bills was used as risk-free rate. This contrasts with one-month government bond equivalents available in the US and other developed markets as the risk-free approximation (Basiewicz & Auret, 2010). The results of OLS regressions indicated that using beta as the sole risk factor has poor explanation of stock return variation evidenced by low adjusted R-square values whose range was between 3.1% and 6.2%.

Okumu and Onyuma (2015) focusing on the Kenyan market computed the risk-return relationship for sixteen NSE 20 index stocks trading under various sectors for the year 2010. Using OLS regression, the researchers found a weak (but positive) correlation and R-square between the evaluated securities' beta and the market returns. They concluded that market risk is not a valid predictor of the risk-return relationship for securities trading in the Kenyan stock market. Riro and Wambugu (2015), analyzing NSE portfolios rather than individual securities similarly observed that the intercept coefficients for most portfolios were significant based on their t-values which were larger than the critical t-value. Therefore, when tested from a portfolio perspective, the evidence in support for market risk at NSE is weak. These findings are however at variance with the findings made by Coffie and Chukwulobelu (2013) who established evidence in support for market risk at the NSE.

2.4.2 Size Risk Premium and Stock Returns

Rashid and Sadaqat (2018) examined size effect using market timing augmented CAPM in Pakistan between 1995 and 2015. The study focused on monthly returns of individual stocks of 167 listed firms. Size portfolios were constructed based on the market capitalization with median as the break-point. The Pakistani TB yield with six months maturity was used as proxy for risk-free rate. Results of descriptive analysis showed that small sized portfolios have high average returns as compared to large size thus confirming the theorized negative relationship between size and return. The range of returns was wider for small sized portfolios but narrow for large portfolios and none of the portfolios had normally distributed returns. The SMB factor was on average of 0.468% with a significant positive coefficient in 50% of the portfolios implying that investors in Pakistan consider market capitalization in their investment decisions.

Shafana et al. (2013) investigated the behavior of average stock returns with respect to size and the B/M ratio at Colombo Stock Exchange in Srilanka. The study sampled 12 out of the target population of 25 firms listed on Milanka Price Index in base year of 2005 in Colombo Stock Exchange, financial year ended in December. Cross-sectional regression and Fama-MacBeth (1973) procedure were used to analyze five-year data from 2005 to 2010. All variables were log-linearized to smooth the data prior to empirical analysis. The study observed insignificant size effect on stock returns of financial and non-financial companies. Additionally, the size factor was found to explain highly stock returns of financial firms than when full sample or non-financial firms are considered. These findings, however, differ with those of Faff (2001) who found a negative significant size factor in Australia using similar methodology.

Karp and Vuuren (2017) tested the validity and accuracy of FF3F model in predicting the stock returns on the South African Stock market. The sample period spanned six years, 2010 to 2015 and included 46 companies. The study adopted the approach outlined in Fama-French (1993) of constructing portfolios of stocks using a 3×2 annual sorting procedure. The FTSE/JSE All-Share index comprising 164 companies was used to proxy return on the market index while a three-month T-bill rate was the benchmark risk-free rate. This contrasts with one-month treasury bills or government bond equivalents available in the US and other developed markets as the risk-free approximation (Basiewicz & Auret, 2010). The results of OLS regressions indicated consistent significant coefficients of SMB factor at 5% level of significance among all the six portfolios. Whereas all the big sized portfolios loaded negatively on SMB, all small sized portfolios had positive factor loadings, consistent with Fama and French (1995) argument that smaller firms tend to outperform large ones, controlling for value and market risk factors.

Patel (2012) investigated whether size effect on stock returns is exhibited in developed and emerging stock markets. The study was anchored on theory of market efficiency which posits that firms should provide returns to investors commensurate with the level of exposure to risk. Data on six stock index series was collected from Russell Associates over a period spanning 1996 to 2010 resulting in 173 monthly observations. The index values for last day of trading for each month were collected for six stock market indices namely: developed, developed small cap, developed large cap, emerging stock index, emerging large cap and emerging small cap index. The study utilized t-tests and Wilcoxon signed rank test to establish significance of differences between stock indices. Additionally, ANOVA and median tests were conducted to determine if differences in size premiums exist over years. Further, t-test and Mann-Whittney U-test were employed to examine if differences in size premiums vary with market conditions. The study findings revealed that stock indices are not significantly different between developed and emerging economies. Additionally, it was observed that Stock markets do not exhibit size effect in either developing or emerging markets. Further, it was concluded that small firms do not generate significant different returns than large firms.

Among recent investigations of size effect on excess stock returns is a study by Hu, et al. (2019) on non-financial firms listed on the Chinese stock market over a 20-year sample period spanning 1996 to 2016. A faily long sample period was selected so as to obtain adequate number of cross-sectional units for time series data. The study employed time series and Fama-MacBeth tests on 25 portfolios related to size, constructed following the Fama and French (1993) framework. Over the period of study, the size risk factor had economically large and statistically significant monthly return (0.61%), higher than market (0.52%) and value (0.23%). The study also observed a large variance in average monthly excess stock returns across the 25 portfolios from -0.58% to 1.97%. The results of time series regression indicated that size factor significantly explains better cross-section of stock returns in China than the market and value factors. Applying GRS test, an F-statistic of 1.42 (p-value > 0.05) was obtained implying that the intercepts across the 25 test portfolios were jointly zero.

Odera (2010) studied size effect by investigating the consistency of FF3F model with efficient market pricing at the NSE from 2008 to 2012. The study employed monthly data on stock prices. Multivariate regression analysis was applied using nine portfolios constructed on basis of size and B/M attributes. The conclusion was that SMB factor captures the size effect on portfolio returns at the NSE. The size effect was however absent on big size-Medium and High value portfolios. These conclusions are somewhat at variance with the findings by Achola and Muiru (2016) using daily stock prices at the NSE over a period of 10 years from 2004-2014. The factors in their model were however adjusted for thin trading to avoid bias in beta estimates. The procedure for thin trading involves diving each factor by number of days a portfolio records zero trades in a month. It was established that on average, small-high B/M stocks earn higher returns than big-low B/M stocks.

2.4.3 Value Effect and Stock Returns

Value effect refers to the relationship that exists between a firm's B/M ratio and risk adjusted returns (Fama & French, 2006). According to Fama and French (1992), a return factor should be given to stocks with relatively higher B/M ratios. Lakonishok, Shleifer and Vishny (1997) argued that value stocks have higher return than glamour stocks because of investment behavior, not because of underlying risk. In their view, market participants more often tend to overestimate future growth rates of glamour stocks relative to value stocks.

Basiewicz and Auret (2010) used Earnings-to-Price, Cash flow-to-Price and Book-to-Market ratios to isolate a suitable measurement for value effect at the Johannesburg Stock Exchange (JSE). The ratios explored were those with similar economic interpretation. The time series regression analysis revealed high correlation amongst the study variables with the B/M being a strong predictor of returns than earnings-to-price and Cash flow-to-price. In a related study, Auret and Sinclaire (2006) applied FF3F model to test the value effect on the same market. Monthly data for stocks from all sectors of the JSE were assembled from 1990 to 2000. Return data was adjusted for dividends and capital events and a thin trading filter was used to ensure that the trading volume of each share exceeded at least one per period. Univariate and multivariate regression analyses were conducted to test the significance of the predictor variables with respect to estimating excess stock returns. Results showed a significant positive relationship between B/M ratios and expected stock returns.

Kilsgard and Wittorf (2011) examined the adequacy of FF3F model in measurement of the value effect on average stock returns in at the United Kingdom (UK). The independent variables in the model were factors formed on size and book-to-market equity other than the market beta. The study adopted Fama-French (1993) approach for constructing 16 portfolios of stocks using 4x4 annual sorting procedure. The yield on UK T-bill with one month to maturity was used to proxy risk-free interest rate. The coefficient on HML variable was positive implying that high B/M ratio stocks earn relatively higher returns than low B/M stocks. Strong value effect was similarly noted by Kubota and Takehara (2018) on Tokyo Stock Exchange.

Shafana et al. (2013) employing Fama-MacBeth (1973) procedure analyzed the association between expected stock returns and value factor in Srilanka. For a given year, firm value was measured using the ratio of book to market value of equity while stock returns were operationalized as dividend plus changes in stock price divided by beginning stock price. Cross-sectional regression was used to analyze five-year data from 2005 to 2010 on a sample of 12 firms. In order to smooth the data, all variables were transformed into natural logarithm prior to empirical analysis. The study observed significant negative value effect on returns. The results also support the view that the value factor explains highly stock returns of financial firms than when full sample or non-financial firms are considered. These findings, however, differ with the results obtained by Mahawanniarachchi (2006) and Anuradha (2007) who reported a significant positive relationship between B/M and individual stock returns in Srilanka.

To further establish the influence of B/M ratio on stock returns in emerging markets, Araujo and Machado (2017) studied 318 non-financial firms in the Brazilian capital market between 1995 and 2015. The financial firms were excluded since according to Fama and French (1992), their high leverage may confound the B/M ratio. Regression models were estimated using panel data where companies were the basic unit of study. Homoskedasticity and autocorrelation assumptions were tested respectively using Wald and Wooldridge (LM) test. Hausman test was run to identify which model was the most adequate in each case. Analysis was done using t-test for significance of variables and F-test for joint significance of variables. The results indicated that B/M ratio has no significant influence on Brazilian stock returns, a contrast to the results obtained by Mahawanniarachchi (2006) and Anuradha (2007) in Srilanka.

Value effect has also been recently investigated by Chen and Zhang (2019) on non-financial firms at the Chinese market. The sample contained 258 months observations spanning 1996 to 2016 so as to obtain adequate number of cross-sectional units for time series data. The study employed time series and Fama-MacBeth tests on 25 portfolios related to size, constructed following the Fama and French (1993) framework. Over the period of study, the HML (High-Minus-Low) factor generated risk adjusted average monthly return of 0.23% (*t*-value = 1.40) which is not statistically different from zero at 1% level. The results of time series regression indicated that value factor does not significantly explain the cross-section of stock returns in China. The results are similar to findings by Hou et al. (2015) who observed weak value effect, contrary to other studies such as Yao et al. (2017) and Cakici, Fabozzi and Tan (2013) who document significant value effect.

Tripathi and Aggarwal (2020) explored if value premium is sector specific among Indian firms. The analysis spanned 18-year period from 1999 to 2017 on companies listed on BSE-500. The sectors that were considered included Fast Moving Consumer Goods, Financials, Health Care, Information Technology, Manufacturing and Miscellaneous. Data consisted of end of month closing share prices and other financial data from institutional websites. Return on S&P BSE-500 equity index was used to proxy for the market portfolio while the 91-days Treasury bill rate was used as proxy for risk-free rate of return. Regression analysis was done using the monthly excess returns from 5 portfolios as the dependent variables. The study used Welch's ANOVA to test if price-to-book ratio is significantly different across the sectors. The market model and FF3F model were used to test the existence of value premium within the sectors. Empirical results indicated that differences in P/B ratios both between and within sectors were statistically significant. The study also established evidence to support existence of value premium within the sectors irrespective of their value-growth orientation.

Odera (2010) analyzed value effect by testing the validity of FF3F model at the NSE They adopted descriptive and correlational research designs. Monthly data of 60 companies were taken over a period of five years from 2008 to 2012. Multivariate regression analysis was applied on nine test portfolios constructed in the framework of Fama and French (1993) on the basis of market value and book-to-market value of equity. The study documented that the value premium is more effective for high B/M stock portfolios. Overall, portfolios containing glamour stocks had higher earnings as compared to value stocks. These findings are consistent with Hanauer and Linhart (2015) and Njogo (2017).

2.4.4 Asset Growth Risk Premium and Stock Returns

The firm investment-return relationship (also known as asset growth effect) has been investigated under different perspectives. Cooper et al. (2008) studied asset growth effect by using change in total assets as a measure for a firm's growth. Utilizing the US panel data, the study found that firms with low asset growth earn superior annualized risk-adjusted average returns (9.1% higher). The study further found evidence of asset growth effect in all firm sizes and that total asset growth dominates other determinants in the predictive abilities of cross-sectional returns. A related study by Nyberg and Poyry (2010) show that asset growth effect is significant and strong explanatory factor for momentum returns in the US market.

Kilsgard and Wittorf (2011) examined the adequacy of a three-factor model introduced by Chen, Novy-Marx and Zhang in UK. The model incorporates factors based on investment and profitability in addition to the market risk premium. The investment premium was constructed by subtracting returns on portfolio of firms with high investments from those with low investment. The authors argued that the investment variable has similar role as the Fama and French HML premium in the sense that firms with low B/M equity have more growth opportunities, invest more and consequently earn lower expected returns than their high B/M counterparts. The investment premium was computed as the annual change in property, plant, and equipment (PPE) added to the annual change in inventories and divided by the lagged book value of total assets (TA). A total of 369 non-financial UK firms were studied from 2002-2011. Regression analysis was conducted using the monthly excess returns from 27 portfolios as the dependent variables. The study established that portfolios containing companies with either low or high investment ratio underestimates the returns at 5% level of significance.

Based on the Growth Option Model, Anderson and Garcia-Feijoo (2006) examined investment returns relationship using capital expenditure as a measure for a company's investments. The study documented a significant investment effect and inferred that firms with low book-to market ratio have accelerated investments and high market value of stock in prior years. Xing (2008) also arrived at similar findings utilizing the investment-to-capital ratio (The ratio between capital expenditures and net fixed assets). Yao et al. (2017) studied the relationship between investment and expected returns using non-financial firms listed on the Shanghai Stock Exchange over the period 1997-2015. The sample included firms with data for at least three years to reduce survivorship bias. Asset growth was used to capture the cross-sectional average returns defined as simple year-to-year percentage change in total assets. The study established that AG factor is positive and significant implying that growth firms have more exposure to asset growth risk than their value counterparts. The study findings also indicated that portfolios with low AG level tend to have higher equity returns in the next one to three years and vice versa. Thus, AG and expected returns exhibit a negative relationship after controlling for size and B/M ratio.

A study by Constantinou et al. (2017) examined the existence of firm level asset investment in Greece. The study sample consisted of 2,767 firm year observations covering all firms (except financial) listed firms on the Greek stock market. The study was premised on mispricing (rational) explanation of asset growth effect. The theoretical proposition was justified on account of the nature of the study context, characterized by low market liquidity and high transaction costs-factors which are usually believed to be barriers to correction of mispricing that may occur in a stock market. The study utilized cross-sectional regressions on ten test portfolios using 21 years data for the period 1988-2008. Asset investment was measured as year-by-year percentage change in firms' total assets following the approach by Cooper et al. (2008). The study employed size effect and book-to market ratio as control variables which have proven to have strong pricing effect on stock returns. The reults of pooled regressions showed that firm investment variable had a negative coefficient (-0.192, t = -6.395) implying a negative effect of firm investment in Greece. The coefficient of firm investment was consistently significant (-0.046, t = -2.082) even after controlling for size and B/M ratio. Overall, it was revealed that firm investment is a strong predictor of stock returns among Greek firms. For purposes of policy and practice, the authors further recommended that a trading strategy consisting of long (short) position in firms with low (high) firm investment growth generate positive returns.

2.4.5 Profitability Risk Premium and Stock Returns

The question as to whether profitability is a priced factor has been at the centre stage of recent studies on asset pricing. Acaravci and Karaomer (2017) tested the validity of the FF5F model in Borsa Istanbul using excess returns of 14 portfolios sorted on the basis of firm size. The sample comprised of all non-financial firms trading on Borsa Istanbul, in accordance with the approach suggested by Fama and French (1992). The study employed the use of 132 monthly data between July 2005 to June 2016 as the sample period with a sample size range of between 174 and 281 firms. Firm Profitability was measured as EBIT to book value of equity ratio (Fama & French, 2015). Profitability premium was computed as return difference between robust and weak profitability portfolios (RMW). Results of analysis showed a higher premium of excess return on market portfolios over the profitability premium implying that maximum return premium can be obtained from the market portfolio.

Mosoeu and Kodongo (2017) examined firm profitability and return relationship in selected emerging markets using FF5F model. The study utilized weekly stock return data for the period between January 2010 and December 2016. Generalized Method of Moments (GMM) was used run regressions and GRS test to measure how well the model fits data. The results from RMW regressions showed that profitability premium is statistically significant priced premium across all countries examined except South Africa and Singapore. The intercepts for these countries were positive with an average standard error of 3.08 from zero. In the same context, Fama and French (2016) observed similar results with a significant RMW factor and standard error of 3.95 from zero. Further evidence of profitability-return relationship is reported in Novy-Marx (2013).

Kilsgard and Wittorf (2011) compared the performance of a three-factor model developed by Chen, Novy-Marx and Zhang (2007) against that of Fama and French (1993) in UK. The former model augments the CAPM market factor with profitability and investment. The period of study spanned 9 years from 2002 to 2011. The authors argued that profitability variable, ROE, explains the variance of returns since shocks to profitability are positively related to contemporary shocks to returns, an aspect not present in FF3F model. The ROE factor was derived by dividing the quarterly net profit with one-quarter-lagged book equity (BE). The book-equity was defined as the shareholders' equity plus deferred taxes as reported in the financial statements and investment tax credit less book value of preferred stock. The results obtained a negative coefficient for ROE which imply that during the period of study, companies were less profitable, especially the companies in the high profitability ratio portfolios. This indicates a potential for lower returns because, quite intuitively, companies that are expected to be relatively less profitable will most likely deliver lower returns than their profitable counterparts.

Building on evidence by Novy-Marx (2013) and Aharoni et al. (2013), Fama and French (2015) examined the explanatory power of a five-factor model using US data. The FF5F model is an extension of the three-factor model that accounts for the effect of firm profitability and investment on expected returns. Profitability factor was measured as the spread of returns on a portfolio of stocks with high operating profitability and low operating profitability. The study used 606 monthly observations for data over the period 1963-2013. Return on one-month treasury was used to estimate the risk-free rate of interest. Portfolios of stocks were constructed based on Fama-French (1993) approach, using a 2x3 annual sorting procedure. The results showed negative correlation between profitability, market and size factors, providing important information regarding potential benefits from portfolios that diversify exposures across these factors.

A comparative study on pricing effect of Fama-French anomalies on excess returns of size-profitability stocks in Nordic markets was investigated by Sundqvist and Toni (2017). The theoretical intuition in variable conceptualization was connected to the DDM model. The study employed monthly price data and total return downloads from Thomson Data stream over a period spanning 1999 to 2015. The pricing factors were constructed following the description in Fama and French (2015) framework on a 4x4 sorting criterion in order to keep portfolios well diversified. The dependent variables were the excess returns on 48 sample portfolios. Monthly returns on stocks, market risk premium and risk-free rate of interest were calculated as mean return from the asset's total return indices. Operating profit was computed by dividing operating income by the book value of equity. The GRS statistics and model regression intercepts were analyzed to measure the performance of each model. The intercepts in FF5F model were mostly jointly indistinguishable from zero on GRS test implying that the FF5F model was closest to complete description of average returns. Overall, the study observed significant loadings of RMW on all but size-profitability sorted portfolios.

Machado and Faff (2017) investigated whether profitability is priced and if it partially explains mean return of stocks in the Brazilian stock market under the model framework developed by Fama and French (2015). The study employed both time series and cross-sectional regression on a sample data spanning 1st June 1997 to 30th June 2014. To minimize chances for survivor bias error, the study included data on both active and inactive stocks in the Brazilian capital market. Financial firms were excluded from analysis following the argument in Fama and French (1992) that the B/M ratio for financial firms is influenced by their degree of leverage. Also excluded were firms with negative equity. Profitability was calculated as EBIT divided by the operational assets. Models were formed from a combination of risk factors. The study further examined if the method of factor premium construction has implication on asset pricing. The study established that regardless of the way factors are constructed, models with no HML have the highest GRS statistic and highest absolute intercept which implies that HML is important in explanation of returns. Additionally, profitability does not add much asset pricing explanatory power in Brazil possibly because the model does not control for trading frictions which is a common feature in developing countries. It is against this background that the current study seeks to establish if the FF5F model would improve the explanatory power at the NSE after controlling for investor sentiment.

2.4.6 Investor Sentiment and Stock Returns

Chuang et al. (2010) employed a generalized auto-regressive conditional heteroskedasticity in mean (GARCH-M) model to study the impact of movement in investor sentiment on stock returns in Taiwan. The sample period for the study spanned 14 years from 1990 to 2004 with a total of 779 weekly observations. The sentiment proxy used in the study was the change in trading volume. The study was premised on the hypothesis that a change of trading volume represents movement in the investor sentiment. The results showed that contemporary sentiment proxy has better explanatory power in excess return and conditional volatility. Supporting the same proposition, Baker and Wurgler (2007) concluded that a positive change in the volume of trade would indicate a bullish sentiment. On the other hand, a bearish sentiment induces investors to sell stocks at first and then decrease trading to avoid loss realization afterwards. Thus, a change in trading volume can reflect some degree of investors' expectations in Taiwan stock market.

Bathia and Bredin (2012) examined whether incorporating investor sentiment, as conditioning information, can help to capture the predictive ability of firm size, value, liqidity and momentum in explaining risk-adjusted returns of individual stocks at the New York Stock Exchange (NYSE). The study incorporated different investor sentiment measures in different asset pricing models to determine if it enhances the performance of these models. The study employed two-pass time series regression of excess monthly returns on individual stocks over the period 1981 to 2010. Results showed that sentiment augmented asset pricing models often contributes in capturing the predictive power of firm fundamental attributes. Furthermore, the study found that the value and momentum effects are effectively captured in the sentiment augmented conditional version of the Fama-French (1993) three factor model.

The effect of investor sentiment on stock returns was highlighted by Tran and Nguyen (2013) in the Norwegian and Vietnamese markets from 1991 to 2013. They employed Brown and Cliff (2005) model which considers ADR Index and Consumer Confidence Index as additional components to improve the predictive power of the sentiment index. The study concluded that the effect of sentiment on stock returns is more pronounced in small, volatile, value and stocks that do not pay dividends. The results further revealed a negative association between sentiment and stock returns particularly for firms with negative returns in Norway and firms with volatile returns in Vietnam. These results are however consistent with the findings in Baker and Wurgler (2007) in which study the sentiment effect was found to be more profound in stocks that are not easy to value and arbitrage.

Dalika and Seetharam (2015) investigated the impact of investor sentiment on stock returns in South African market over the period from 1999 to 2009. The study was premised on the assumptions that mispricing is caused by both an uninformed demand shock and a limit to arbitrage. The authors adopted Baker and Wurgler (2007) methodology to develop a sentiment index by employing a number of sentiment proxies hypothesized to contain some component of investor sentiment and some component of non-sentiment related idiosyncratic variation. The sentiment series was estimated as the first principal component in the orthogonalized sentiment proxies. A set of portfolios were formed in accordance with Fama and French (1993) methodology. The results indicated that investor sentiment has strong impact on share returns in the South African market. During low sentiment periods, subsequent returns were relatively high especially among low market cap, highly volatile, growth and start-up firms. These patterns, however, were seen to reverse when sentiment is high.

Dash and Mahakud (2015) analyzed IS as a conditioning information variable for explaining cross-section of stock returns for National Stock Exchange listed non-financial firms in India. The study sample comprised 98 monthly stock return observations over a period spanning 2003-2011. Data on stock returns and other firm specific information was obtained from the Centre for Monitoring Indian Economy PROWESS database and National Stock Exchange website. The S&P CNX Nifty value weighted index return was used as proxy for market return while the 91 days T-bill yield published by the Reserve Bank was used as proxy for risk-free rate. The systematic risk variables in the study consisted of the market factor, size, value, momentum and liquidity-formed following the approaches in Fama and French (1993), Cahart (1997) and Keene and Peterson (2007). The dependent variables were 36 test asset portfolios scaled by size. The study further employed a new implicit sentiment proxy using P/E ratio. Analysis of data involved crossectional tests of alternative APMs using Fama and Macbeth Generalized Method of moments. Results of analysis showed that a conditional model that augments the Cahart model with liquidity performs better than other models. For all conditioned specifications, the risk factors were found to be significant implying that IS has significant information for making risk factors time varying and hence it has impact on asset pricing.

2.5 Critique of Empirical Literature

A number of studies find weak support for single factor model for asset pricing both in international markets (Mohamed & Khairy, 2014; Iqbal & Brooks, 2010; Ajlouni & Khasawneh, 2017; Alexander & Einar, 2017) as well as locally (Okumu & Onyuma, 2015; Riro & Wambugu, 2015). Other studies however, conclude that market risk is a good predictor of cross-sectional variations in stock returns (Syed, 2017; Coffie & Chukwulobelu, 2013; Rustam & Nicklas, 2010). Among the reviewed studies that find increasing explanatory power of the market risk also observe changing risk-return relationship in up and down-market states (Lind & Sparre, 2016; Blumberg, et al., 2005). A question therefore arises as to as to whether high or low investor sentiment periods would as well influence predictive power of asset models in an equity market.

Researchers employ different approaches for constructing portfolios sorted on size and one other variable in line with Fama and French (1993) framework. For instance, Fama and French (2015), Karp and Vuuren (2017), Mosoeu and Kodongo (2017) use 2x3 annual sorting. Odera (2010) used 3x3 sorting procedure with risk premia adjusted for thin trading at the NSE while Kilsgard and Wittorf (2011) used a 4x4 sorting at London Stock Exchange. The choice of sorting criteria has implication on the model accuracy as observed by Hearn and Piesse (2013). Thus, variations in findings in the prior studies reviewed could be associated with the criterion used in sorting portfolios.

Empirical research particularly in the aftermath of the 2008 global financial crisis, have underscored the importance of market imperfections in the analysis of traditional asset pricing models. Emerging markets are characterized by low capitalization, scarce shares outstanding, infrequent and irregular trading which are all likely to affect firm valuation (Hou et al., 2015). Chan et al. (2011) found that augmenting asset pricing models with a liquidity premium resulted to marginal improvement in the model's explanatory power. Studies by Auret and Sinclaire (2006) and Odera (2010) employed a thin trading filter to avoid bias in beta estimates. Investors in emerging markets, according to Duff and Phelps (2010), are influenced by social and cultural underpinnings while their counterparts in more advanced and efficient markets tend to base their investment decisions on the information available. The mixed results in the empirical studies reviewed can be attributed to failure to adjust the test models for constraints in the market. Thus, the predictive power of a model is likely be boosted by adding to the standard asset pricing models other risk premia that could influence market efficiency.

Researchers have often employed different proxies and measurements for firm investment and profitability risk factors in studying cross-sectional variation in stock returns. Kilsgard and Wittorf (2011) in their study used ROE to proxy for profitability premium while investment to assets ratio was used to proxy for investments. Yao et al. (2017) recommended the use of operating profitability to proxy for profitability factor premium while investment premium measured as the sum of annual change in gross PPE and inventories divided by lagged book value of firm assets. Machado and Faff (2017) on the other hand calculated profitability as EBIT per unit of operational assets while investment premium was measured as change in total asset between year t-2 and t-1 divided by the total assets in year t-2. Further, Xing (2008) adopted investment-to-capital ratio (the ratio between capital expenditure and net fixed assets) to proxy for firm investment in contrast with Novy-Marx (2013) who argued against using measures which may contain expensed investments. Lack of consensus among researchers on a common measure for investment and profitability variables could account for inconsistencies in the study outcomes.

Studies investigating how investor sentiment impacts on risk-adjusted returns have adopted varied measures for sentiment and yielded mixed results. Baker and Wurgler (2007) does not prescribe the investor sentiment index to explain excess returns on US stocks. Chuang et al. (2010) established that the model using changes in current year's trading volume was the most suitable to explain variation in excess stock returns. Lee and Swaminathan (2002) indicated that changes in current trading volume gives most predictive power rather than the lagged volume. Anusakumar, Ali and Hooy (2017) using trading volume as measure of sentiment in the emerging Asian markets concluded that stock specific sentiment has a greater positive influence on returns than market specific sentiment after controlling for macroeconomic premia. Locally, Abdullahi (2012) represented investor sentiment index by value of shares traded at the NSE and found the existence of both long-run and short run effect of investor sentiment on stock market performance. In view of the inconsistencies in the measurements of investor sentiment and the general absence of convergence in findings, there is compelling need for further research to establish the definitive nature of relationship between firm specific fundamental variables, investor sentiment, and cross-sectional variation in stock returns.

A critical analysis of past empirical studies on asset pricing also reveals wide variations in employment of research methodologies. Some studies such as Mohamed and Khairy, 2014) utilize monthly data and reach conclusions that are somewhat at variance with those that use daily stock prices (Iqbal & Brooks, 2010). Other studies vary in findings on account of sample period used (Karp & Vuuren,

2017) and number of stock markets studied (Mosoeu & Kadongo, 2017). Whereas some models are tested using data on individual stocks (Okumu & Onyuma, 2015), others analyze from the portfolio perspective (Riro & Wambugu, 2015). The methods of analysis also differ across the studies. Shafana et al. (2013) apply Fama-MacBeth (1973) procedure, Odera (2010) used multivariate regression analysis while Basiewicz and Auret (2010) used both univariate and multi-variate regression analysis. It is unclear as to whether the employment of different methods of analysis could contribute to the mixed results in various research contexts.

2.6 Research Gaps

Most studies on asset pricing are confined to contexts in developed markets (Hearn & Piesse, 2013). The results in Fama and French (2012), Fama and French (2017), and Griffin (2002) suggest that the global version of a factor asset pricing model is not overall convincing and that local versions might provide better insights regarding relevant factors. It is therefore important to explore the debate around asset pricing in the emerging markets owing to their distinctive structure and importance in international portfolio diversification (Iqbal & Brooks, 2010). In many African equity markets, the return generating process is not well established making it difficult to identify components for risk premia due to lack of reliable historical data (Basiewicz & Auret, 2010). Owing to the fact that no single study has been done on applicability of FF5F model in the Kenyan equity market under market imperfections, this study therefore seeks to fill this knowledge gap by testing the pricing effect of market, size, value, asset growth and operating profitability as explanatory variables for cross-sectional variation in equity stock returns at the NSE.

Past studies construct factor premia by distributing the sample into portfolios sorted on size and one additional variable following Fama and French (1993) methodology. The median is often used as size break-point, while 30th and 70th percentiles are used as break-points for all other variables. A major weakness of this methodology is that mean returns of the middle group are excluded from the calculation which could introduce measurement error (Hearn & Piesse, 2013). Whereas most of the existing local studies use a 2x3 sort in the formation of portfolios, the current study adopted a

2x2 sort due to small number of stocks at the NSE and so as to give a guarantee that the composition of stocks in each portfolio is satisfactorily large (not less than ten) in any given year.

As a departure from traditional finance theory which assumes that investors are rational, the current study considers that asset pricing in emerging markets is more likely to be influenced either category of investors. Past studies have often neglected the role of different states of investor sentiment in explaining risk-adjusted returns (Lind & Sparre, 2016). To the best of the researcher's knowledge, this type of analysis has not yet been conducted using Kenyan data. Thus, the current study adds a new dimension in asset pricing studies by investigating if changes in investor sentiment, as proxied by the bull-bear spread, would moderate the effect of APR premia on stock returns at the Kenyan equity market. It is expected that an investigation of this kind would extend literature in the context of emerging market economy by providing more ideas on investor sentiment and asset pricing.

Prior studies estimate model parameters in time-series regression using ordinary least square (OLS) techniques. However, Phuoc, Kee and Yingcai (2018) provide evidence against the employment of standard OLS regression method in estimating the coefficients of risk premia in asset pricing models. According to the authors, using OLS techniques would produce estimators that are biased downwards for securities that trade infrequently and upwards for those that are traded more frequently. A significant contribution of this thesis is therefore in regard to robust analysis of relationships among the variables using Auto-Regressive Distributed Lag (ARDL) and Vector Error Correction (VEC) estimation models. The ARDL model is applied to analyze short-run relationship when variables display a mix of $I(0)$ and $I(1)$ series. Further, the results of bounds test showed presence of co-integration and hence it was necessary to estimate both the ARDL and ECM model respectively for short-run and long-run relationship among the variables (Engle & Granger, 1987).

2.7 Summary

This chapter identified and critiqued theoretical concepts that were used to explain variable linkage, namely: the capital market theory, Efficient Market Hypothesis, Equity Valuation Model, and the Noise Trader Theory. The theoretical foundation of variable linkage was also supported by other explanations namely: Investor Bias, Risk-Based Explanation, Managerial Agency and Extrapolation Hypothesis. The variables of study were conceptualized and represented in a conceptual model. Monthly stock returns were the dependent variable while the FF5F risk premia were the predictor variables. The moderating effect of Investor Sentiment was reviewed in recognition of potential effect of investor irrationality in asset pricing. The study explored past relevant empirical literature relating to formulated objectives. The empirical review highlighted findings arising from studies undertaken in diverse contexts employing a variety of methodological approaches. A critique of the reviewed literature was done and research gaps identified.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter provides discussion on the following components: research design, the population, sampling and sample size determination, data collection, diagnostic tests and procedure for data analysis.

3.2 Research Philosophy

The philosophical foundation of the current study was anchored on positivist assumptions. In the perspective of Druckman (2005), positivists recognize the need for distance between the researcher and those being studied so that biases can be avoided. According to Saunders, Lewis and Thornhill (2007), positivists are more concerned with facts or causes of social phenomena with little regard for subjective states of mind. Many accounts of positivism suggest that scientific knowledge is arrived at through accumulation of verified facts and that scientific theories provide basis on which hypotheses are derived and subjected to empirical tests (Bryman & Bell, 2011). Thus, under the positivist approach, researchers control the theoretical framework and the structure of research in search for causal relationships and focuses on prediction and control.

Positivism view has been successfully used in a number of asset pricing studies (Bryman & Bell, 2011; Druckman, 2005; Hearn & Piesse, 2013; Rustam & Nicklas, 2010; Yao et al., 2017). The current study utilized the established theoretical linkage between FF5F premia, investor sentiment and variation in cross-section of excess returns to develop hypotheses that were tested and validated against empirical observations. In this regard, the existing theory was the starting point before further tests and validations were done through empirical research. The outcome of the test of hypotheses formed the basis of formulating new or revising existing theory. In this regard, numerical measurement, statistical analysis and search for cause-and-effect relationships were at the center of the study.

3.3 Research Design

A research design is a conceptual structure adopted by the researcher to provide an appropriate framework for a study (Sileyew, 2019). It is also considered as the blue print that guides the process of research from problem identification to reporting the research findings (Gay, Mill & Airasan., 2010). The current study sought to explain the cause-effect relationship between APR premia that proxy for systematic risk and stock returns in Kenya. In this regard, the study adopted a causal research design. Causal effect, according to Blumberg et al. (2005), occurs when changes in one phenomenon results, on average, in changes in another phenomenon

The study also employed time series study design which involves gathering data from the same subjects repeatedly over a defined period. Time series designs are useful for analysis of changes in behavior patterns as well as identifying short-term and long-term trends in data. In the proposed study, monthly stock returns data was collected over an eight-year period with NSE listed firms acting as observational units. Other similar studies that have employed causal and time series designs include Cooper et al. (2008), Basiewicz and Auret (2010), Dalika and Seetharam (2015), Sundqvist and Toni (2017) and Racicot and Rentz (2016).

3.4 Population

The study population consisted of all the 64 firms listed at the NSE as at 31st December 2019 and summarized in appendix IX. The firms are distributed across eleven (11) industrial sectors in the Main Investment Market Segment (MIMS) and four (4) categorized under Growth Enterprises Market segment (GEMS). Listed firms were preferred as unit of analysis on account of their defined structure, operational mandate and likelihood for giving elaborate relationships among the study variables. The size of population was reckoned as small and hence did not warrant the need for sampling. Hence a complete census was undertaken.

3.5 Data Collection Instrument

The study employed secondary data obtained from audited annual company reports, central bank reports and publications, Capital Markets Authority and NSE annual investor handbook. Secondary data was collected using secondary data collection sheet presented in Appendix III-VII. The instrument was designed to capture relevant information on market capitalization, book value of stocks, operating profit, book equity, total assets, T-bill rates, market indices, and stock prices of firms listed at the NSE.

3.6 Data Collection Procedure

Data collection procedure involved download requests for relevant quantitative data from websites of the listed firms. The study employed use of a relatively short time series secondary data (9 years long), as opposed to similar research conducted in developed markets where the available time series are more than 20 years long. The choice of length of period for analysis was informed mainly by availability of data on variables. The predictor variables were risk premium on market, size, book-to-market equity, operating profitability, asset growth and investor sentiment while monthly excess return on 12 test portfolios were used as the dependent variables.

Data for computing return on market index was obtained from monthly statistics on the NSE 20 share index as tabulated in Appendix V. The market index, according to Berk and Van (2016) is a reliable proxy for measuring investor exposure to overall market risk. The risk-free rate of interest was computed from statistics on annualized T-bill rates retrieved from the central bank of Kenya website and databases. Size portfolios were constructed from data on market capitalization of NSE listed firms obtained from their respective published annual statements and reports. Other relevant data for portfolio construction included annual statistics on total assets, total debt and operating profit of NSE listed firms as tabulated in appendix IV. Monthly returns on the test portfolios (dependents), investor sentiment (moderator) and APR premia (independents) were computed from monthly closing prices data of NSE listed stocks as keyed in appendix III.

3.7 Data Processing, Analysis and Presentation

Processing of data in this study involved filtering and screening of data for accuracy, missing values and removal of outliers before entering in the E-views (v-10) software package for analysis. Filtering process was undertaken to exclude stocks whose time series data was missing or not applicable for analysis. To minimize survivorship bias, active firms that got delisted during the sample period did not form part of analysis. In order to eliminate the confounding effects of financial distress, firms with a negative book value of equity were excluded from analysis in line with Fama and French (1993) framework. Descriptive statistics and correlation analysis were used to give summary and describe basic characteristics of data. Correlation coefficient measures the strength of linear association between variables. The coefficient, denoted by r is obtained by standardizing the covariance which gives values lying between -1 and +1. A coefficient of +1 indicates that the variables are perfectly positively correlated. Conversely, a coefficient of −1 indicates a perfect negative relationship. A coefficient of zero indicates no linear relationship at all. The correlation matrix in asset pricing studies is useful for getting a rough idea of the relationships between the predictors and for a preliminary assessment of multicollinearity.

Multivariate time series regression, as advocated by Black et al. (1996) was used to regress test portfolio returns on explanatory variables across time to obtain the regression coefficients or factor loadings which were interpreted as sensitivities of test portfolios to the risk factors. The study utilized Auto-Regressive Distributed Lag (ARDL) and Error Correction (EC) estimation models. The ARDL estimation technique is applied to analyze relationships when variables have mixed order of integration i.e. $I(0)$ and $I(1)$ series. In order to test if the ordinary Least Squares (OLS) assumptions of time-series data hold, diagnostic checks were performed. The checks included test for normality, linearity, multicollinearity, heteroskedasticity, autocorrelation, stationarity, cointegration, stability and functional form.

The overall significance of regression models were tested by observing the *p*-values of the F-statistic. R-squared values were used for assessing the proportion of variation in the dependent variables explained by the predictor variables. According to Keith (2015), R-square is useful in determining the statistical significance and importance of the overall regression. R-squared change (ΔR^2) was used to check if models incorporating the interaction terms account for significantly more variance than main effects models. Hypotheses were tested at 5% level of significance using t-statistics and probability values. The optimal model was tested based on standard test recommended by Gibbons, Ross and Shanken (1989) and adopted in Kubota and Takehara (2015) for mean–variance efficiency. A well specified equilibrium model is one with the highest GRS statistic and whose intercept term is indistinguishable from zero which would imply that the endogenous variables are important in explaining of returns.

3.8 Model Specification

The study adopted multivariate time series regression technique for analysis of relationships among the study variables. The model equation for the study is as specified in the ensuing sections.

3.8.1 Main Effects Models

3.8.1.1 The ARDL Representation for Main Effects

The main effects model specified in equation 3.1 was used to test the amount of variation in the outcome variable accounted for by the predictors without effect of sentiment.

$$\Delta y_t = \alpha_0 + \sum \delta_i y_{t-i} + \sum \beta_i \Delta x_{t-i} + \varphi_i x_{t-1} + e_t \qquad (3.1)$$

Where:

y_t: Returns on portfolio *j* in time *t*.

α_0 : Intercept of portfolio *j*. If the predictors in a model capture adequately expected returns, α_j should be indistinguishable from zero

β_i: The coefficient loadings for the respective risk premia capturing short-run property.

φ_i : Represents long-run elasticities

$e_{j,t}$: The random error term capturing other factors influencing stock returns besides the explanatory variables. It is assumed to be identically and independently distributed of the dependent variable and normally distributed with zero expectation and constant variance σ^2.

x: Represents respective asset risk premia namely:

MKT: The market risk premium

SIZE: The size risk premium

VALUE: The value risk premium

OPROF The profitability risk premium

ASTG: The Asset Growth risk premium

Δ = First difference operator

3.8.1.2 The Error Correction Model Representation

In order to investigate simultaneously the long-term and short-term effects of one series on the other, ECM procedure was adopted. The co-integration of at least one of the variables warrants the ECM to determine their degree of convergence in the long-run. The ECM relates to the fact that last period's deviation from long-run equilibrium influences the short-run properties. Suppose two series are *I* (1) and have a long-term relationship between them (co-integrated), then their relationship can be expressed as a static model thus:

$$y_t = \propto_0 + \beta X_t + \mu_t \quad \text{(3.2)}$$

Where μ_t is a zero mean, *I* (0) process. The expression for error correction term can be defined by $\mu_t = y_t - \propto_0 - \beta X_t$ where β is the cointegrating coefficient. Similarly, one period lagged value of the error from cointegrating regression can be expressed as

$$\mu_{t-1} = y_{t-1} - \propto_0 - \beta X_{t-1}. \quad \text{(3.3)}$$

Since the system cannot always be in equilibrium, it is also vital to consider the short – run dynamics of the variables too. A simple ECM incorporating short-run adjustment can thus be written as:

$$\Delta y_t = \propto_0 + \propto_1 \Delta X_t + \propto_2 \mu_{t-1} + \varepsilon_t \quad \text{(3.4)}$$

Statistically, the equilibrium error term will converge to zero. The $\propto_1$ coefficient shows how changes in X_t impacts either positively or negatively on short run changes in y_t. The ECM for stock returns can therefore be defined as in equation 3.4.

$$\Delta y_t = \alpha_0 + \sum \delta_i y_{t-i} + \sum \beta_i \Delta x_{t-i} + \xi \text{ECT}_{t-1} + e_{2t} \quad \text{(3.5)}$$

Where:

ξ = The coefficient of ECT i.e. the speed adjustment to long-run equilibrium. A negative coefficient implies that the previous period's deviation from long-run equilibrium is corrected in the current period at a rate of ξ%. A positive coefficient $\xi > 0$ indicates that the model is unstable.

ECT = Error Correction Term which replaces the ARDL bounds test long-run terms ($\varphi_i x_{t-1}$).

3.8.2 Testing for Moderation -Without Interaction

3.8.2.1 The ARDL Model Representation

To test whether investor sentiment has a direct effect or moderates the relationship between APR premia and stock returns, the approach of hierarchical multiple regression as adapted in Namazi and Namazi (2016) was used.

$$\Delta(avret)_t = \alpha_0 + \sum \delta_i \Delta(avret)_{t-i} + \sum \beta_i \Delta(X')_{t-i} + \sum \lambda_i \Delta(SENT)_{t-i} + \varphi X'_{t-1} + \varphi SENT_{t-1} + e_{4t} \quad (3.6)$$

3.8.2.2 The Error Correction Model Representation

$$\Delta(avret)_t = \alpha_0 + \sum \delta_i \Delta(avret)_{t-i} + \sum \beta_i \Delta(X')_{t-i} + \sum \lambda_i \Delta(sent)_{t-i} + \lambda ECT_{t-1} + e_t \quad (3.7)$$

Where $X_j{}'$ represent a composite index for APRP

SENT: Investor Sentiment variable

AVRET: Average stock returns

3.8.3 Testing for Moderation –With Interaction

Model Equation:

$$\Delta avret_t = \alpha_0 + \sum \delta_i \Delta avret_{t-i} + \sum \beta_i \Delta X'_{t-i} + \sum \lambda_i \Delta(sent)_{t-i} + \sum \varphi_i \Delta(X' * sent)_{t-i} + \xi ECT_{t-1} + e_t \quad (3.8)$$

Where:

X': A composite index for APR premia.

$X' * \text{SENT}$: Interaction term between composite index of the APR premia and sentiment variable. The moderating effect was tested by assessing the change in adjusted R^2 and significance of the interaction term. If the change in R^2 for the respective models and the coefficient of the interaction term are statistically significant, then the moderating hypothesis would be supported. This means that the relationship between APR premia and stock returns varies with sentiment. Conversely, it would imply that the effect of sentiment on stock returns varies with APR premia.

3.8.3 Gauss-Markov Assumptions for Time Series Regression

3.8.3.1 Linearity

The time series process follows a model which is linear in its parameters. It was assumed that the outcome variable has linear relationship with the predictors. This is represented by equation of the form:

$$y_t = \beta_0 + \beta_1 X_{t1} + \cdots \beta_k X_{tk} + \mu_t \qquad (3.9)$$

Where:

y_t : The dependent variable

X_{tj}: Independent variables in which t denotes the time period while j denotes one of the explanatory variables, j=1, 2.........k.

β_0 : Model intercept. The intercept should be indistinguishable from zero in a model that completely captures excess stock returns

$\beta_1 \ldots\ldots \beta_k$: The coefficient loadings for the respective explanatory variable.

μ_t : The error term or disturbances at time *t*.

Pedhazur and Schmeklin (2013) contend that modelling a non-linear relationship using a linear model would limit the generalizability of study findings. The current study adopted the use of plot of residuals against fitted values to check if the outcome variable and the regressors were linear in nature as proposed in Field (2009). Linearity was determined by a smooth fit to the error terms in order to establish the trend easily. Bryman and Bell (2011) recommend non-linear transformations of the predictor variables in circumstances where residual plot indicates non-linear association in the data.

3.8.3.2 Multicollinearity

Multicollinearity exists where there is perfect linear relationship between two or more of the predictor variables. The presence of multicollinearity makes it difficult to precisely estimate how each predictor variable impacts on the response variables and also standard errors for each independent variable become inflated (Komlos, 2019). Multicollinearity can be corrected by excluding one or more of the correlated independent variables from the regression model (Lind & Sparre., 2016). Bowerman and O'Connell (1990) suggest collecting more data to see whether the multicollinearity can be lessened. As with ordinary regression, this assumption can be checked with Variance Inflation Factor (VIF), tolerance statistic (1/VIF), the eigenvalues of the scaled, uncentred cross-products matrix, the condition indexes and the variance proportions. In this thesis, multicollinearity was assessed using Variance Inflation Factor and Tolerance Level. Myers (1990) suggests that a VIF value of less than 10 or a tolerance statistic greater than 0.1 is acceptable.

3.8.3.3 Heteroskedasticity

The classical linear regression model (CLRM) assumes that at each level of the independent variable (s), the variance of the disturbance terms should be constant. This means that disturbance terms at each level of the indepedents should have the same variance (homoscedastic). When the variances are very unequal, the errors are said to be heteroscedastic. In a homoscedastic series, the graph of standardized residuals against the standardized predicted values of the dependent variable based on the model should look like a random array of dots evenly dispersed around zero.

Heteroscedasticity in the data is said to be present if the graph funnels out (or in), as the case may be. Violation of homoskedasticity makes standard errors of estimators biased and inconsistent thereby invalidating tests of hypothesis (Green, 2017; Marco, 2019). This study utilized Breusch-Pagan Godfrey test and White's General Heteroscedasticity test (where appropriate) to check validity of constant variance assumption under the null hypothesis that data is homoscedastic. The null hypothesis is rejected for a value of $(n - \mathrm{p}) * R^2$ greater than the critical X^2 value (where p is the degree of freedom) or for a probability value (*p*) less than 5% implying that data is heteroscedastic.

3.8.3.4 Autocorrelation

Autocorrelation considers the consequences of correlation in error terms entering the Population Regression Function (PRF). For any two different observations, the residual terms should be uncorrelated (or statistically independent). The presence of autocorrelation produces non-efficient OLS estimators, although unbiased. This assumption was tested using Breusch-Godfrey (BG) Lagrange Multiplier test. The test is applicable if the residuals (μ_t) of p order Autoregressive Scheme-AR (p) are generated by the process $\mu_t = \rho_1\mu_{t-1} + \rho_2\mu_{t-2} + \rho_3\mu_{t-3} \dots \rho_p\mu_{t-P} + \varepsilon_t$ under the null hypothesis:

H0: $\rho_1 = \rho_2 = \rho_3 = \cdots \rho_P = 0$

BG test follows chi-square distribution with p degrees of freedom (lag length) estimated as follows- $(n - P)R^2 \sim X^2{}_P$. The study relied on the Akaike and Schwarz Information Criterion to select the lag length of the time series. The value of R^2 was obtained from auxiliary regression of $\widehat{\mu_t}$ on the original X_t values. The null hypothesis is rejected for a value of $(n - P)R^2$ greater than the critical X^2 value which indicates that at least one of the rho (ρ) is statistically significantly different from zero implying there is serial correlation.

3.8.3.5 Normality

The classical linear regression assumes normally distributed errors. It is assumed that the residuals in the model are normally distributed random variables with a mean of 0 and constant variance σ^2. This assumption implies that the spread between the model and the observed data are most frequently zero or very close to zero, and that differences much greater than zero happen only occasionally. Normality of data enhances the analysis of regression model for goodness of fit and reliability of relationships depicted amongst the variables (Nguyen, Ulku & Zhang., 2015). Normality assumption was tested using Jarque-Bera (JB) test for large samples (n) with the joint hypothesis that the coefficient of Skewness (S) = 0 and Kurtosis (K) =3.

$$JB_{\text{stat}} = n\left[\frac{s^2}{6} + \frac{(K-3)^2}{24}\right] \qquad (3.10)$$

The JB statistic follows a chi-square distribution with 2 d.f under the null hypothesis that the residuals are normally distributed. If the computed p-value of JB statistic is greater than the level of significance, the null hypothesis of normality assumption is supported, otherwise it is rejected. The kurtosis

Normality of residuals were further visually tested using a histogram and normal probability (Quantile-Quantile [Q-Q]) plots obtained from a regression command. A normal Q-Q chart plots the quantiles of the data set instead of every individual score in the data. According to Field (2009), a Q-Q chart is plot of values that a researcher would expect to get if distribution was normal against values actually seen (read observed) in a data set. A normally distributed variable is indicated by a straight diagonal line representing expected values with the observed points distributed evenly along the diagonal. Similarly, if a model is a perfect fit, all data points would fall on the regression line and the mean of the residuals would be zero. On the flip side, if a model is a poor fit of the sample data, the residuals will be large.

3.8.3.6 Stationarity

In order to conduct valid statistical inference using time series data, it is necessary to assume that the time series is stationary. A stationary time series is one whose mean and variance between two Y values K periods apart remain the same no matter at what point we measure them (Gujarati, 2017). Under the classical Linear regression technique, modelling a non-stationary series would produce spurious regressions. Stationary condition of time series data is necessary for effective and valid test of *t* and *F*-statistics. Additionally, the results for regressing non stationary series cannot be used in forecasting beyond the period under consideration (Baltagi, 2005 & Gujarati, 2017). This study adopted Augmented Dickey-Fuller (ADF) unit root test on variables at 5% level of significance as recommended by DeFusco, Ivanov and Karels (2011) to test the null hypotheses that a series has a unit root (non-stationary).

A time series that does not contain a unit root is considered to be stationary. The estimated t-value of the coefficient of Y_{t-1} was compared against the Mackinnon critical values of standard Neyman Pearson Framework at 5% margin of error. The null hypothesis is not supported if the absolute test statistic is greater than the absolute critical value. Alternatively, if the *p*-value of the ADF test statistic is less than 5% level of significance, the null hypothesis is not supported. Non-stationary series would subsequently require performance of first and second difference to make it stationary.

3.8.3.7 Cointegration

Cointegration is an analytical tool for testing relations between variables. The importance of studying relationships between variables while analyzing economic phenomena has been underscored by Rao (2007). The authors postulate that in the short-run, variables may drift apart but converge in the long-run to equilibrium. Two variables, according to Gujarati (2017) are cointegrated if they have a long-run or equilibrium relationship between them. A test for cointegration, as noted by Engle and Granger (1987) is to overcome the limitation inherent in traditional models as well as avoid spurious regression situations. Co-integration test is vital to establish if variables are able to move together in the long-run and to decide which model to adopt for estimation.

To establish whether or not there is long-term cointegrating relationship among variables in the general model, Engle and Granger (1987) recommend Johansen and Juselius maximum likelihood cointegration technique which uses Trace and Maximum Eigenvalue statistics. This approach shows the number of cointegrating relationships between the dependent variable and its determinants at 5% level of significance. The null hypothesis is that there are no cointegrating equations in the model against the alternative hypothesis of at most 1 or 2 and so on. If either the Trace (or Maximum Eigenvalue) statistic is greater than the critical value at 5% level of significance, the null hypothesis is rejected and hence concluded that there is at least one cointegrating equation, implying that there is a long-run association between the variables.

An alternative approach adapted from Narayan (2005) requires the performance of bounds test for co-integration in the presence of a combination of $I(0)$ and $I(1)$ variables. The null hypothesis of no co-integrated equation is rejected if the F-statistic exceeds the upper $I(1)$ bound value. Under this approach, the Null hypothesis cannot be rejected for an F-statistic less than the lower $I(0)$ bound critical value. The test is however indeterminate for a value of F-statistic lying in the range: $I(0) < F < I(1)$. Similar approach has been used in related works by Kemal and Qadir (2005) and Kalu and Onyinye (2015).

Table 3.1: Summary Hypothesis Testing for Time Series Diagnostics

Test	Null Hypothesis	Decision Rule	Conclusion
Normality	Normally Distributed Residuals	JB stat < 0.05	Reject
Stationarity	Variable is non-stationary (has unit root)	Absolute ADF/P-P t-stat >test ctitical value	Reject
Cointegration	No Cointegration Equation	F-stat > Lower $I(0)$	Reject
Multicollinearity	No Multicollinearity	VIF > 10	Reject
Heteroscedasticity	Data is Homoscedastic	$(n - \text{p}) * R^2 > \chi^2$ value	Reject
Autocorrelation	Serially uncorrelated errors	$(n - \text{p}) * R^2 > \chi^2$ value	Reject

3.9 Operationalization of Study Variables

To enhance construct validity in the current study, we adopted constructs already tested in previous empirical studies on asset pricing. Table 3.2 shows a summary of study variables, their operational definitions, and the measurements that were used to estimate them.

Table 3.2: Operationalization of Study Variables

Variable	Variable Symbol	Indicators	Measurement
Market Risk Premium	MKT	Market Index 91-day T-bill rate	$(\text{r}_{\text{m,t}}) - \text{r}_{\text{f,t}}$
Size Risk Premium	SIZE	Market value of Equity	Small minus Big
Value Risk Premium	VALUE	Book value of Equity Market value of Equity Book-to-Market ratio	High minus Low
Asset Growth Risk Premium	ASTG	Total Assets % growth in Assets	Conservative minus Agressive
Profitability Risk Premium	OPROF	Operating Profit	Robust minus Weak
Investor Sentiment	SENT	Adjusted closing prices	Bull-Bear Spread
Stock Returns	PORT	Portfolio Return Risk-free Rate	$R_{j,t} - r_{f,t}$
	AVRET	Average Return Risk-free rate	$\frac{1}{n}\sum(R_{j,t} - r_{f,t})$

Where:

Small-Big: Return difference on portfolio of small and large stocks at period t.

High-Low: Return difference on High and low B/M portfolios at period t. The B/M is the ratio of Book-Equity to market capitalization where book equity is the excess of TA over TL.

Conservative-Aggressive:

Return difference on portfolio of stocks with conservative over aggressive investment policy. Investment was measured as percentage change in TA.

Robust-Weak: Spread of returns on portfolios with robust and weak profitability.

Bull- Bear Spread:

The difference between the proportion of stocks that closed higher and the proportion that closed lower than the previous period's closing prices

$r_{f,t}$: Risk-free rate of return at time *t*

$r_{m,t}$: Return on the market index. Also denotes return on a risky but diversified market portfolio

$R_{j,t}$: Return on portfolio *j* in period *t* based on % change in stock prices where

$$R_{j,t} = Ln\left[\frac{P_t}{P_{t-1}} - 1\right]$$

PORT: Portfolio Return

AVRET: Average Stock Return

Table 3.3: Test of Hypotheses

Objective	Null and Hypothesis	Hypothesis Tests and Interpretation
To determine the effect of market risk premium on stock returns of listed firms at the NSE.	$\mathbf{H_0 1}$:Market risk premium has no effect on stock returns of listed firms at the NSE.	$H_0: \beta = 0$ $H_1: \beta \neq 0$ 2-tailed T-statistic α =5% Reject H_0 for a p-value < 5% A negative significant ECT implies that long-run causal relationship can be inferred.
To determine the effect of size risk premium on stock returns of listed firms at the NSE.	$\mathbf{H_0 2}$:Size risk premium has no effect on stock returns of listed firms at the NSE.	$H_0: \beta = 0$ $H_1: \beta \neq 0$ 2-tailed T-statistic α =5% Reject H_0 for a p-value < 5% A negative significant ECTimplies that long-run causal relationship can be inferred
To establish the effect of value risk premium on stock returns of listed firms at the NSE.	$\mathbf{H_0 3}$:Value risk premium has no effect on stock returns of listed firms at the NSE.	$H_0: \beta = 0$ $H_1: \beta \neq 0$ 2-tailed T-statistic α =5% Reject H_0 for a p-value < 5% A negative significant ECT implies that long-run causal relationship can be inferred
To establish the effect of profitability risk premium on stock returns of listed firms at the NSE.	$\mathbf{H_0 4}$:Profitability risk premium has no effect on stock returns of listed firms at the NSE.	$H_0: \beta = 0$ $H_1: \beta \neq 0$ 2-tailed T-statistic α =5% Reject H_0 for a p-value < 5%
To establish the effect of asset growth risk premium on stock returns of listed firms at the NSE.	$\mathbf{H_0 5}$:Asset growth risk premium has no effect on stock returns of listed firms at the NSE.	$H_0: \beta = 0$ $H_1: \beta \neq 0$ 2-tailed T-statistic α =5% Reject H_0 for a p-value < 5% A negative significant ECT implies that long-run causal relationship can be inferred
To establish the moderating effect of investor sentiment on the relationship between APR premia and stock returns of listed firms at the NSE.	$\mathbf{H_0 6}$: Investor sentiment does not moderate the effect of APR premia on stock returns of listed firms at the NSE.	Hierarchical multiple regressions $H_0: \beta_{is} = 0$ $H_1: \beta_{is} \neq 0$ 2-tailed *t*-statistic Adjusted R-Square α =5% Reject H_0 for a p-value < 5% R-square and R-Square Change A negative significant ECT implies that long-run causal relationship can be inferred

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.1 Introduction

This chapter presents the analysis of data, interpretation of results thereof and discussion of findings in line with the objectives and research hypotheses as outlined in chapter one. In particular, this chapter presents descriptive, diagnostic and empirical results of time series regression analysis to establish the link between asset pricing risk premia, investor sentiment and stock returns at the NSE. The predictor variables were risk premium on market, size, book-to-market equity, operating profitability, and asset growth while the dependent variable was stock returns measured as monthly return on 12 test portfolios and the overall market index. Investor sentiment was the moderating variable in the conceptualization. Data was analyzed using E-views version 10. The GRS test was performed in STATA version 13. To examine the linkages among variables, the Auto-Regressive Distributed Lag (ARDL) bounds testing approach to cointegration for the long-run results was applied. The Error Correction model was used to examine the short-run dynamics. The ARDL model contains lagged values of the dependent variable, current and lagged values of the regressors.

4.2 Data

Firm level accounting data was extracted from audited financial statements published annually in the NSE Handbook. Monthly returns on the test portfolios and predictor variables were computed from daily equity price lists of the NSE. The analysis covered the period from January 2011 to December 2019, yielding a total of 108 monthly observations. Data was screened for accuracy, missing values and outliers before entering in the E-views (10) software package for analysis. Filtering process was undertaken to exclude stocks whose accounting information was unavailable or not applicable for analysis. To minimize survivorship bias, firms that got delisted during the sample period formed part of the analysis up to the delisting year provided they had at least 50% of the period data. In order to eliminate the confounding effects of financial distress, firms with negative book value of equity were excluded from analysis consistent with recommendations in Fama and French (1993). Only firms which met specification of selection criteria commonly used in asset pricing literature were included in the sample. The final sample frame comprised 60 firms whose list is shown in appendix IX.

4.3 Descriptive Analysis of Portfolio Characteristics

This section provides the descriptive statistics of portfolios that were used to generate time series data for study variables.

4.3.1 Number of Stocks in the Test Portfolios

Using accounting data at the end of December each year, stocks were distributed into two size groups and also independently allocated to two value, two profitability and two asset growth groups using sample median breakpoints. This study adopted a 2x2 sorting criteria yielding 12 test asset portfolios. Fewer portfolios were resorted to so as to achieve a reasonable number of stocks in each portfolio that would provide sufficient diversification of idiosyncratic risk. Table 4.1 shows annual average distribution of stocks in each portfolio.

Table 4.1: Number of Stocks in Test Portfolios

	Low	**High**	**Weak**	**Robust**	**Conserv.**	**Aggress.**	**%**
Small	7	15	21	3	15	10	48.97
Big	17	8	3	22	10	14	51.03
Total	24	23	24	25	25	24	100%

Source: Published Financial Statements and Annual Reports (2011-2019)

Table 4.1 shows average number of stocks in each regression portfolio. The portfolios were ascribed initials relative to their location in the matrix. For example, a portfolio at the intersection of small and low (RSL), big and conservative (RBC) and so on. Overall, big market cap stocks were concentrated in robust profitability portfolios while most small stocks were in the weak profitability portfolios possibly due to their low earning capabilities. Portfolios with the least number of stocks comprised big firms with weak profitability and small firms with robust profitability having an average of three (3) firms each. When compared with related studies in developed contexts, the number of stocks under each portfolio in this study was considerably small. Except for small-weak (21) and big-robust (22), all other portfolios had fewer than the 20-30 threshold number of stocks required to achieve sufficient diversification of non-systematic risk (Sundqvist &Toni, 2017). It can also be inferred from the results in Table 4.1 that high book-to-market, weak profitability and conservative stocks tend to be small while low book-to-market, robust profitability and aggressive stocks are associated with big firms.

4.3.2 Portfolio Market Capitalization

Table 4.2 shows descriptive statistics on market capitalization of the 12 regression portfolios used in the analysis.

Table 4.2: Portfolio Market Capitalization (Ksh. Millions)

	Obs	Mean	Max	Min	Std. Dev.	Skew	Kurt
RBA	220	32,696.67	889,452.50	84.00	80,844.72	7.96	77.30
RBC	91	84,277.21	1,051,717.00	4,378.67	149,390.80	4.39	25.41
RBH	68	24,447.57	172,437.10	4,378.67	23,855.92	3.98	23.63
RBL	149	89,789.48	1,051,717.00	6,056.00	145,535.80	4.39	24.74
RBR	195	72,077.90	1,051,717.00	4,378.67	129,800.60	5.09	32.47
RBW	220	5,434.70	228,533.70	38.60	18,672.55	9.56	105.43
RSA	86	2,657.02	9,108.00	84.00	2,290.03	1.16	3.55
RSC	132	2,087.35	11,365.95	27.14	1,923.12	1.70	7.15
RSH	137	2,453.26	11,365.95	27.14	2,183.50	1.43	4.96
RSL	61	2,158.69	8,640.00	38.60	1,834.74	1.14	4.09
RSR	25	3,622.27	8,050.00	51.59	2,292.81	0.73	2.47
RSW	191	1,973.68	11,365.95	38.60	1,792.21	1.67	7.03

Source: Published Financial Statements and Annual Reports (2011-2019)

Results in Table 4.2 indicate that the largest portfolio was RBL with an average market cap of Ksh. 89.789 billion, a maximum of Ksh. 1.052 trillion and a minimum of Ksh. 6.056 billion. The smallest portfolio was RSW with an average market cap of Ksh. 1.974 billion, a maximum of Ksh. 11.366 billion and a minimum of Ksh. 38 million. Dispersion was highest on RBC portfolio (SD = Ksh. 149.391 billion) and lowest on RSW (SD = Ksh. 1.792 billion). Also notable was disproportionate distribution of firms by size where big firms accounted for 96.64% of the sample market cap while small firms accounted for 3.36%, suggesting that big firms command high market valuation and or dominate trading activity at the NSE.

4.3.3 Size-B/M Ratio Portfolios

Book value of equity is described in Karp and Vuuren (2017) as the value that shareholders would receive on their holdings if the assets were sold at the value indicated in the statement of financial position after all liabilities are settled. The market value of equity, on the other hand, is the market capitalization of a firm. The ratio of book value to market value of equity was computed for each firm on annual basis from 2011 to 2019. For each year over the entire sample period, firms were classified as either value (high B/M Stocks) or growth (low B/M stocks) using median breakpoint. Firms that trade at low book-to-market ratios are expected to earn lower returns relative to their risk than stocks of firms with less attractive outlooks. The descriptive statistics for book-to-market ratios of firms scaled by size are summarized in Table 4.3.

Table 4.3: Size-B/M Portfolios

	Obs.	Mean	Maximum	Minimum	Std. Dev.	Skew	Kurtosis
RBH	68	1.9955	8.0841	0.6973	1.3126	2.5585	10.9048
RBL	149	0.4657	1.3469	0.0002	0.2742	0.3419	2.7646
RSH	137	2.9858	17.1500	0.6985	2.9661	2.7104	10.6523
RSL	61	0.4809	1.1945	0.0000	0.2796	0.0864	2.6524

Source: Published Financial Statements and Annual Reports (2011-2019)

The summary statistics in Table 4.3 show that RBH portfolio had the highest average book-to-market ratio of 1.9955 with a minimum ratio of 0.6973 and maximum of 8.0841. The RBL portfolio had the least mean book-to-market ratio of 0.4657, the ratios ranging between 0.0002 and 1.3469. Overall, the average B/M ratio for value firms was greater than 1 while that of growth firms was less than 1. The standard deviation was higher (Std. Dev. = 2.9661) for small value firms and lower for big growth firms (Std. Dev. = 0.2742). A higher ratio of 2.9858 implies that the book-value of equity is Ksh. 2.9858 for every Ksh.1 of the market value of small value firms. In contrast, the book value of equity is Ksh. 0.4657 for every Ksh.1 of the market value of big-growth firms. Viewed from the M/B perspective, the results show that investors are willing to pay sh.0.3349 for every sh.1 of book value of small value firms but sh. 2.1433 for every sh.1 of book value of big growth firms. According to theoretical postulations, firms that are expected to perform well, that is, improve profits, increase their market share or launch successful products, typically trade at lower B/M ratios (or higher M/B ratios) than stocks of firms with less attractive outlooks. In general, therefore, results in Table 4.3 show that growth firms were viewed more favorably than value firms and that investors were willing to pay more than the book value of a share of growth firms.

4.3.4 Size-Operating Profit Portfolios

Operating profit is the excess of operating income over the operating expenses of a firm. It provides an idea of how a company's principal business activities are doing. It is a measure of a company's efficiency, profitability and overall financial health. Such profit excludes from its calculation all events that are unusual and infrequent. This study adopted operating profitability as a proxy for systematic risk as recommended in Yao et al. (2017). Firms whose operating profit was above the median breakpoint were classified as robust while those whose profit was below the median were classified as weak. The relevant descriptors for portfolios formed on basis of operating profit scaled by size over the sample period are summarized in Table 4.4.

Table 4.4: Size-OP Portfolios (Ksh. billions)

	Obs.	Mean	Max.	Min.	Std. Dev.	Skew.	Kurt.
RBR	195	11.138	243.756	0.683	21.421	7.570	75.609
RBW	26	-1.569	1.070	-9.012	3.054	-1.155	2.913
RSR	25	2.405	9.567	0.714	1.905	2.418	9.147
RSW	192	-0.242	1.232	-9.436	1.506	-4.072	21.225

Source: Published Financial Statements and Annual Reports (2011-2019)

Results in Table 4.4 show that RBR firms had the highest annual average operating profit of Ksh.11.138 billion with a minimum of Ksh. 0.683 billion and a maximum of Ksh. 243.756 billion. The RBW portfolio had the least annual average operating profit of Ksh. (1.569 billion), a minimum of Ksh. (9.012) billion and a maximum of Ksh. 1.070 billion. There was considerable variation in deviation around the operating profits with highest deviation noticeable among RBR (Std. Dev. =21.421) while RSW firms showed least deviation (Std. Dev. = 1.506). These results further suggest that most weak profitability firms reported negative returns over the sample period while robust profitability firms had positive returns.

4.3.5 Size-Asset Growth Portfolios

This study adopted the approach developed by Fama and French (2015) to compute the proxy for firm investment (asset growth) as annual percentage change in total assets. A positive change would imply asset expansion while a negative change would mean corporate action towards asset contraction. Over the sample period, firms whose rate of asset growth was above the median breakpoint were categorized as aggressive while those below the median were categorized as conservative. Table 4.5 shows summary descriptors of asset growth portfolios scaled by size.

Table 4.5: Size-Asset Growth Portfolios

	Obs.	Mean	Max.	Min.	Std. Dev.	Skew	Kurt.
RBA	134	26.53	313.98	3.56	31.94	6.08	51.64
RBC	92	1.29	13.57	-28.91	7.78	-1.54	6.24
RSA	86	31.53	247.40	4.53	38.49	3.33	15.80
RSC	126	-5.60	13.77	-100.00	16.89	-3.41	18.62

Source: Published Financial Statements and Annual Reports (2011-2019)

Summary statistics in Table 4.5 revealed that small-aggressive firms had the highest average growth rate at 31.53% with a minimum rate of 4.53% and a maximum rate of 247.40%. Small conservative firms had the least mean asset growth rate of -5.60%. The negative average value implies that firms in this portfolio mostly undertook corporate action to reduce their assets on annual basis over the sample period. Also noticeable was high volatility in the rate of asset growth among RSA firms (Std. Dev. =38.49%) but low volatility among the RBC firms (Std. Dev. = -7.78%). It can therefore be inferred that most small firms undertook decision to reduce their assets while majority of big firms took decision to expand their assets over the sample period.

4.4 Descriptive Statistics on Variables

4.4.1 Predictor Variables

From the 12 portfolio groups constructed at the end of each year, value weighted monthly returns were computed using adjusted closing price data for the following year. Following Lam and Wei (2010) and Fama and French (2015), five risk premia were constructed to reflect firm level risk characteristics related to market, size, value, profitability and asset growth. The market risk premium (MKT) represents market excess return over the 91-days Treasury bill interest rate rate; size risk premium (SIZE) is the value weighted returns on six small stock portfolios minus the value weighted returns on six big stock portfolios; value risk premium (VALUE) is the difference between returns on diversified portfolios of high and low book-to-market ratio stocks; asset growth risk premium (ASTG) is the difference between the returns on conservative and aggressive firms while profitability risk premium

(OPROF) represents the difference in returns on portfolios of stocks with robust and weak profitability. Investor sentiment (SENT) was computed by subtracting the proportion of stocks that closed lower from the proportion that closed higher than their previous period's closing prices. A positive (negative) spread implies bullish (bearish) trend in the market while a zero difference is an indicator of market correction (Brown & Cliff, 2005; Dash & Mahakud, 2015). Table 4.6 displays the summary of the descriptive analysis.

Table 4.6: Descriptive Statistics on Predictor Variables

	Mean	Max.	Min.	Std. D	Skew.	Kurt.	Jar-B	Prob.
MKT	-0.0070	0.0836	-0.1335	0.0456	-0.5516	3.0466	5.4860	0.0644
SIZE	0.0010	0.1198	-0.1300	0.0422	-0.0376	3.8081	2.9643	0.2271
VALUE	0.0005	0.1033	-0.0953	0.0326	0.1168	4.0672	5.3710	0.0682
OPROF	-0.0017	0.1220	-0.1356	0.0521	-0.4434	3.2282	3.7736	0.1516
ASTG	-0.0015	0.1115	-0.0750	0.0343	0.2169	3.1301	0.9231	0.6303
SENT	-0.0678	0.8039	-0.8261	0.3894	-0.0686	2.3090	2.2332	0.3274

Source: Published Financial Statements and Annual Reports (2011-2019)

Table 4.6 reports pairwise descriptive statistics for the predictor variables used in the factor regressions. Among the main effects predictors, the size factor had the highest mean return premium (Mean = 0.1%) with volatility rate of 4.56%. This result somewhat contrasts with evidence found by Sundqvist and Toni (2017) who observed a negative size premium (Mean = -0.20%, t = -0.88) though not significantly different from zero. The difference could be attributable to methodology adopted in constructing the size premium. In the current study, the median was used as the sample size breakpoint in constructing the size premium, while Fama and French (2015) and Sundqvist and Toni (2017) used 10^{th} percentile as sample size breakpoint, which could account for the variation in the results. The high average return on size premium when compared to other predictors implies that size effect is likely to contribute more in explaining cross-sectional returns.

The market risk premium had the least return difference (Mean = -0.70%) with a standard deviation of 4.56%. This result contrasts the findings by Sundqvist and Toni (2017) among Nordic countries in which the market factor had a mean of 0.55% with a standard deviation of 6.7% (t = 1.17). The average premium for value, profitability and investment risk premia as reported in this study were generally low (0.05%, -0.15% and -0.15%) respectively with higher standard deviations of 3.26%, 5.21% and 3.43% as compared to Fama and French (2015) factors. Sundqvist and Toni (2017) observed that rapid fluctuations in currency may cause dilution of portfolio returns which results in weaker factor premia. Over the sample period, the mean bull-bear spread was -6.78% implying a generally bearish sentiment.

4.4.2 Dependent Variables

The portfolios were kept unchanged for the following 12 months, from July to June next year. Returns on the 12 portfolios are calculated as the equal-weighted average of individual stock returns.

Table 4.7: Portfolio Returns (%)

	RBH	RBL	RBR	RBW	RBA	RBC
Obs.	108	108	108	108	108	108
Mean	-0.8185	-0.1240	-0.3275	-1.8280	0.0752	-0.6911
Median	-0.9775	-0.3268	-0.2463	-1.6225	0.4742	0.1505
Maximum	18.1551	8.9900	13.9313	18.0178	15.0210	11.7949
Minimum	-14.7317	-10.1765	-10.8990	-23.4020	-11.4818	-11.5286
Std. Dev.	0.0551	0.0449	0.0455	0.0741	0.0520	0.0462
Skewness	0.0511	-0.2461	-0.0505	0.0526	-0.0824	-0.3213
Kurtosis	3.6122	2.2755	3.1105	3.3080	2.9414	2.7638
Jarque-Bera	1.7336	3.4529	0.1008	0.4767	0.1377	2.1092
Prob.	0.4203	0.1779	0.9509	0.7879	0.9335	0.3483

Table 4.7: Portfolio Returns (%) cont…

	RSH	RSL	RSR	RSW	RSA	RSC
Obs.	108	108	108	108	108	108
Mean	-0.0759	-0.5428	-0.9975	0.4368	-0.7945	-0.4937
Median	-0.3697	-0.5992	-1.5219	0.1842	-1.2199	-0.4120
Maximum	12.2531	16.2966	18.7045	12.1171	13.0610	16.6517
Minimum	-10.1379	-12.6202	-19.3770	-13.0554	-13.7739	-13.5250
Std. Dev.	0.0475	0.0524	0.0688	0.0514	0.0481	0.0538
Skewness	0.3421	0.2577	0.3044	-0.0673	0.4059	0.1237
Kurtosis	2.7725	3.2614	3.8925	2.6375	3.6572	3.2508
Jarque-Bera	2.3398	1.5027	5.2520	0.6727	4.9095	0.5587
Prob.	0.3104	0.4717	0.0724	0.7144	0.0859	0.7563

Table 4.7: Average Return Index (%) cont…..

	Mean	Max.	Min.	Std. Dev.	Skew.	Kurt.	Jar-B	Prob.
AVRET	-0.52	10.44	-9.54	0.0400	-0.2256	2.8329	1.0419	0.5940

Table 4.7 shows that only two portfolios, RSW (Mean = 0.4368%) and RBA (Mean = 0.0752%) had positive monthly mean excess returns. The lowest mean excess return was observed among the RBW stocks (Mean = -1.8280%). Average return was generally higher on small stocks (Mean = -0.4113%) as compared to big stocks (Mean = -0.6189%). Consistent with the current findings, Fama and French (1996) and Ajlouni and Khasawneh (2017) observed a strong negative relationship between size and average returns. Similar results were also documented by Yao et al. (2017) at the Chinese stock market. The average return index (AVRET) was generally negative over the sample period (Mean = -0.52%). The largest dispersion in portfolio excess returns was among the big stocks ranging from 4.49 % to 7.41% per month implying that big stocks generally experienced wide variation in returns as compared to small stocks.

4.5 Time-Series Assumptions

4.5.1 Stationarity

The test for stationarity serves to check if the series revolves around a constant mean. Non-stationarity in time series data causes the problem of spurious regression, which further leads to errors in estimating the results. This study utilized the ADF and P-P unit root tests to examine the stationarity of the variables at 5% level of significance. The null hypothesis that the variable contains unit root (i.e., it is not stationary) is rejected for an absolute ADF or P-P t-value greater than the corresponding absolute test critical values. Results of unit root test are shown in Table 4.8 and 4.9

Table 4.8: Unit Root Test for Predictor Variables and Interacting Terms

Series	ADF t-Stat	Mac Kinnon Crit. (5%)	*p*-Value	P-P Adj. t-Stat (At Level)	Test Crit. Values. (5%)	*p*-Value
MKT	-9.5690	-2.8887	0.0000	-9.6643	-2.8887	0.0000
SIZE	-11.1648	-2.8887	0.0000	-11.2721	-2.8887	0.0000
VALUE	-9.5690	-2.8895	0.0126	-11.2721	-2.8887	0.0000
OPROF	-3.4143	-2.8895	0.0126	-11.2721	-2.8895	0.0000
ASTG	-11.2252	-2.8887	0.0000	-11.2309	-2.8887	0.0000
SENT	-11.0085	-2.8887	0.0000	-10.9907	-2.8887	0.0000
APR Premia	-5.0304	-2.8889	0.0000	-8.3948	-2.8887	0.0000
MKT*SENT	-9.7401	-2.8887	0.0000	-9.7361	-2.8887	0.0000
VALUE*SENT	-9.8940	-2.8887	0.0000	-9.9197	-2.8887	0.0000
OPROF*SENT	-10.2180	-2.8887	0.0000	-10.2429	-2.8887	0.0000
ASTG*SENT	-11.7842	-2.8887	0.0000	-11.7392	-2.8887	0.0000
SIZE*SENT	-10.9184	-2.8887	0.0000	-10.9184	-2.8887	0.0000
APR *SENT	-9.3406	-2.8887	0.0000	-9.4207	-2.8887	0.0000

Lag Length: 0 (Automatic - based on SIC, maxlag=12); Bandwidth: 9 (Newey-West automatic) using Bartlett kernel

From the results in Table 4.8, the null hypothesis of unit root is not supported for all predictor variables and interacting terms at level. On each variable, and for both tests, the absolute t-value was greater than the absolute critical values at 5% level of significance. Hence, all the predictor variables and interacting terms were integrated at level.

Table 4.9: Unit Root Test for Dependent Variables

Series	ADF Fisher Chi-Square t-Stat	MacKinnon Crit. (5%)	*p*-Value	Phillips-Perron Adj. t-Stat	Test Crit. Values. (5%)	*p*-Value
RSH	-8.5160	-2.8887	0.0000	-8.8092	-2.8887	0.0000
RSL	-4.0849	-2.8892	0.0016	-9.4303	-2.8887	0.0000
RSR	-5.5349	-2.8889	0.0000	-9.2893	-2.8887	0.0000
RSW	-9.4924*	-2.8898	0.0000	-8.3183	-2.8887	0.0000
RSA	-4.1382	-2.8892	0.0013	-10.5892	-2.8887	0.0000
RSC	-11.1917*	-2.8898	0.0000	-30.7178	-2.8889	0.0001
RBH	-10.3239	-2.8887	0.0000	-10.4455	-2.8887	0.0000
RBL	-5.4335	-2.8889	0.0000	-10.2600	-2.8887	0.0000
RBR	-5.3925	-2.8889	0.0000	-9.8483	-2.8887	0.0000
RBW	-11.7273	-2.8887	0.0000	-11.8159	-2.8887	0.0000
RBA	-5.6378	-2.8889	0.0000	-9.5862	-2.8887	0.0000
RBC	-4.4265	-2.8892	0.0005	-10.9756	-2.8887	0.0000
AVRET	-3.9878	-2.8892	0.0022	-9.4585	-2.8887	0.0000

Lag Length: 0 (Automatic - based on SIC, maxlag=12); Bandwidth: 9 (Newey-West automatic) using Bartlett kernel: *****denotes variable stationary at 1st difference

The analysis of results in Table 4.9 indicates that excess return on RSW portfolio (t = -9.4924, *p*-value < .05) and RSC portfolio (t = -11.1917, *p*-value< .05) were stationary at first difference on the ADF test while the rest of the series were stationary at level on both tests. Thus, the dependent variables displayed a mix of *I*(0) and *I*(1) series thereby providing sufficient justification for adopting ARDL estimation technique.

4.5.2 Lag Length

The need to select optimal number of lags for each model used in time series analysis is premised on the assumption that regressands will tend to respond to regressor variables with a lapse of time (Pesaran, Shin & Smith., 2001). Further, the results of long-run relationship are sensitive to lag-length selected in the model. Adding lagged terms can eliminate the influence of uncontrollable factors thereby increasing the credibility of the regression results. Including too many lagged values in a model can however consume degrees of freedom and might introduce the likelihood of multicollinearity. Table 4.10 shows results of optimal lag selection on the combined effect model using different criteria.

Table 4.10: Optimal Lags

Endogenous	Lag	LogL	LR	FPE	AIC	SC	HQ
Port 1.	0	233.1502	NA*	0.0007	-4.3683	-4.2157*	-4.3065
2	0	236.4144	NA	0.0007	-4.4310	-4.2785*	-4.3692*
3	0	226.9323	NA*	0.0008*	-4.2487*	-4.0961*	-4.1869*
4	0	256.6853	NA	0.0005	-4.8209	-4.6683*	-4.7591*
5	0	272.8187	NA	0.0003	-5.1311	-4.9786*	-5.0693
6	0	178.0867	NA	0.0021	-3.3094	-3.1568*	-3.2476*
7	0	218.9475	NA*	0.0011*	-4.0179*	-3.8671*	-3.9568*
8	0	233.7920	NA*	0.0008*	-4.2980*	-4.1472*	-4.2369*
9	0	238.7389	NA*	0.0007*	-4.3913*	-4.2405*	-4.3302*
10	0	210.1698	NA*	0.0012*	-3.8523*	-3.7015*	-3.7912*
11	0	182.6970	NA*	0.0021*	-3.3340*	-3.1831*	-3.2728*
12	1	249.9951	14.0283*	0.0006*	-4.5848*	-4.4089*	-4.5135*
AVRET	0	277.6023	NA	0.0003	-5.1246	-4.9738*	-5.0635

* Indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

Exogenous variables: C MKT SIZE VALUE OPROF ASTG

In this study, optimal lag length selection was based on the lower value of Akaike information criterion (AIC), Schwarz information criterion (SIC) and Hannan–Quinn (HQ) information criterion computations. Hence the number of appropriate lags was zero according to AIC, SIC and HQ criteria as shown in Table 4.10. The maximum lag length was however 1 for big-conservative investment portfolios (RBC).

4.5.3 Co-integration

The presence of a combination of *I*(0) and *I*(1) variables requires the performance of bounds test of co-integration (Narayan, 2005). Co-integration test is vital to establish if variables are able to move together in the long-run and to decide which model to adopt for estimation. At a given level of significance, the co-integration test output displays two sets of critical values. One set of the critical values is generated on the premise that all the variables in the ARDL model are stationary at level while the other assumes that the variables are stationary at first difference. The null hypothesis of no co-integration relationship (no long-run relationship exists) is rejected if the F-statistic exceeds the upper bound *I*(1) value at 5% level of significance (Pesaran et al., 2001; Narayan, 2005). The Null hypothesis cannot be rejected for an *F*-test statistic less than the lower bound *I*(0) critical value at 5% level of significance. The test is however indeterminate (inconclusive) for a value of F-statistic lying in the range: *I*(0) < F< *I*(1). The results for F-bounds test on the main effects model are shown in Table 4.11.

Table 4.11: F-Bounds Co-integration Test

Series	F-Statistic	Sig.	Lower Bound I(0)	Upper Bound I(1)	Null Hyp.
RSH	97.5811	5%	2.45	3.61	Reject
RSL	49.9329	5%	2.45	3.61	Reject
RSR	54.4053	5%	2.45	3.61	Reject
RSW	7.5283	5%	2.45	3.61	Reject
RSA	64.0505	5%	2.45	3.61	Reject
RSC	89.6567	5%	2.45	3.61	Reject
RBH	101.7796	5%	2.45	3.61	Reject
RBL	67.3954	5%	2.45	3.61	Reject
RBR	257.4762	5%	2.45	3.61	Reject
RBW	83.9494	5%	2.45	3.61	Reject
RBA	107.9854	5%	2.45	3.61	Reject
RBC	135.8706	5%	2.45	3.61	Reject
AVRET	114.8296	5%	2.39	3.38	Reject

Table 4.11 reports two sets of critical values at 5% level of significance. The results show that all portfolio regressions had F-statistic greater than the upper critical bounds value. Consequently, the Null hypothesis of no co-integrating relationship was rejected and hence it was concluded that there is co-integration implying that

there exist long-run equilibrium relationship between stock returns and asset pricing risk premia. In this regard, the models passed the co-integration test. From the above analysis, it was therefore necessary estimate both the ARDL and Error Correction Model representation respectively for short-run and long-run relationship among the variables.

4.6 Residual Diagnostics

4.6.1 Test for Normality

In this study, the variables were tested for normality assumption using Jarque-Bera (JB) test for large samples (n) with the joint hypothesis that the coefficient of Skewness (S) = 0 and Kurtosis (K) =3.0. The Kurtosis indicates the peakedness or flatness of a series while skewness measures the degree of symmetry of a series. A distribution embodies normality if the kurtosis value and skewness measure is 3.0 and 0 respectively. The JB statistic follows a chi-square distribution with 2 df under the null hypothesis that the residuals are normally distributed. Normality of residuals were further visually tested using a histogram and normal probability (Quantile-Quantile [Q-Q)]) plots obtained from the regression commands. The results for each test are shown in Table 4.12 and appendix XI and XII respectively.

Table 4.12: Jarque-Bera Test for Normality

Variable	Skewness	Kurtosis	Jarque-Bera	Probability
RBA	-0.0824	2.9414	0.1377	0.9335
RBC	-0.3213	2.7638	2.1092	0.3483
RBH	0.0511	3.6122	1.7336	0.4203
RBL	-0.2461	2.2755	3.4529	0.1779
RBR	-0.0505	3.1105	0.1008	0.9509
RBW	0.0526	3.3080	0.4767	0.7879
RSA	0.4059	3.6572	4.9095	0.0859
RSC	0.1237	3.2508	0.5587	0.7563
RSH	0.3421	2.7725	2.3398	0.3104
RSL	0.2577	3.2614	1.5027	0.4717
RSR	0.3044	3.8925	5.2520	0.0724
RSW	-0.0673	2.6375	0.6727	0.7144
AVRET	-0.2256	2.8329	1.0419	0.5940
MKT	-0.5516	3.0466	5.4860	0.0644
SIZE	-0.0376	3.8081	2.9643	0.2271
VALUE	0.1168	4.0672	5.3710	0.0682
OPROF	-0.4434	3.2282	3.7736	0.1516
ASTG	0.2169	3.1301	0.9231	0.6303
SENT	-0.0686	2.3090	2.2332	0.3274

Table 4.12 illustrates that all variables mirror a normal distribution as indicated by their values of skewness and kurtosis. Variables with negative coefficient of skewness imply that there were higher values of the variable than the mean. The converse is also true. All variables had positive kurtosis implying that there were more high values than the variable mean. The *p*-values for Jarque-bera statistic on all variables were all greater than 0.05. Thus, the null hypothesis of normally distributed residuals could not be rejected for all variables implying that normality assumption was met. This implies that in all variables, the pile up of scores were around the mean of the distribution.

From Appendix IV, it was observed that for each variable, the dots neither sag consistently below the diagonal nor do they rise consistently above it showing that the kurtosis does not differ from a normal distribution. The observed values mostly fall along the straight line with only slight deviation from the diagonal in each variable. This implies that the observed values are the same as what one would expect to get from a normally distributed data set and hence the normality assumption was inferred visually. The diagrams also depict bell shaped histogram of residuals from the main effects model and a model with interaction terms for the benchmark portfolio. The shape of the curve on the histogram indicates that most points are in the middle, with fewer and fewer farther from the mean which implies that the residuals are normally distributed. The straight diagonal line in the Q-Q plots displayed in appendix X represents a normal distribution, and the points represent the observed residuals. In a perfectly normally distributed data of residuals, all points will lie on the line. In these figures, there seem to be no much deviation of the dots from the line and thus, in particular, the assumption of constant standard deviation around the line appears reasonable.

4.6.2 Multicollinearity

Multicollinearity exists where there is strong correlation between the predictor variables. Multicollinearity is suspected in a model in case of very few significant predictors. The presence of multicollinearity makes it impossible to obtain unique estimates of the regression coefficients because there are an infinite number of combinations of coefficients that would work equally well (Field, 2009). Further, the presence of multicollinearity could make a significant variable insignificant by increasing its standard error thus lowering its t-statistic and consequently raising its p-value. This assumption was assessed using the Variance Inflation Factor (VIF) and Tolerance Statistic (TS). Field (2009) recommends that a VIF value of less than 10 or a tolerance statistic greater than 0.1 is acceptable. Table 4.13 is a summary of the VIF values for each predictor in factor regressions for the main effects model.

Table 4.13a: Variance Inflation Factors-Main Effects Model

Variable	RBH	RBL	RBR	RBW	RBA	RBC
MKT	1.6562	2.4909	2.3122	1.6964	1.1057	1.9551
SIZE	1.4648	1.8152	3.2224	2.1142	1.1900	1.4848
VALUE	1.2024	2.5133	2.3763	1.1178	1.1445	2.0400
OPROF	1.2080	1.5095	2.0998	1.3983	1.2697	1.6467
ASTG	1.3877	2.1748	1.4667	1.3767	1.1206	1.3604

Dependent Variable: Stock Returns; Dynamic regressors (1 lag, automatic): MKT SIZE VALUE OPROF ASTG

Table 4.13b: Variance Inflation Factors-Main Effects Model (cont.)

Variable	RSH Centered VIF	RSL Centered VIF	RSR Centered VIF	RSW Centered VIF	RSA Centered VIF	RSC Centered VIF
MKT	1.7555	1.7763	1.2713	1.6823	1.5560	2.7201
SIZE	1.8292	2.0322	1.4754	1.9354	2.2803	2.9533
VALUE	1.3364	1.9059	1.2273	1.9245	1.2214	1.9910
OPROF	1.5476	1.3499	1.3410	1.2246	1.4359	1.3904
ASTG	1.4458	1.8216	1.6168	2.2148	1.8421	1.7725

Dependent Variable: Stock Returns; Dynamic regressors (1 lag, automatic): MKT SIZE VALUE OPROF ASTG

Based on the results in Table 4.13 for assessment of multicollinearity, none of the values of the VIF was greater than 10. They all fall within the established range adopted by this study implying absence of multicollinearity problem among the variables. This further implies that it was possible to obtain stable estimates of the regression coefficients and isolate their individual contribution within the overall model.

4.6.3 Heteroscedasticity

The classical linear regression model assumes that the residual terms at each level of the predictor variable should have the same variance (homoscedastic). When the variances are very unequal, the errors are said to be heteroscedastic. This study utilized Breusch-Pagan Godfrey test and White's General Heteroscedasticity test (where appropriate) to check validity of constant variance assumption under the null hypothesis that data is homoscedastic at 5% level of significance. The null hypothesis is rejected for a value of $(n - \text{p}) * R^2$ greater than the critical X^2 value (where p is the degree of freedom) or for a probability value (p) less than 5% implying that data is heteroscedastic. Table 4.14 summarized the test results for main effects model.

Table 4.14a: Heteroscedasticity Test-Big Portfolios

1. Breusch-Pagan Godfrey Test

2. White's Test

	RBH	RBL	RBR	RBW	RBA	RBC
Obs*R^2.	11.0042	12.3356	10.6953		14.4246	11.0042
Prob.	(7)	(9)	(7)		(8)	(7)
χ^2(p)	0.1384	0.1950	0.1525		0.0713	0.1384
Obs*R^2.				62.63853		
Prob.				(35)		
χ^2(p)				0.0028		

Table 4.14b: Heteroscedasticity Test-Small Portfolios (Cont.)

	RSH	RSL	RSR	RSW	RSA	RSC
Obs*R^2.	15.3318		9.5177	10.1390	2.3290	7.0403
Prob.	(9)		(7)	(7)	(7)	(9)
χ^2(p)	0.0822		0.2176	0.1808	0.9394	0.6329
Obs*R^2.		98.96373				
Prob.		(90)				
χ^2(p)		0.2431				

Table 4.14c: Heteroscedasticity Test-Average Return Index (cont….)

	F-Stat	Prob. F(6,100)	Obs*R-Square	Prob. χ^2(6)
AVRET	1.683061	0.1329	9.814182	0.1327

It can be deduced from Table 4.14 that the probability values of BPG test statistics were all greater than 5% significance level across the test portfolios and the overall monthly return index. Hence the null hypothesis of homoscedasticity could not be rejected and therefore it was concluded that the regression of excess returns on main effects is homoscedastic. This implies that the standard errors of estimators are unbiased and consistent thereby lending greater validity to tests of hypothesis (Vynck, 2017).

4.6.4 Autocorrelation

For any two different observations, the residual terms should be uncorrelated (Kothari and Garg (2014). The presence of autocorrelation produces non-efficient OLS estimators, although unbiased. This assumption was tested using Breusch-Godfrey (BG) Lagrange Multiplier test (and not Durbin Watson Test) since the estimation models contain non-stochastic lagged values of the regressand (Gujarati, 2017). The BG LM test follows chi-square distribution with p degrees of freedom estimated as $(n - \mathrm{p})R^2 \sim X^2{}_{\mathrm{p}}$. The null hypothesis of serially uncorrelated errors is rejected for a value of $(n - \mathrm{p}) * R^2$ greater than the critical X^2 value or for a *p*-value < 0.05 implying there is serial correlation. Table 4.15 shows results of B-G LM test for the time series regression models.

Table 4.15a: Breusch-Godfrey Serial Correlation LM Test-Big Portfolios

	RBH	RBL	RBA	RBC	RBR	RBW
Obs*R^2.	0.2548	0.9386	0.4272	0.2549	0.2738	2.1545
Prob. χ^2(1)	0.6137	0.3327	0.5134	0.6137	0.6008	0.1422

Table 4.15: b Breusch-Godfrey Serial Correlation LM Test-Small Portfolios

	EX_RSH	EX_RSL	EX_RSA	EX_RSC	EX_RSR	EX_RSW
Obs*R^2.	0.3060	1.1189	0.8630	1.2430	0.3032	2.5996
Prob. χ^2(1)	0.5801	0.2901	0.3529	0.2649	0.5819	0.1069

Table 4.15c: Breusch-Godfrey Serial Correlation LM Test-AVRET

	F-Stat	Prob. F (1,99)	Obs*R-Square	Prob. χ^2(1)
AVRET	0.673714	0.4137	0.723234	0.3951

From the result of assessment of autocorrelation in Table 4.15, the null hypothesis of no serial correlation could not be rejected for regressing stock returns on main effects since *p-value*s are greater than 5% for all values of Obs*R^2. This implies that the models were properly specified and that the OLS standard errors and statistics were reliable and consistent.

4.7 Correlation Analysis

Correlation coefficient is used to measure the strength of linear association between variables. The coefficient, denoted by r is obtained by standardizing the covariance which gives values lying between -1 and +1. A coefficient of +1 indicates that the variables are perfectly positively correlated. Conversely, a coefficient of −1 indicates a perfect negative relationship. A coefficient of zero indicates no linear relationship at all. The correlation matrix in asset pricing studies is useful for getting a rough idea of the relationships between the predictors and for a preliminary assessment of multicollinearity.

4.7.1 Correlation Analysis of Predictor Variables

Table 4.16 shows the correlation matrix between the predictor variables used in the analysis.

Table 4.16: Pairwise Correlation of Predictor Variables (Pearson Corr. Coef)

VARIABLE	VARIABLE	Correlation	t-Statistic	Probability
SIZE	MKT	-0.2318	-2.4539	0.0158
VALUE	MKT	0.0037	0.0382	0.9696
VALUE	SIZE	-0.1206	-1.2510	0.2137
ASTG	MKT	-0.0942	-0.9741	0.3322
ASTG	SIZE	-0.0431	-0.4442	0.6578
ASTG	VALUE	0.0196	0.2021	0.8402
OPROF	MKT	0.0627	0.6463	0.5195
OPROF	SIZE	0.1697	1.7726	0.0792
OPROF	VALUE	0.2446	2.5972	0.0107
OPROF	ASTG	-0.2453	-2.6046	0.0105
SENT	MKT	0.8361	15.6903	0.0000
SENT	SIZE	-0.0361	-0.3717	0.7108
SENT	VALUE	0.0026	0.0271	0.9784
SENT	ASTG	-0.1236	-1.2824	0.2025
SENT	PROF	0.0679	0.7010	0.4848

Table 4.16 displays correlation matrix of main effects predictor variables. Adjacent to each coefficient are the t-values based on the Newey-West adjusted standard errors and *p*-values at 5% level of significance. It was noticed that VALUE, OPROF and ASTG were each not significantly correlated with MKT. There was however significant but less than average correlation between MKT and SIZE (r = -0.2318, $p<0.05$). Similar results are replicated in Daxhamer and Beyer (2016). The table further illustrates that market risk premium and SENT were highly positively correlated and significantly different from zero (r = 0.8361, $p<0.05$). This implies that variation in sentiment variable has impact on estimation of market beta at the NSE. Other significant but low correlations were observed between OPROF and VALUE (r = 0.2446, $p<0.05$) and OPROF and ASTG (r = -0.2453, $p<0.05$). According to Field (2009) multi-collinearity is bound to arise in cases where there is substantial correlation ($r > 0.8$) between the predictor variables. The correlation coefficients as summarized in Table 4.16 were rather low, which suggests that each variable represented an independent influencing factor of stock returns. Basing on the argument in Wooldridge (2012), the low correlations among predictors further indicate that the procedure used to construct the factor premia successfully controlled each factor for the influence of the other.

4.7.2 Correlation Analysis between Predictor Variables and Stock Returns

Table 4.17 displays the correlation matrix between the predictor variables and the overall return index measure for stock returns.

Table 4.17: Correlation of Predictors with Average Return Index (Pearson Corr. Coef.)

Dependent	Predictor	Correlation	t-Statistic	Probability
AVRET	AVRET	1.0000	-----	-----
AVRET	MKT	0.8583	17.2182	0.0000
AVRET	SIZE	-0.0038	-0.0387	0.9692
AVRET	VALUE	-0.0444	-0.4575	0.6483
AVRET	OPROF	-0.0575	-0.5930	0.5545
AVRET	ASTG	-0.0932	-0.9636	0.3374
AVRET	SENT	0.8898	20.0744	0.0000

Table 4.17 represents results of bivariate correlations of predictor variables and the overall monthly average return index (AVRET). Also reported in the correlation matrix adjacent to each coefficient are the t-values (based on the Newey-West adjusted standard errors) and *p*-values at 5% level of significance. The table generally shows low and insignificant negative correlation between AVRET index and each predictor variable except MKT and SENT. Significant positive correlation was observed between market risk premium and the AVRET index (r = 0.8583, $p<0.05$) and between investor sentiment AVRET index (r = 0.8898, $p<0.05$). This implies that the overall average return index has a positive co-movement with the market risk and investor sentiment.

4.8 Hypothesis Testing and Discussion of Findings

4.8.1 Market Risk Premium and Stock Returns

The first objective of the study was to evaluate the effect of market risk premium on returns of listed equity stocks in Kenya. The dependent variable was stock returns measured as monthly excess return on each equity portfolio as well as average return index over the sample period (2011–2019). The regressors were the lagged values of the dependent variable and the market risk premium. The market risk premium represents the excess return on value weighted NSE 20 share index over a one month return on Kenyan Treasury bills. The study tested both short-run ARDL and long-run ECM model representation to assess if the relationship was statistically significant. The following null hypothesis was tested.

> $H_0$1**:** There is no significant effect of market risk premium on stock returns of listed firms at the NSE.

Table 4.18 shows short-run results of time-series regression of portfolio returns on market risk premium using ARDL model representation. The single index model representation is as shown in equation 4.1.

$$\Delta(\text{port})_t = \alpha_0 + \sum \delta_i \Delta(\text{port})_{t-i} + \sum \beta_i \Delta(\text{market})_{t-i} + \varphi_1 (\text{market})_{t-1} + e_t \quad (4.1)$$

Table 4.18: Market Effect on Portfolio Returns

Port.	Alpha	Prob (α)	Coeff.	Std. Error	t-Stat.	Prob. (Coeff)	R-Sq.	Adj. R-Sq.
RBA	0.0067	0.0128	0.8936	0.0792	11.2854	0.0000	0.6427	0.6393
RBC	-0.0016	0.6198	0.8120	0.0525	15.4643	0.0000	0.6420	0.6386
RBH	-0.0017	0.6352	0.9961	0.0543	18.3289	0.0000	0.6720	0.6689
RBL	0.0044	0.0498	0.8124	0.0574	14.1633	0.0000	0.6990	0.6961
RBR	0.0029	0.1804	0.8915	0.0476	18.7349	0.0000	0.8194	0.8177
RBW	-0.0146	0.0475	0.8936	0.0792	11.2854	0.0000	0.2575	0.2504
RSA	-0.0048	0.2685	0.5387	0.0792	6.8015	0.0000	0.2383	0.2311
RSC	-0.0003	0.9488	0.6531	0.0904	7.2269	0.0000	0.3306	0.3243
RSH	0.0026	0.5008	0.5543	0.0958	5.7888	0.0000	0.3342	0.3278
RSL	-0.0009	0.8489	0.6156	0.0851	7.2323	0.0000	0.3033	0.2967
RSR	-0.0039	0.5714	0.7168	0.1269	5.6475	0.0000	0.2315	0.2242
RSW	0.0070	0.1121	0.5600	0.0824	6.8005	0.0000	0.3377	0.3314

Dependent Variable: (Portfolio Returns) Predictor variable: (MKT)

Results in Table 4.18 show that the coefficients of the market risk were all positive and significant ranging from a minimum of 0.5387 on RSA to a maximum of 0.9961 on RBH portfolio. The maximum sensitivity (β=0.9961, p<.05) on RBH portfolio implies that a unit increase in market risk is predicted to increase portfolio returns on large stocks with high B/M ratios by 0.9961 units. Whereas Fama-French (1993) observed an increase in value of coefficients on market factor as one moves from low through high B/M portfolios for both small and big stocks, the pattern in this study however reverses when small stocks are considered. The same pattern was observed when size-asset growth sorted portfolios are examined. These results however conform to the findings in Fama and French (1993) when size-operating profitability sorted portfolios were considered.

The alpha (intercept) values in the regressions represent the abnormal return that cannot be explained by the factors included in the model. The cross-section analysis also shows that seven (7) out of twelve (12) time series regressions had negative intercept values implying that investment in equity stocks would yield abnormal losses for most investment strategies adopted by investors at the NSE. Out of 12 time series regressions, 25% had intercepts with *p*-values less than 5% thereby suggesting the existence of anomalies. This implies that the single index model could not explain fully stock returns in 25% of the regressions. A well specified equilibrium model, as described by Gibbons et al. (1989), is one whose intercept term is indistinguishable from zero implying that the endogenous variables are important in explaining of returns. The portfolio with the highest explained variation was RBR (R-square= 81.94 %) while RSR portfolio had the lowest (R-square= 23.15 %).

Table 4.19: Short-run Market Effect on Average Stock Returns

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.***
ΔAVRET(-1)	0.1060	0.0400	2.6533	0.0092
ΔMKT	0.7461	0.0431	17.2980	0.0000
Intercept	0.0003	0.0024	0.1297	0.8970
R-squared	0.7516	Mean dependent var		-0.0056
Adjusted R-squared	0.7469	S.D. dependent var		0.0399
S.E. of regression	0.0201	Akaike info criterion		-4.9493
Sum squared resid	0.0420	Schwarz criterion		-4.8744
Log likelihood	267.7879	Hannan-Quinn criter.		-4.9190
F-statistic	157.3717	Durbin-Watson stat		1.9550
Prob(F-statistic)	0.0000			

Dependent Variable: Stock Returns (AVRET) Predictors: MKT

In Table 4.19, the coefficient on MKT variable was positive (β = 0.7461) with a *p*-value < 5%. This was interpreted to mean that a unit increase in market risk would increase average stock returns by 0.7461 units in the short-run. This implies market risk has a positive and significant effect on stock returns at NSE in the short-run. Coefficients of the variables with Δ sign show the short-run elasticities. The one month lagged value of the dependent variable measure (AVRET) was positive and significant (β =0.1060, *p*-value< 0.05) implying that positive average returns one month prior are more likely to influence positively current month returns at the NSE. The intercept term was positive but indistinguishable from zero (α=0.0003, *p-value* >.05). This implies that market risk variable is a good predictor of stock returns at NSE. The R-square for the model was 75.16% implying that the single index model is able to explain 75.16% of average return variations at the NSE. The probability value of F-statistic for the single index model is very small (less than 5%), suggesting that the short-run model provides a good fit.

Table 4.20: F-bounds test for Market Effect

Test Statistic	**Value**	**Signif.**	***I*(0)** **Asymptotic: n=1000**	***I*(1)**
F-statistic	306.9081	5%	4.94	5.73
K	1			

Table 4.20 shows results of ARDL bounds test performed to establish whether a long-run relationship exists between average stock returns and market risk premium variable. The null hypothesis of no cointegrating relationship between variables is rejected for an F-bounds statistic greater than the upper bound critical value *I*(1). The results show that the single index model had F-statistic greater than the upper critical bounds value. Consequently, the null hypothesis of no co-integrating relationship was rejected and it was concluded that there exists a long-run relationship between stock returns and market risk at 5% level of significance. From the above analysis, it was therefore necessary to estimate the Error Correction Model representation to determine the long-run relationship as modelled in equation 4.2.

$$\Delta avret_t = \alpha_0 + \sum \delta_i \Delta avret_{t-i} + \sum \beta_i \,\Delta(\text{market})_{t-i} + \lambda \text{ECT}_{t-1} + e_t \qquad (4.2)$$

Table 4.21: Long-run Market Effect on Stock Returns

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
Intercept	0.0003	0.0019	0.1622	0.8715
MKT	0.8346	0.0710	11.7595	0.0000
CointEq(-1)*	-0.8940	0.0359	-24.8941	0.0000
R-squared	0.8551	Mean dependent var	-0.0002	
Adjusted R-squared	0.8537	S.D. dependent var	0.0523	
S.E. of regression	0.0200	Akaike info criterion	-4.9680	
Sum squared resid	0.0420	Schwarz criterion	-4.9180	
Log likelihood	267.7879	Hannan-Quinn criter.	-4.9477	
F-statistic	619.7183	Durbin-Watson stat	1.9550	
Prob(F-statistic)	0.0000			

Dependent Variable: AVRET Predictor variable: MKT

In Table 4.21, the coefficient on MKT variable was positive (β =0.8346) with a p< .05. Thus, there was enough evidence at 5% significance level to support the researcher's claim of significant effect of market risk premium on equity stock returns at the NSE. This implies market risk has a positive and significant effect on stock returns in the long-run. It was interpreted to mean that a unit increase in market risk would lead to 0.8346 increase in average stock returns in the long-run, holding other factors constant. The alpha (intercept) value in Table 4.21 was positive but not significant. The positive intercept implies that investment in equity stocks would mostly result in insignificant abnormal gains to investors at the NSE in the long-run. The existence of insignificant t-values of the intercepts imply that the market index is efficient and can predict variation in stock returns at the NSE. The R-square for the long-run model was 0.8551 implying that the market risk premia explain 85.51% of the variation in average stock returns at the NSE. The probability value of F-statistic for the ECM representation was very small (less than 5%), suggesting that the overall model provides a good fit.

The current findings nonetheless affirm earlier conclusions by inter-alia, Ajlouni and Khasawneh (2017) in Italy, Iqbal and Brooks (2010) in the Pakistani markets and Coffie and Chukwulobelu (2013) who established evidence in support for market risk at the NSE. The study results however differ from reported results by Jónsson and Ásgeirsson (2017) in the European stock markets and Karp and Vuuren (2017) in South Africa who discerned that risk-return relationship cannot be described by beta only. This was evidenced by extremely low R-square values from OLS regressions. Other contrary results were reported by Okumu and Onyuma (2015) who found weak but positive effect of market risk, thereby concluding that market risk is not a valid predictor of the risk-return relationship for securities trading on the Kenyan stock market.

4.8.2 Size Risk Premium and Stock Returns

The second objective of this study was to assess the effect of size risk premium on returns of listed equity stocks in Kenya. Size risk premium represents additional returns generated historically from investment in small market capitalization stocks.

The study tested both short-run ARDL and long-run ECM model representation to assess if the relationship was statistically significant. The following null hypothesis was tested.

$H_0$2**:** No significant effect of size risk premium on stock returns of listed firms at the NSE.

Table 4.22 shows results of ARDL time-series regression of portfolio returns on size risk premium, controlling for Market risk. The model representation is as shown in equation 4.3.

$$\Delta(port)_t = \alpha_0 + \sum \delta_i \Delta(port)_{t-i} + \sum \beta_1 \Delta(\text{size})_{t-i} + \varphi_1 (\text{size})_{t-1} + e_t \qquad (4.3)$$

Table 4.22: Size Effect on Portfolio Returns

Port.	**Alpha .**	**Prob.(α)**	**Coeff.**	**Std. Error**	**t-Stat.**	**Prob. (Coeff)**	**R-Sq.**	**Adj. R-sq.**
RBA	0.0065	0.0175	-0.1962	0.0863	-2.2731	0.0251	0.6823	0.0065
RBC	-0.0014	0.6404	-0.2019	0.0870	-2.3205	0.0223	0.6736	0.6641
RBH	-0.0014	0.6726	-0.2250	0.0796	-2.8280	0.0056	0.6987	0.6899
RBL	0.0043	0.0568	-0.0768	0.0681	-1.1274	0.2622	0.7131	0.7047
RBR	0.0029	0.1768	-0.1262	0.0615	-2.0530	0.0426	0.8356	0.8308
RBW	-0.0139	0.0367	-0.6044	0.1458	-4.1464	0.0001	0.4016	0.3842
RSA	-0.0046	0.2378	0.4922	0.0844	5.8294	0.0000	0.4251	0.4083
RSC	-0.0001	0.9661	0.6875	0.1574	4.3679	0.0000	0.6005	0.5889
RSH	0.0031	0.3128	0.6032	0.1294	4.6616	0.0000	0.6076	0.5962
RSL	-0.0009	0.8260	0.4877	0.0976	4.9970	0.0000	0.4457	0.4296
RSR	-0.0040	0.5062	0.6909	0.1696	4.0737	0.0001	0.3999	0.3824
RSW	0.0079	0.0292	0.6501	0.1408	4.6175	0.0000	0.6149	0.6036

Dependent Variable: (Portfolio Returns), Predictor variable: Size

Results in Table 4.22 show significant coefficients of size risk premium at 5% level across all the twelve test portfolios. All big sized portfolios had negative coefficients on size, while small portfolios had positive coefficients, indicating that size investment strategies are more beneficial for small rather than big portfolios. The highest size risk effect was with regard to RSR portfolio comprising robust profitability small stocks (β =0.6909, p<0.05) interpreted to mean that a unit increase in size risk would increase portfolio returns on robust profitable small stocks by

0.6909 units, controlling for other factors in the model. The lowest loading was on weak profitability big stocks (β = -0.6044, p<0.05) suggesting that high size risk would lower portfolio returns on big but less profitable stocks, controlling for other factors in the model. Overall, this result indicate that a higher size risk exposure is estimated to lower stock returns for large stocks but raise returns for small stocks.

The alpha (intercept) values in the regressions represent the abnormal return that cannot be explained by the factors included in the model. Table 4.22 further shows that more than 50% of time series regressions had negative intercept values implying that investment in equity stocks would mostly result in extra abnormal losses to investors at the NSE. Out of 12 time series regressions, 25% had intercepts with p-values less than 5% thereby suggesting that augmenting the single index model with size risk premium does not alter the number of non-significant alphas.

Table 4.23: Short-run Size Effect on Average Stock Returns

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
ΔAVRET(-1)	0.0605	0.0412	1.4688	0.1449
ΔSIZE	0.1773	0.0653	2.7134	0.0078
Intercept	0.0002	0.0022	0.0938	0.9255
R-squared	0.7830	Mean dependent var		-0.0056
Adjusted R-squared	0.7767	S.D. dependent var		0.0399
S.E. of regression	0.0189	Akaike info criterion		-5.0656
Sum squared resid	0.0367	Schwarz criterion		-4.9657
Log likelihood	275.0083	Hannan-Quinn criter.		-5.0251
F-statistic	123.8801	Durbin-Watson stat		1.9833
Prob(F-statistic)	0.0000			

Dependent Variable: (avret), Predictor variable: (Size)

In Table 4.23, the coefficient on size risk was positive and significant (β = 0.1773, p<0.05). It implies that a unit increase in size risk would significantly increase average stock returns by 0.1773 units in the short-run. This signifies that size risk has a positive and significant effect on stock returns at NSE in the short-run. The one month lagged value of the dependent variable (avret) was positive but insignificant (β=0.0605, p-value > .05) implying that positive average returns one month prior would insignificantly influence current month returns positively at the NSE. The intercept term was positive but indistinguishable from zero (α=0.0002, *p*-value> .05). This implies that size risk premium is an efficient proxy for systematic risk in asset pricing modeling at the NSE. The R-square for the model (R-square = 0.7830) indicates that adding size risk premium to the single index model enhances the explanatory power of the model. The F-statistic (F=123.8801) with a corresponding *p*-value < .05 suggests that the short-run model provides a good fit.

Table 4.24: F-bounds test for Size Effect

Test Statistic	**Value**	**Signif.**	***I*(0)** **Asymptotic: n=1000**	***I*(1)**
F-statistic	236.8786	5%	3.79	4.85
K	2			

Table 4.24 shows results of ARDL bounds test conducted to establish whether long-run relationship exists between average stock returns and size risk variable. The null hypothesis of no cointegrating relationship between variables is rejected for an F-bounds statistic greater than the upper bound critical value *I*(1). The results for F-bounds test in Table 4.24 show that the F-statistic = 236.8786 is greater than the upper critical bounds value *I*(1) = 4.85. Consequently, the Null hypothesis of no co-integrating relationship was rejected and it was concluded that there exists a long-run relationship between average stock returns and size risk at 5% level of significance. From the above analysis, it was necessary to estimate the Error Correction Model representation to determine the long-run relationship.

Model Equation: $\Delta \text{avret}_t = \alpha_0 + \sum \delta_i \Delta \text{avret}_{t-i} + \sum \beta_i \, \Delta(\text{SIZE})_{t-i} + \lambda \text{ECT}_{t-1} + e_t$ (4.4)

Table 4.25: Long-run Size Effect on Average Stock Returns

Variable	Coefficient	Std. Error	t-Statistic	Prob.
SIZE	0.1887	0.0671	2.8127	0.0059
Intercept	0.0002	0.0018	0.1156	0.9082
CointEq(-1)*	-0.9395	0.03491	-26.9153	0.0000
R-squared	0.8734	Mean dependent var		-0.0002
Adjusted R-squared	0.8722	S.D. dependent var		0.0523
S.E. of regression	0.0187	Akaike info criterion		-5.1030
Sum squared resid.	0.0367	Schwarz criterion		-5.0530
Log likelihood	275.0083	Hannan-Quinn criter.		-5.0827
F-statistic	724.4345	Durbin-Watson stat		1.9833
Prob (F-statistic)	0.0000			

Dependent Variable: (avret), Predictor variable: (Size)

In Table 4.25, the coefficient on size variable is positive (β= 0.1887) with a p-value < 5% and t-value =2.8127. Thus, the null hypothesis of no significant effect of size risk premium on stock returns was rejected and thereby concluded that size risk is a significant predictor of average stock returns at the Kenyan equity market. The positive significant coefficient on size risk variable in Table 4.25 is interpreted to mean that a unit increase in size risk would raise average stock returns by 0.1887 units in the long-run, controlling for market risk.

The coefficient of error correction term (–0.9395) was significant at 5% level. The negative coefficient on ECT shows evidence of long-run convergence/reversion to equilibrium and thus it was possible to infer long-run causal relationship. Alternative inference on the coefficient of ECT further implies that the speed of adjustment in average stock returns from previous month's disequilibrium to current month's equilibrium is 93.95 percent. The alpha (intercept) value for the long-run model is positive but not different from zero. The positive intercept implies that investment in equity stocks would mostly result to insignificant abnormal gains to investors at the NSE in the long-run investment horizon. The insignificant alpha value implies that the variables in the model are good proxies for systematic risk. The R-square for the long-run model was 0.8734 implying that the model that adds size risk premia to the single index model explains about 87.34% of the variation in average stock returns in the long-run. The probability value of F-statistic for the ECM representation is very small (less than 5%), suggesting that the overall model provides a good fit.

According to Chen and Yang (2016), a positive size risk coefficient in the Fama-French regression is often interpreted as a signal for portfolios weighted towards small-cap stocks. Therefore, the results imply that an investment strategy that involves allocation of more wealth in low cap portfolios would earn higher returns on average in the long-run. This result also has implication on cost of capital decisions. According to the equity valuation theory, increasing investment in low market capitalization stocks poses a higher risk to investors who will in turn demand higher compensation in terms of required rate of return. Thus, the current finding is consistent with Fama-French (1995) conclusion that small companies are more sensitive to many risk factors as they are comparatively undiversified in nature and have little ability to undertake adverse financial situations and hence, they tend to outperform large ones. Size effect has also been observed by Odera (2010) whose conclusion was that the size factor captures size effect on portfolio returns in Kenya. The current findings however do not coincide with the findings by Shafana et al. (2013) whose study failed to find supporting evidence for size effect in Srilanka. The current findings also differ with those of Rashid and Sadaqat (2018) and Liu, Stambaugh and Yuan (2019) whose findings affirmed the theorized negative relationship between size and return.

4.8.3 Value Risk Premium and Stock Returns

The third objective of this study was to assess the effect of value risk premium on returns of listed equity stocks in Kenya. Value risk premium refers to the return spread between stocks with high B/M ratios (value stocks) and stocks with low B/M ratios (growth stocks). To test the value effect, regressions were first run on each of the twelve portfolios using value risk premium as the predictor variable and controlling for market risk. Subsequently, short-run and long-run effects were tested by regressing average stock returns on value risk premium, controlling for market risk. Table 4.26 shows results of time-series regression of portfolio returns on value risk premium using ARDL estimation technique. The following null hypothesis was tested.

$H_0 3$**:** There is no significant effect of value risk premium on stock returns of listed firms at the NSE.

The ARDL model representation is as shown in equation 4.5

$$\Delta(\text{port})_t = \alpha_0 + \sum \delta_i \Delta(\text{port})_{t-i} + \sum \beta_1 \Delta(\text{value})_{t-i} + \varphi_1 (\text{value})_{t-1} + e_t \quad (4.5)$$

Table 4.26: Value effect across Portfolio Returns

Port.	Alpha α	Prob.(α)	Coeff.	Std. Error	t-Stat.	Prob. (Coeff)	R-Square	Adj. R-Sq.
RBA	0.0068	0.0135	-0.1684	0.1110	-1.5177	0.1322	0.6704	0.6608
RBC	-0.0015	0.6465	-0.1083	0.0904	-1.1985	0.2335	0.6489	0.6387
RBH	-0.0018	0.5541	0.3968	0.1348	2.9439	0.0040	0.7280	0.7201
RBL	0.0045	0.0297	-0.3437	0.0855	-4.0190	0.0001	0.7705	0.7638
RBR	0.0029	0.1810	-0.0359	0.0744	-0.4816	0.6311	0.8240	0.8189
RBW	-0.0147	0.0464	0.0502	0.1796	0.2796	0.7804	0.2939	0.2734
RSA	-0.0048	0.2721	-0.0193	0.1278	-0.1514	0.8800	0.2481	0.2262
RSC	-0.0001	0.9776	-0.2128	0.1795	-1.1854	0.2386	0.3472	0.3282
RSH	0.0025	0.5089	0.2242	0.1100	2.0387	0.0440	0.3614	0.3428
RSL	-0.0004	0.9175	-0.5968	0.1734	-3.4425	0.0008	0.4415	0.4252
RSR	-0.0041	0.5316	0.4105	0.2064	1.9882	0.0494	0.2722	0.2510
RSW	0.0071	0.1071	-0.3698	0.1221	-3.0283	0.0031	0.4108	0.3936

Dependent Variable: (Portfolio), Predictor variable: (value)

Table 4.26 displays results of ARDL regression analysis when monthly excess return on 12 equity portfolios were regressed on value risk premium controlling for market risk. Overall, value premium is significant in all portfolios classified in the size-B/M and small-profitability sorted portfolios. It was observed that the coefficients of value risk premium were positive and significant on big stocks with high book-to-market ratio (β = 0.3968, p<0.05) and on small value portfolio (β = 0.2242, p-value <0.05). The coefficients were however negative and significant on big robust portfolio (β =0.3437, p-value < 0.05) and small growth portfolio (β =-0.5968, p-value <.05) which sugests that value investing strategies are more beneficial for high book-to-market ratio stocks. Additionally, eight (8) out of twelve (12) portfolios had negative loadings on the value risk premium, suggesting that on the overall, value investing strategies are not beneficial to investors the NSE.

Table 4.26 further shows that more than 58.3% of the time series regressions had negative intercept values implying that value investment strategy would mostly result in extra abnormal losses to investors at the NSE. Out of 12 time series regressions, 25% had intercepts with *p*-values less than 5% thereby suggesting that augmenting the single index model with value risk premium does not change the number of non-significant alphas.

Table 4.27: Short-run Value Effect on Average Stock Returns

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.***
AVRET(-1)	0.1104	0.0412	2.6805	0.0086
VALUE	-0.0720	0.0839	-0.8577	0.3931
Intercept	0.0004	0.0024	0.1506	0.8806
R-squared	0.7551	Mean dependent var		-0.0056
Adjusted R-squared	0.7480	S.D. dependent var		0.0399
S.E. of regression	0.0201	Akaike info criterion		-4.9446
Sum squared resid	0.0414	Schwarz criterion		-4.8447
Log likelihood	268.5374	Hannan-Quinn criter.		-4.9041
F-statistic	105.8561	Durbin-Watson stat		1.9026
Prob(F-statistic)	0.0000			

Dependent Variable: (Portfolio), Predictor variable: (value)

In Table 4.27, the coefficient on value risk factor was negative (β = -0.0720) with a p>0.05. It implies that a unit increase in value risk would reduce average stock returns by 0.0720 units in the short-run. This signifies that value risk has a negative but insignificant effect on equity stock returns at NSE in the short-run. The one month lagged value of the dependent variable (avret) was positive and significant (β = 0.1104, p<0.05) implying that positive returns one month prior would significantly positively influence current month returns on value investing strategy at the NSE.

The intercept term was positive but indistinguishable from zero (α=0.0004, p>.0.05).

This implies value risk is an efficient proxy for systematic risk in asset pricing at the NSE. The R-square for the model was 75.51% indicating that adding value risk premium to the single index model marginally enhances the explanatory power of the model. The F-statistic (*F*=105.8561) with a corresponding *p*-value < 5% suggests that the short-run model provides a good fit.

Table 4.28: F-bounds test for Value Effect

Test Statistic	**Value**	**Sig.**	***I*(0)** **Asymptotic: n=1000**	***I*(1)**
F-statistic	205.9816	5%	3.79	4.85
K	2			

Table 4.28 displays results of ARDL F-bounds test undertaken to establish if a long-run relationship exists between stock returns and value risk variable. The null hypothesis of no cointegrating relationship between variables is rejected if the F-bounds statistic is greater than the upper bound critical value *I*(1). The results show that the F-statistic = 205.9816 is greater than the upper critical bounds value *I*(1) = 4.85. Consequently, the null hypothesis of no co-integrating relationship was rejected and hence it was concluded that there exists a long-run relationship between average stock returns and value risk at 5% level of significance. It was therefore necessary to estimate the Error Correction Model representation to determine the long-run relationship.

Model Equation: $\Delta \text{avret}_t = \alpha_0 + \sum \delta_i \Delta \text{avret}_{t-i} + \sum \beta_i \Delta(\text{value})_{t-i} + \lambda \text{ECT}_{t-1} + e_t$ (4.6)

Table 4.29: Long-run Value Effect on Average Stock Returns

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
Intercept	0.0004	0.0019	0.1918	0.8483
VALUE	-0.0809	0.0939	-0.8612	0.3912
CointEq(-1)*	-0.8896	0.0354	-25.0987	0.0000
R-squared	0.8571	Mean dependent var		-0.0002
Adjusted R-squared	0.8558	S.D. dependent var		0.0523
S.E. of regression	0.0199	Akaike info criterion		-4.9820
Sum squared resid	0.0414	Schwarz criterion		-4.9320
Log likelihood	268.5374	Hannan-Quinn criter.		-4.9618
F-statistic	629.9438	Durbin-Watson stat		1.9026
Prob(F-statistic)	0.0000			

Dependent Variable: (avret), Predictor variable: (Value)

Table 4.29 illustrates that the long-run coefficient of value risk was negative (β = -0.0809) with a *p*-value >5% and t-value = -0.8612. Thus, the null hypothesis of no significant effect of value risk premium on stock returns could not be rejected and hence concluded that value risk premium has apparently no effect on average stock returns in Kenya. This result was interpreted to mean that in the long-term, increasing investment in value stocks by a unit would reduce average stock returns by 0.0809 units, though not significantly. The results also imply that investors exposed to high value risk at the NSE would on average demand lower required rate of return, a contrasting view to the valuation theory. The insignificant coefficient on value risk in the current study does not, however, invalidate the equity valuation theory. According to the theory, increasing investment in high book-to-market ratio stocks is perceived as a high risk undertaking for investors who would in turn demand higher compensation in terms of required rate of return.

Applying panel data to estimate regression models, Araujo and Machado (2017) observed similar results that indicated that B/M ratio has no significant influence on Brazilian stock returns. The current findings also agree with the results documented by Odera (2010) and Shafana et al. (2013) who observed that portfolios containing glamour stocks have higher earnings and hence appear to be riskier as compared to value stocks. These findings are however inconsistent with Auret and Sinclair (2006) in South Africa, Kilgard and Wittorf (2011) in UK and Anuradha (2011) in Srilanka who observed a positive coefficient on value factor when studied under the Fama-French (1993) model framework. The redundancy of value premium at the NSE could be an indication of low investor confidence in the accounting information from which value risk factor is derived. The existence of imperfect regulatory environment and weak surveillance systems in the emerging markets like NSE may account for problems such as failure by listed firms to make adequate disclosure of relevant information to the investors and insider-dealing.

The negative coefficient on ECT shows evidence of long-run convergence/reversion to equilibrium and thus we can infer long-run causal relationship between the variables. It further implies that the speed of adjustment in average stock returns from previous month's disequilibrium to current month's equilibrium is 88.96% percent. The alpha (intercept) value in Table 4.29 is positive but not different from zero. The positive intercept implies that investment in equity stocks would mostly result to insignificant abnormal gains to investors at the NSE in the long-run investment horizon. The R-square for the long-run model was 0.8571 implying that adding value risk variable to the single index model would marginally enhance the explanatory power of the model. The probability value of F-statistic for the ECM representation is very small (less than 5%), suggesting that the overall model provides a good fit.

4.8.4 Profitability Risk Premium and Stock Returns

The fourth objective of the study was to assess the effect of profitability risk premium on returns of listed equity stocks in Kenya. Profitability risk premium refers to the return spread between stocks with robust profitability and stocks with weak profitability. According to risk-based explanation, more profitable firms tend to be growth firms whose cash flows are expected in the distant future which is more uncertain. Hence profitability investing strategies create more risk and should require a risk premium. To test the profitability effect, regressions were run on each of the 12 equity stock portfolios with profitability risk premium as the predictor, controlling for market risk. The study tested both short-run ARDL and long-run ECM model representation to assess if the relationship was statistically significant. The following null hypothesis was tested.

$H_0 4$: There is no significant effect of profitability risk premium on stock returns of listed firms at the NSE.

Table 4.30 shows results for time-series regression of portfolio returns and profitability risk premium using ARDL model representation. The model representation is as shown in equation 4.3.

$$\Delta(\text{port})_t = \alpha_0 + \sum \delta_i \Delta(\text{port})_{t-i} + \sum \beta_1 \Delta(\text{oprof})_{t-i} + \varphi_1 (\text{oprof})_{t-1} + e_t \quad (4.7)$$

Table 4.30: Profitability Effect across Portfolio Returns

Port.	**Alpha α**	**Prob. (α)**	**(Coeff.)**	**Std. Error**	**t-Stat.**	**Prob. (Coeff)**	**R-Sq.**	**Adj. R-Sq.**
RBA	0.0067	0.0285	-0.0195	0.0575	-0.3399	0.7347	0.6595	0.6496
RBC	-0.0014	0.6074	-0.1813	0.0513	-3.5342	0.0006	0.6817	0.6724
RBH	-0.0017	0.5975	0.0148	0.0606	0.2314	0.8175	0.6731	0.6635
RBL	0.0043	0.0748	-0.0493	0.0464	-1.0620	0.2907	0.7114	0.7030
RBR	0.0029	0.1609	0.0634	0.0646	0.9826	0.3281	0.8285	0.8235
RBW	-0.0131	0.0390	-0.7836	0.1314	-5.9636	0.0000	0.5810	0.5688
RSA	-0.0025	0.5564	-0.0666	0.0786	-0.8476	0.3988	0.3225	0.2732
RSC	0.0013	0.7505	-0.1905	0.0802	-2.3756	0.0195	0.4124	0.3760
RSH	0.0026	0.4984	-0.0615	0.0735	-0.8371	0.4045	0.3417	0.3226
RSL	-0.0010	0.8154	-0.2326	0.0802	-2.8994	0.0046	0.3847	0.3537
RSR	-0.0028	0.5709	-0.2383	0.1092	-2.1831	0.0313	0.5138	0.4947
RSW	0.0063	0.0822	-0.3160	0.0677	-4.6705	0.0000	0.5274	0.4982

Dependent Variable: (Portfolio returns), Predictor variable: (OPROF)

Table 4.30 displays results of ARDL regression conducted to test the effect of profitability risk across portfolio returns at the NSE. It was observed that when big profitability sorted portfolios were considered, robust profitability portfolios had the largest coefficient ($\beta = 0.0634$, p-value > 0.05) while the weak profitability portfolios had the least ($\beta = -0.7836$, p-value < 0.05). The same pattern was observed in small robust profitability sorted portfolios ($\beta = -0.2383$, p-value < 0.05) and the small weak profitability portfolios ($\beta = -0.3160$, p-value < 0.05). This result is consistent with the conclusion by Novy-Marx (2013) that profitable firms earn substantially higher equity returns than unprofitable businesses. It was further observed that profitability factor was mostly significant among small firms than large firms. It was also observed that ten (10) portfolios had negative loadings on the profitability risk factor. This implies that overall portfolio returns are lower for investments made on basis of profitability strategy at the NSE. It also means that investors at the NSE tend to underestimate risk on profitable equity stocks and hence demand low required rate of return.

Table 4.31 further shows that out of 12-time series regressions, 16.67% had intercepts with p-values less than 5% thereby suggesting that a model that augments profitability risk with single index model reduces significantly the number of non-significant alphas. Thus, profitability risk is may be considered as an efficient variable for explaining stock returns in a cross-section of portfolios.

Table 4.31: Short-run Profitability Effect on Average Stock Returns

Variable	**Coeff.**	**Std. Error**	**t-Stat.**	**Prob.***
AVRET(-1)	0.1018	0.0480	2.1220	0.0363
OPROF	-0.1155	0.0363	-3.1836	0.0019
Intercept	0.0010	0.0019	0.5501	0.5835
R-squared	0.7822	Mean dependent var		-0.0048
Adjusted R-squared	0.7712	S.D. dependent var		0.0397
S.E. of regression	0.0190	Akaike info criterion		-5.0332
Sum squared resid	0.0357	Schwarz criterion		-4.8816
Log likelihood	270.2433	Hannan-Quinn criter.		-4.9718
F-statistic	71.1030	Durbin-Watson stat		1.9363
Prob(F-statistic)	0.0000			

Dependent Variable: (avret), Predictor variable: (OPROF)

In Table 4.31, the coefficient on profitability risk factor was negative (β = -0.1155) with a *p*-value < 5%. It implies that a unit increase in profitability risk would lower average stock returns by about 0.1155 units in the short-run. This signifies that profitability risk has a negative but significant effect on equity stock returns at NSE in the short-run. The one month lagged value of average returns was positive and significant (β =0.1018, *p*-value < 0.05) implying that positive average returns one month prior would significantly positively influence current month returns at the NSE in the short-run. The intercept term was positive though indistinguishable from zero (α=0.0010, *p*-value >0.05. The relatively low *p*-value for the intercept term implies that profitability risk factor is an efficient proxy of systematic risk at NSE. The R-square for the model is 78.22% indicating that adding profitability risk premium to the single index model enhances considerably the explanatory power of the model. The F-statistic (F=71.1030) with a corresponding p-value < 5% suggests that the short-run model provides a good fit.

Table 4.32: F-bounds test for Profitability Effect

Test Statistic	Value	Sig.	*I*(0) Asymptotic: n=1000	*I*(1)
F-statistic	126.4713	5%	3.79	4.85
K	2			

Table 4.32 shows estimation results of F-bounds test undertaken to establish the existence of a long-run relationship between stock returns and profitability risk premium. The null hypothesis of no cointegrating relationship between variables is rejected if the F-bounds statistic is greater than the upper bound critical value *I*(1).

The results for F-bounds test in Table 4.32 showed that the F-statistic = 126.4713 was greater than the upper critical bounds value *I*(1) = 4.85. Consequently, the Null hypothesis of no co-integrating relationship was rejected and it was concluded that there exist a long-run relationship between average stock returns and profitability risk at 5% level of significance. Hence the Error Correction Model representation to determine the long-run relationship was conducted. Results are summarized in Table 4.33.

Model Equation: $\Delta \text{avret}_t = \alpha_0 + \sum \delta_i \Delta \text{avret}_{t-i} + \sum \beta_i \Delta(\text{oprof})_{t-i} + \lambda \text{ECT}_{t-1} + e_t$ (4.8)

Table 4.33: Long-run Profitability Effect on Average Stock Returns

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Intercept	0.0010	0.0018	0.5710	0.5693
OPROF	-0.1619	0.0568	-2.8503	0.0053
CointEq(-1)*	-0.7135	0.0363	-19.6743	0.0000
R-squared	0.8740	Mean dependent var		0.0008
Adjusted R-squared	0.8702	S.D. dependent var		0.0522
S.E. of regression	0.0188	Akaike info criterion		-5.0713
Sum squared resid	0.0357	Schwarz criterion		-4.9702
Log likelihood	270.2433	Hannan-Quinn criter.		-5.0303
F-statistic	233.4884	Durbin-Watson stat		1.9363
Prob(F-statistic)	0.0000			

Dependent Variable: (AVRET), Predictor variable: (Profitability Risk)

In Table 4.33, the coefficient for profitability risk premium was negative (β= -0.1619) with a p-value <5% and t-value = -2.8503. Thus, the null hypothesis of no significant effect of profitability risk premium on stock returns was not supported and thereby concluded that profitability risk premium is a significant predictor of average stock returns in Kenya. This implies that controlling for market risk, a unit increase in profitability risk premium would result in 0.1619 points reduction in return required by investors at the NSE in the long-run. It is further interpreted to mean that in the long-term, increasing investment in profitability stocks by a unit would significantly decrease average stock returns by 0.1619 units. Therefore, the results suggest that investors exposed to high profitability risk at the NSE would on average demand lower required rate of return, which is an opposite view of the equity valuation theory. According to the equity valuation theory, increasing investment in robust stocks poses a higher risk to investors who would in turn demand higher compensation in terms of required rate of return.

The current findings are consistent with empirical evidence by Mosoeu and Kodongo (2017) who established firm profitability and return relationship in selected emerging markets between the year 2010 and 2016. The evidence provided in this study is further consistent with the findings by Kilsgard and Wittorf (2011) in the UK who found a negative coefficient for ROE implying that profitable companies will more likely yield lower returns than their less profitable counterparts. The results however sharply contrast the theoretical prediction and empirical evidence in Machado and Faff (2017) who did not find pricing effect of profitability factor in Brazilian market and Njogo et al. (2017) who observed weak but positive effect of profitability at the Kenyan equity market.

The negative coefficient on ECT (λ= -0.7135, p-value <0.05) shows evidence of long-run convergence/reversion to equilibrium and thus we can infer long-run causal relationship between the variables. It further implies that the speed of adjustment in average stock returns from previous month's disequilibrium to current month's equilibrium was 71.35% percent. The alpha (intercept) value in Table 4.34 was positive but not significant (α = 0.0010, p-value$>$ .05). The positive intercept implies that investment in equity stocks would mostly result to insignificant abnormal gains to investors at the NSE in the long-run investment horizon. The mean R-square for the long-run model was 0.8740 implying that adding profitability risk variable to the single index model would greatly enhance the explanatory power of the model. The probability value of F-statistic for the ECM representation was very small (F-stat. = 233.4884, p-value < 0.05), suggesting that the overall model provides a good fit.

4.8.5 Asset Growth Risk Premium and Stock Returns

The fifth objective of the study was to assess the effect of asset growth risk premium on returns of listed equity stocks in Kenya. Asset growth risk premium refers to higher average returns on conservative stocks relative to aggressive stocks required by investors as compensation for exposure to investment risk (Cooper et al., 2008). According to fundamental valuation theory, an increase in the cost of capital is likely to result in decreased investment because high cost of capital may limit accessibility to funding sources. A decrease in the cost of capital, on the other hand, tends to stimulate investment. To test the asset growth effect, regressions were run on each of the 12 equity stock portfolios with asset growth risk premium as the predictor, controlling for market risk. The study tested both short-run ARDL and long-run ECM model representation to assess the relationship. The following null hypothesis was tested.

$H_0 5$**:** There is no significant effect of asset growth risk premium on stock returns of listed firms at the NSE.

Table 4.34 shows short-run results for time-series regression of portfolio returns and asset growth risk premium using ARDL model representation. The model representation is as shown in equation 4.9.

$$\Delta(\text{port})_t = \alpha_0 + \sum \delta_i \Delta(\text{port})_{t-i} + \sum \beta_1 \Delta(\text{astg})_{t-i} + \varphi_1 (\text{astg})_{t-1} + e_t \quad (4.9)$$

Table 4.34: Asset Growth Effect on Portfolio Returns

Port.	Alpha α	Prob. (α)	Coeff.	Std. Error	t-Stat.	Prob. (Coeff	R-Sq.	Adj. R-Sq.
RBA	0.0060	0.030	-0.3694	0.0793	-4.6572	0.0000	0.7273	0.7165
RBC	-0.0013	0.647	0.1672	0.0782	2.13922	0.0348	0.6583	0.6483
RBH	-0.0008	0.798	-0.0123	0.0907	-0.1346	0.8932	0.6863	0.6739
RBL	0.0053	0.026	-0.1217	0.0687	-1.7722	0.0795	0.7477	0.7323
RBR	0.0029	0.117	-0.1266	0.0534	-2.3714	0.0197	0.8442	0.8363
RBW	-0.0211	0.001	0.4067	0.1760	2.3103	0.0231	0.4465	0.3870
RSA	-0.0036	0.361	-0.5035	0.1122	-4.4878	0.0000	0.4229	0.3872
RSC	0.0029	0.467	0.50944	0.1192	4.2726	0.0000	0.4850	0.4474
RSH	0.0038	0.327	0.1001	0.1101	0.9094	0.3653	0.3543	0.3290
RSL	-0.0009	0.846	0.0159	0.1266	0.1255	0.9004	0.3037	0.2834
RSR	-0.0031	0.626	-0.1722	0.1750	-0.9839	0.3275	0.2578	0.2284
RSW	0.0069	0.086	0.1465	0.1172	1.2507	0.2140	0.4304	0.3951

Dependent Variable: (portfolio Returns), Predictor variable: (Asset Growth)

Table 4.34 displays results of ARDL regression conducted to test effect of asset growth risk premium on a cross-section of portfolio returns of equity stocks at the NSE. For large firms, the coefficient on ASTG risk premium was significant on aggressive investment (β=-0.3694, p<0.05), conservative investment (β =0.1672, p-value>0.05), robust profitability (β = -0.1266, p< .05) and weak profitability (β = 0.4067, p<.05). When small stocks were analyzed, ASTG was found to predict returns on aggressive investment (β = -0.5035, p< 0.05) as well as conservative investment (β = -0.5094, p < 0.05) only. In this connection, it can therefore be concluded that asset growth effect is more observed among large firms than small firms. This finding however contrasts Fama and French (2008) who did not find investment effect among the large companies. The coefficients on conservative investment stocks were consistently larger than those on aggressive investment. This implies that low investments are associated with high cost of capital while high investment intensity is associated with low cost of capital, consistent with fundamental valuation theory. Thus, for a given level of exposure to asset growth risk, the significant t-statistics suggest that asset growth risk effect is not conclusive since six (6) out of twelve (12) regression coefficients are significant.

The intercept value represents the abnormal return which cannot be explained by the variables included in the model. Overall, 25% of the regressions had *p*-values of the intercepts less than 5%. This implies that asset growth risk when added to the single index model can explain fully variation in stock returns in 75% of the regressions. Hence, the regressors are jointly good proxies for systematic risk.

Table 4.35: Short-run Asset Growth Effect

Variable	Coefficient	Std. Error	t-Stat.	Prob.*
AVRET(-1)	0.1061	0.0403	2.6312	0.0098
ASTG	-0.0096	0.0633	-0.1514	0.8800
Intercept	0.0003	0.0024	0.1229	0.9024
R-squared	0.7517	Mean dependent var		-0.0056
Adjusted R-squared	0.7445	S.D. dependent var		0.0399
S.E. of regression	0.0202	Akaike info criterion		-4.9309
Sum squared resid	0.0420	Schwarz criterion		-4.8310
Log likelihood	267.8024	Hannan-Quinn criter.		-4.8904
F-statistic	103.9432	Durbin-Watson stat		1.9483
Prob(F-statistic)	0.0000			

In Table 4.35, the coefficient on asset growth risk factor was negative (β = -0.0096) with a *p*-value >5%. It implies that a unit increase in asset growth risk would reduce average stock returns by about 0.0096 units in the short-run. This signifies that asset growth risk exhibits a negative but insignificant effect on equity stock returns at NSE in the short-run. The one month lagged value of average stock returns was positive and significant (β =0.1061, *p*-value < 0.05) implying that positive average returns one month prior significantly and positively influence current month returns at the NSE in the short-run. The intercept term was positive but indistinguishable from zero (α=0.0003, p>.0.05 This implies that asset growth risk factor is a good predictor of average stock returns at NSE. The R-square for the model was 75.17% indicating that adding profitability risk premium to the single index model increases the explanatory power of the model. The F-statistic (F=103.9432) with a corresponding p-value < 5% suggests that the short-run model provides a good fit.

Table 4.36: F-bounds Test

Test Statistic	Value	Sig.	*I*(0) Asymptotic:	*I*(1)
F-statistic	202.7024	5%	3.79	4.85
K	2			

Table 4.36 shows results of ARDL bounds test undertaken to estimate the long-run causal effect of asset growth risk premium on average stock returns. The null hypothesis of no cointegrating relationship between variables is rejected if the F-bounds statistic is greater than the upper bound critical value *I*(1). The results for F-bounds test in Table 4.36 show that the F-statistic = 202.7024 is greater than the upper critical bounds value *I*(1) = 4.85. Consequently, the null hypothesis of no co-integrating relationship was rejected and hence concluded that there exist a long-run relationship between average stock returns and asset growth risk at 5% level of significance. It became therefore necessary to estimate the Error Correction Model representation to determine the long-run relationship.

Model Equation: $\Delta \text{avret}_t = \alpha_0 + \sum \delta_i \Delta \text{avret}_{t-i} + \sum \beta_i \Delta(\text{astg})_{t-i} + \lambda \text{ECT}_{t-1} + e_t$ (4.10)

Table 4.37: Long-run Effect of Asset Growth Risk on Average Stock Returns

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Intercept	0.0003	0.0019	0.1538	0.8781
ASTG	-0.0107	0.0709	-0.1511	0.8802
CointEq(-1)*	-0.8939	0.0359	-24.8981	0.0000
R-squared	0.8552	Mean dependent var		-0.0002
Adjusted R-squared	0.8538	S.D. dependent var		0.0523
S.E. of regression	0.0200	Akaike info criterion		-4.9683
Sum squared resid	0.04200	Schwarz criterion		-4.9183
Log likelihood	267.8024	Hannan-Quinn criter.		-4.9480
F-statistic	619.9151	Durbin-Watson stat		1.9483
Prob(F-statistic)	0.0000			

Predictors: (constant), Asset Growth Risk (ASTG) Dependent Variable: AVRET

Table 4.37 shows results for regressing average stock returns on asset growth risk, controlling for market risk. Consistent with risk-based and mispricing based theoretical explanation, asset growth effect on average stock returns was negative but insignificant at 5% in the long-run (β = -0.0107) with a p-value >5% and t-value = -0.1511. Hence, the null hypothesis of no significant effect of asset growth risk premium on stock returns could not be rejected and thereby concluded that asset growth risk is not a significant predictor of average stock returns in Kenya, holding constant other factors in the model. The ceteris peribus interpretation of the ASTG coefficient is that in the long-run, an increase by one unit in asset growth risk would significantly decrease average stock returns by 0.0107 units. Therefore, the results imply that investors exposed to high asset growth risk at the NSE will on average demand lower returns. The negative coefficient on ECT (λ =-0.8939, p-value < 0.05) shows evidence of long-run convergence/reversion to equilibrium and thus a long-run causal relationship between the variables was confirmed. It further implies that the speed of adjustment in average stock returns from previous month's disequilibrium to current month's equilibrium is 89.39% percent.

The interpretation of the current finding is that investors do not necessarily consider the company's total asset variation as an important factor for making investment decisions at the NSE. The results in the current study are somewhat consistent with conclusions by Cooper et al. (2008) that US firms with low asset growth earn superior annualized risk-adjusted average returns. Although Yao et al. (2017) indicated that firm investment and expected returns tend to exhibit a negative relationship after controlling for size and B/M ratio, the relationship is however somewhat different when the FF5F model is considered. It should however be noted that the difference in the conclusions could be attributed to different measurement for ASTG variable and methodology adopted by researchers for the analysis.

The alpha (intercept) value in Table 4.37 is positive but not significant (α = 0.0003, p-value > 0.05). The positive intercept implies that investment in equity stocks would mostly result to insignificant abnormal gains to investors at the NSE in the long-run investment horizon. The R-square for the long-run model was 85.52% implying that adding asset growth risk variable to the single index model would greatly enhance the explanatory power of the model. The probability value of F-statistic for the ECM representation is very small (F-stat = 619.9151, p-value < .05), suggesting that taken together in some optimally weighted combination, the predictor variable explains average return in the long-run to a statistically significant degree.

4.8.6 The Joint Effect of Asset Pricing Risk Premia and Stock Returns

To facilitate the analysis of joint effect, a multiple time series regression model was fitted. First, portfolio returns were regressed against individual APR variables over the sample period of 9 years (2011–2019).

The hypothesized ARDL model representation is replicated in equation 4.11.

$$\Delta port_t = \alpha_0 + \sum \delta_i \Delta(port)_{t-i} + \sum \beta_i \Delta(market)_{t-i} + \sum s_i \Delta(size)_{t-i} + \sum h_i \Delta(value)_{t-i} + \sum r_i \Delta(oprof)_{t-i} + \sum c_i \Delta(astg)_{t-i} + \beta_1 (market)_{t-1} + \beta_2 (size)_{t-1} + \beta_3 (value)_{t-1} + \beta_4 (oprof)_{t-1} + \beta_5 (astg)_{t-1} + e_t \quad (4.11)$$

Table 4.38 displays the estimated intercepts, regression coefficients and their corresponding *p*-values (in parentheses).

Table 4.38: Joint Effect of APR Premia on Portfolio Returns.

Variable	**RBA**	**RBC**	**RBH**	**RBL**	**RBR**	**RBW**
PORT(-1)	0.1158	0.02415	0.0198	-0.1153	0.0385	0.0440
p-value	(0.0293)	(0.6651)	(0.6281)	(0.2268)	(0.2535)	(0.5842)
MKT	0.8340	0.7808	0.9485	0.7775	0.8524	0.8149
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
SIZE	-0.2343	-0.1907	-0.1808	-0.1438	-0.1560	-0.4348
	(0.0000)	(0.0061)	(0.0138)	(0.0107)	(0.0197)	(0.0001)
VALUE	-0.2064	-0.0892	0.3859	-0.3548	-0.0866	0.2699
	(0.0137)	(0.3872)	(0.0050)	(0.0000)	(0.2611)	(0.1427)
OPROF	-0.0138	-0.1502	-0.0364	0.0059	0.0768	-0.7887
	(0.7998)	(0.0029)	(0.4974)	(0.8944)	(0.1337)	(0.0000)
ASTG	-0.3996	0.1022	-0.0525	-0.1457	-0.1152	0.0045
	(0.0000)	(0.1760)	(0.5687)	(0.0070)	(0.0192)	(0.9743)
Intercept	0.0035	0.0036	-0.0015	0.0058	0.0035	-0.0018
	(0.5008)	(0.5967)	(0.8488)	(0.3633)	(0.5237)	(0.8421)
R-squared	0.7646	0.7139	0.7471	0.7964	0.8549	0.6539
Adj. R-squared	0.7505	0.6967	0.7319	0.7842	0.8462	0.6332
S.E. of regression	0.0259	0.0256	0.0286	0.0209	0.0179	0.0450
F-stat.	54.1405	41.5830	49.2392	65.1851	98.2003	31.4954
Prob(F-stat.)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Table 4.38: Joint Effect of APR Premia on Portfolio Returns. (Cont)

Variable	**RSA**	**RSC**	**RSH**	**RSL**	**RSR**	**RSW**
RET(-1)	-0.0251	0.0980	0.0583	0.2173	0.0414	0.1626
p-value	(0.6216)	(0.0684)	(0.2411)	(0.0192)	(0.6582)	(0.0028)
MKT	0.6085	0.8577	0.7549	0.7234	0.8023	0.79601
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
SIZE	0.5261	0.7504	0.7055	0.4805	0.5973	0.7571
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
VALUE	0.1799	0.0251	0.4266	-0.3722	0.2794	-0.1053
	(0.1281)	(0.8071)	(0.0000)	(0.0204)	(0.1065)	(0.1326)
OPROF	-0.2359	-0.2292	-0.1934	-0.2660	0.5613	-0.3769
	(0.0027)	(0.0021)	(0.0017)	(0.0002)	(0.0000)	(0.0000)
ASTG	-0.5744	0.4668	0.0655	-0.0284	0.0725	0.0814
	(0.0000)	(0.0000)	(0.6103)	(0.8171)	(0.5766)	(0.4466)
Intercept	0.0009	0.0023	0.0029	0.0047	-0.0080	-0.0059
	(0.8815)	(0.6924)	(0.2845)	(0.5003)	(0.3647)	(0.2059)
R-squared	0.5874	0.7560	0.7115	0.5908	0.6112	0.8013
Adj. R-squared	0.5627	0.7414	0.6942	0.5662	0.5879	0.7894
S.E. of reg.	0.0318	0.0273	0.0260	0.0345	0.0444	0.0236
F-stat.	23.7299	51.6394	41.1128	24.0599	26.2035	67.2108
Prob(F-stat.)	0.0000	0.0000	0.0000	0.0000	0.0000	0.8013

Predictors: (Constant), Market, Size, Value, Profitability, Asset Growth; Dependent Variable: (PORT)
p-values (in parentheses)

The market risk premium in this study represented the excess return on the NSE 20 share index over the one month return on Kenyan Treasury bills. In Table 4.38, the coefficients for market risk premium were all positive and significant ranging from a minimum of 0.6085 on RSA portfolio to a maximum of 0.9485 on RBH portfolio. The highest effect of market risk on portfolio returns was observed on the RBH (β=0.9485, p<0.05) implying that a unit increase in the market index was predicted to increase portfolio returns on big stocks with high B/M ratio by 0.9485 units, controlling for size, value, operating profitability and asset growth. The lowest effect was however observed on the portfolio of small stocks with aggressive investment policy, RSA (β = 0.6085, p-value < .05). Consistent with Fama-French (1993), the coefficient on market risk premium increases as one moves from low to high B/M portfolios for both small and big stocks. The same pattern was observed on size-operating profitability sorted portfolios. This pattern however reversed when size-asset growth sorted portfolios were examined, in which case the coefficients on the market risk premium decreased.

Size effect represents additional returns generated historically from investment in small market capitalization stocks. The results in Table 4.38 indicated significant coefficients of size risk premium at 5% level across all the twelve portfolios. All the big sized portfolios had negative coefficients, while all small sized portfolios had positive coefficients, indicating that big stocks earn comparatively lower returns. The highest size risk effect was with regard to portfolio of less profitable small stocks-RSW (β =0.7571, p-value < .05) interpreted to mean that a unit increase in size risk would increase portfolio returns on less profitable small stocks by 0.7571 units, controlling for other factors in the model. The lowest loading was on less profitable big stocks, RBW (β = -0.4348, p-value < .05) suggesting that a higher size risk decreases portfolio returns on large stocks with weak profitability, controlling for other factors in the model. Overall, this result indicates that a higher size risk premium is estimated to lower stock returns for large stocks but raise returns for small stocks.

Value risk premium refers to higher average returns of value stocks relative to growth stocks required by investors as compensation for exposure to value risk (Fama & French, 2006). Table 4.38 shows results of ARDL regression conducted to test the significance of value risk premium on a cross-section of portfolio returns at the NSE, controlling for size, profitability and asset growth risk premia. Overall, value risk premium was significant in all portfolios classified under the size-B/M sort but not significant in all size-profitability sorted portfolios. It was observed that the coefficients of value risk premium were positive and significant on big stocks with high B/M ratio (β = 0.3859, p-value < .05) and on small-high B/M stocks (β = 0.4266, p-value < .05) at 5% level. The coefficients were however negative and significant on low B/M portfolios, RBL (β = -0.3548, p-value < .05) and RSL (β = -0.3722, p-value < .05) which suggests that value stocks yield relatively high returns than growth stocks. Additionally, seven (7) out of twelve (12) portfolios had the expected positive loading on the value risk premium, suggesting that a high value risk premium would certainly increase returns on portfolio of equity stocks at the NSE.

Profitability risk premium refers to higher average returns of robust relative to weak profitability stocks required by investors as compensation for exposure to operating profitability risk (Fama & French, 2015). Table 4.38 displayed results of ARDL regression conducted to test the null hypothesis of no significant effect of profitability risk premium on stock returns at the NSE. It was established that when portfolios sorted on size and profitability were considered, robust profitability portfolios, RBR (β = 0.0768, *p*-value > .05) and RSR (β = 0.5613, *p*-value = 0.0000) had largest coefficients while weak profitability portfolios, RBW (β = -0.7887, *p*-value < .05) and RSW (β = -0.3769, *p*-value < .05) had smallest coefficients. This result is consistent with the conclusion by Novy-Marx (2013) that profitable stocks earn substantially higher returns than unprofitable stocks. It was observed that nine (9) portfolios had negative loadings on the profitability risk premium. This implies that at higher profitability risk premium, portfolio returns are likely to be lower for equity investments at the NSE. The coefficients on profitability risk premium were jointly significant on RSC portfolio (F-stat = 7.5573, *p*-value < .05) and RSH portfolio (F-stat = 10.0467, *p*-value < .05). Overall, profitability risk premium was statistically significant at 5% level in eight (8) out of twelve (12) test portfolios, six (6) of which were small-sized. It was therefore concluded that profitability risk premium has statistically significant effect on portfolio returns at the NSE.

Asset growth risk premium refers to higher average returns on conservative stocks relative to aggressive stocks required by investors as compensation for exposure to investment risk (Cooper et al., 2008). According to fundamental valuation theory, an increase in the cost of capital is likely to result in decreased investment because high cost of capital may limit accessibility to funding sources. A decrease in the cost of capital, on the other hand, tends to stimulate investment. Table 4.38 displayed results of ARDL regression conducted to test the null hypothesis of no significant effect of asset growth risk premium on portfolio returns of equity stocks at the NSE. The coefficients on ASTG risk premium were significant on big stocks with aggressive investment (β = -0.3996, *p*-value < .05), big stocks with low book-to-market ratio (β

= -0.1457, *p*-value < .05) and big stocks with robust profitability (β = -0.1152, *p*-value < .05). When small stocks were analyzed, ASTG predicted returns on aggressive investment stocks (β = -0.5744, *p*-value < .05) as well as conservative investment stocks (β = 0.4668, *p*-value < .05) only. This was interpreted to mean that an increase in ASTG risk tends to decrease portfolio returns for big stocks but increase portfolio returns for small stocks. The coefficients on conservative portfolios were positive while those on aggressive portfolios are negative implying that low investments are associated with high required rate of return while high investment intensity is associated with low required rate of return. Thus, for a given level of exposure to asset growth risk, the insignificant *p*-values suggest that asset growth risk does not have a strong explanatory power since only five (5) out of twelve (12) regression coefficients were significant.

The intercept value represents the abnormal return that cannot be explained by the variables included in the model. The *p*-values of the intercepts in the main effects model were all greater than 5%, implying that the regressors are jointly good proxies for systematic risk. The overall mean R-square for the main effects model was 0.7402 implying that APR premia taken together would account for 74.02% of variance in the portfolio returns at NSE. Big stocks with robust profitability potential (RBR) had the highest explained variation (Adj. R-square = 85.49%) while small growth stocks (RSL) had the lowest explained variation (R-square = 59.08%). The probability values of F-statistics were very small (less than 5%) in all regressions, suggesting that the overall model in each portfolio regression is significant.

Table 4.39: Short-run Joint Effect of APR Premia on Stock Returns

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
AVRET(-1)	0.0864	0.0455	1.8990	0.0605
MKT	0.7976	0.0397	20.1020	0.0000
SIZE	0.2035	0.0450	4.5259	0.0000
VALUE	0.0171	0.0561	0.3050	0.7610
OPROF	-0.1368	0.0368	-3.7197	0.0003
ASTG	-0.0449	0.0527	-0.8520	0.3963
Intercept	0.0027	0.0015	1.7539	0.0825
R-squared	0.8103	Mean dependent var		-0.0056
Adjusted R-squared	0.7990	S.D. dependent var		0.0399
S.E. of regression	0.0179	Akaike info criterion		-5.1441
Sum squared resid	0.0321	Schwarz criterion		-4.9693
Log likelihood	282.2115	Hannan-Quinn criter.		-5.0733
F-statistic	71.2052	Durbin-Watson stat		1.8545
Prob(F-statistic)	0.0000			

Predictors: (Constant), MKT, SIZE, VALUE, OPROF, ASTG, Dependent Variable: (AVRET)

In Table 4.39, the market risk variable (β=0.7976, *p*-value < .05), size (β=0.2035, *p*-value < .05), and profitability (β = -0.1368, *p*-value < .05) were significant predictors in the short-run at 5% level. This implies that premium on market risk and size exert a positive and significant effect on average stock returns at NSE in the short-run. In addition, the results further indicate that OPROF variable bears a negative but significant effect on stock returns in the short run. The results however indicated that value (β = 0.0171, *p*-value > .05) and asset growth (β = -0.0449, *p*-value > .05) were not significant predictors of stock returns at the NSE in the short-run. The one month lagged value of average returns was positive but insignificant (β = 0.0864, *p*-value > .05) implying that average returns one month prior would insignificantly influence current month returns at the NSE in the short-run. The intercept term is positive but indistinguishable from zero (α = 0.0027, *p*-value>0.05 but with a lower probability value. This implies that the FF5F risk premia are efficient predictors of average stock returns at NSE. The R-square for the model was 0.8103 indicating that 81.03% of variations in average stock returns is explained by the FF5F risk premia and sentiment jointly. The F-statistic (F=71.2052) with a corresponding *p*-value < 5% implies that the short-run model provides a good fit.

Table 4.40: F-bounds test for Joint Effect

Test Statistic	Value	Signif.	*I*(0) Asymptotic:	*I*(1)
F-statistic	170.8507	5%	2.45	3.61
K	6			

Table 4.40 shows results of ARDL bounds test undertaken to estimate the long-run combined effect of APR premia and investor sentiment on average stock returns. The null hypothesis of no cointegrating relationship between variables is rejected if the F-bounds statistic is greater than the upper bound critical value *I*(1). The results for F-bounds test show that the F-statistic = 170.8507 is greater than the upper critical bounds value *I*(1) = 3.61. Consequently, the null hypothesis of no co-integrating relationship was rejected and hence concluded that there exist a long-run relationship between APR premia, investor sentiment and average stock returns at 5% level of significance. It became therefore necessary to estimate the Error Correction Model representation to determine the long-run relationship.

$$\begin{aligned}\Delta \mathrm{avret}_{\mathrm{t}} = \alpha_0 &+ \sum \delta_{\mathrm{i}} \Delta \mathrm{avret}_{\mathrm{t-i}} + \sum \beta_{\mathrm{i}}\, \Delta(\mathrm{market})_{\mathrm{t-i}} + \sum s_{\mathrm{i}} \Delta(\mathrm{size})_{\mathrm{t-i}} \\ &+ \sum h_{\mathrm{i}} \Delta(\mathrm{value})_{\mathrm{t-i}} + \sum r_{\mathrm{i}} \Delta(\mathrm{oprof})_{\mathrm{t-i}} + \sum c_{\mathrm{i}} \Delta(\mathrm{astg})_{\mathrm{t-i}} \\ &+ \lambda \mathrm{ECT}_{\mathrm{t-1}} + e_t \end{aligned} \tag{4.12}$$

Table 4.41: Long-run Joint Effect of APR Premia on Stock Returns

Variable	Coefficient	Std. Error	t-Statistic	Prob.
MKT	0.4499	0.0703	6.4018	0.0000
SIZE	0.1443	0.0394	3.6651	0.0004
VALUE	0.0078	0.0483	0.1617	0.8719
OPROF	-0.1241	0.0328	-3.7778	0.0003
ASTG	-0.0216	0.0456	-0.4730	0.6373
Intercept	0.0027	0.0014	1.9033	0.0599
CointEq(-1)*	-0.9708	0.0273	-35.615	0.0000
R-squared	0.9235	Mean dependent var		-0.0002
Adjusted R-squared	0.9228	S.D. dependent var		0.0523
S.E. of regression	0.0145	Akaike info criterion		-5.6073
Sum squared resid	0.0222	Schwarz criterion		-5.5573
Log likelihood	301.9898	Hannan-Quinn criter.		-5.5870
F-statistic	1268.4370	Durbin-Watson stat		1.8348
Prob(F-statistic)	0.0000			

Dependent Variable: (Avret), Predictor variables: (Market, Size, Value, OPROF and ASTG)

In Table 4.41, the coefficient on MKT was positive (β = 0.4499) with a *p*-value < 5%. This implies that market risk bears a positive and significant effect on average stock returns in the long-run. Other significant variables include SIZE (β = 0.1443, *p*-value < 5%), OPROF (β = -0.1241, *p*-value < 5%) and SENT (β = 0.0506, *p*-value < 5%). In the joint effect analysis however, VALUE (β = 0.0078, *p*-value > 5%) and ASTG (β = -0.0216, *p*-value > 5%) were found not to significantly predict average stock returns in the long-run. The results represent that specialized investment management products can be offered which take benefit of market, size, OPROF and SENT premium to provide comparatively higher returns on average.

The alpha (intercept) value in Table 4.41 was positive but not significant (*p*-value > 0.5). The positive intercept implies that investment in NSE equity stocks would mostly result to insignificant abnormal gains to investors at the NSE in the long-term investment horizon. The negative coefficient on ECT shows evidence of long-run convergence/reversion to equilibrium and thus we can infer long-run causal relationship between the variables. It further implies that the speed of adjustment in average stock returns from previous month's disequilibrium to current month's equilibrium is 97.08% percent. The R-square for the long-run model was 0.9236 implying that the predictor variables jointly account for 92.36% of the variance in average stock returns at the NSE. The remaining 7.64% are accounted for by other systematic risk proxies not included in the model. The probability value of F-statistic for the ECM representation is very small (less than 5%), suggesting that the overall model provides a good fit.

4.8.7 Investor Sentiment, APR premia and Stock Returns

The sixth objective of the study was to assess the moderating effect of investor sentiment on the relationship between APR Premia and stock returns of listed equity stocks in Kenya. To establish the moderating effect, the sudy conducted sequential moderated regression analysis following approach outlined in Keith (2015). Sequential regression involves entering variables one at a time or in blocks according to the underlying causal model. The dependent variable was stock returns measured as value weighted average of individual stock returns (avret). The predictor variables were individual dimensions of APR premia conceptualized within the FF5F model framework. Scores on each predictor term were mean centered then multiplied by the moderator to create cross-product terms. Centering was done by subtracting the sample mean from the scores on each predictor (Aiken & West, 1991). The purpose of mean centering was to avoid the potentially problematic multi-collinearity between the interaction terms and the predictor scores, so that the effects of the predictors are distinguishable from the interaction.

The first sequential step involved regressing stock returns on the joint APR premia in simultaneous regression. The results were illustrated in Table 4.38. In the second sequential step, stock returns were regressed on the joint APR premia with investor sentiment, both short-run and long-run. This was done to assess if the added variable (SENT) was efficient. The ARDL-ECM representation is as shown in equation 4.13

$$\Delta(avret)_t = \alpha_0 + \sum \delta_i \Delta(avret)_{t-i} + \sum \beta_i \Delta(X')_{t-i} + \sum \lambda_i \Delta(sent)_{t-i} + \lambda ECT_{t-1} + e_t \tag{4.13}$$

Where X_j' represent individual components of asset pricing risk premia

SENT : Investor Sentiment variable

$avret$: Average stock returns

ECT : Error correction term

Table 4.42 displays results of second step sequential analysis to assess if the added variable (SENT) was efficient.

Table 4.42: APR premia, Investor Sentiment and Stock Returns Model 1

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.***
Long-run Estimates:				
Intercept	-0.0025	0.0015	-1.7148	0.0895
MKT	0.4498	0.1069	4.2081	0.0001
SIZE	0.1443	0.0385	3.7512	0.0003
VALUE	0.0078	0.0572	0.1365	0.8917
ASTG	-0.0216	0.0494	-0.4359	0.6638
OPROF	-0.1241	0.0343	-3.6125	0.0005
SENT	0.0506	0.0115	4.3913	0.0000
CointEq(-1)*	-0.9708	0.0271	-35.7850	0.0000
Short-Run Estimates				
Intercept	-0.0024	0.0014	-1.7021	0.0919
AVRET(-1)	0.0292	0.0319	0.9136	0.3631
MKT	0.4367	0.1002	4.3590	0.0000
SIZE	0.1401	0.0383	3.6587	0.0004
VALUE	0.0076	0.0555	0.1364	0.8918
ASTG	-0.0209	0.0481	-0.4354	0.6642
OPROF	-0.1204	0.0328	-3.6741	0.0004
SENT	0.0492	0.0114	4.3080	0.0000
R-squared	0.8689			
Adjusted R-squared	0.8597			
S.E. of regression	0.0150			
F-statistic	93.7761			
Prob(F-statistic)	0.0000			

Model 1 Predictors: (constant), 1st Lag Stock Returns, Market, Size, Value, Profitability, Asset Growth, Sentiment; Dependent Variable: Stock Returns

In model 1, the estimated coefficients of long-run relationship were significant for market (0.4498, p<0.05), size (0.1443, p<0.05), profitability (-0.1241, p<0.05) and sentiment (0.0506, p<0.05). The estimates for value (0.0078, p<0.05) and asset growth (-0.0216, p<0.05) were however not significant. The same pattern was observed in the short-run. The variables in model 1 accounted for significant amount of variance in stock returns, R-square = 0.8689, adjusted R-square = 0.8597, F-stat = 93.7761 $p<0.05$. This implies that augmenting the FF5F risk premia with sentiment risk would explain 86.89% of the variation in stock returns. The coefficient of the lagged EC term was statistically significant at 5% level suggesting that the model convergence to LR equilibrium level is rapid at 97.08%.

In the third step, interaction terms were added sequentially. The model for third level analysis (with interaction) is as shown equation 4.14.

Model 2: $\Delta avret_t = \alpha_0 + \sum \delta_i \Delta avret_{t-i} + \sum \beta_i \Delta X'_{t-i} + \sum \lambda_i \Delta(sent)_{t-i} +$

$$\sum \varphi_i \Delta(X' * sent)_{t-i} + \xi ECT_{t-1} + e_t \quad (4.14)$$

Where:

X': represent individual components of asset pricing risk premia.

$X' * SENT$: Interaction term between individual asset pricing risk premium and sentiment variable.

The moderating effect was tested by assessing the significance of the coefficient of the interaction term and respective changes in R-square as compared with the main effects model. If the ΔR^2 for the respective models and the coefficient of the interaction term were statistically significant, then the moderating hypothesis was deemed supported. This would be interpreted to mean that the effect of APR premia on stock returns varies at each level of sentiment. Table 4.43 displays results of third step sequential analysis to assess the interaction effects on stock returns.

Table 4.43: Interaction Effects on Stock Returns Model 2

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
Long-run Estimates:				
Intercept	-0.0022	0.0017	-1.2974	0.1977
MKT	0.4389	0.0901	4.8691	0.0000
SIZE	0.1626	0.0336	4.8452	0.0000
VALUE	0.0052	0.0507	0.1029	0.9183
OPROF	-0.1298	0.0328	-3.9624	0.0001
ASTG	-0.0112	0.0473	-0.2373	0.8129
SENT	0.0474	0.0095	4.9916	0.0000
MKT*SENT	0.3393	0.1288	2.6342	0.0099
SIZE*SENT	0.0936	0.0781	1.1989	0.2336
VALUE*SENT	0.2291	0.1118	2.0496	0.0432
OPROF*SENT	-0.0556	0.0744	-0.7477	0.4565
ASTG*SENT	0.2344	0.1100	2.1307	0.0357
CointEq(-1)*	-0.9893	0.0250	-39.5891	0.0000
Short-Run Estimates				
Intercept	-0.0022	0.0017	-1.2975	0.1977
AVRET(-1)	0.0107	0.0320	0.3347	0.7386
MKT	0.4342	0.0881	4.9272	0.0000
SIZE	0.1608	0.0346	4.6519	0.0000
VALUE	0.0052	0.0502	0.1029	0.9183
ASTG	-0.0111	0.0468	-0.2370	0.8132
OPROF	-0.1284	0.0319	-4.0291	0.0001
SENT	0.0469	0.0093	5.0404	0.0000
MKT*SENT	0.3356	0.1268	2.6471	0.0095
SIZE*SENT	0.0926	0.0778	1.1900	0.2371
ALUE*SENT	0.2266	0.1101	2.0590	0.0423
OPROF*SENT	-0.0550	0.0730	-0.7540	0.4528
ASTG*SENT	0.2319	0.1100	2.1080	0.0377
R-squared	0.8914			
Adjusted R-squared	0.8762			
S.E. of regression	0.0141			
F-statistic	58.7229			
Prob(F-statistic)	0.0000			

Model 2 Predictors: (constant), 1st Lag Stock Returns, Market, Size, Value, Profitability, Asset Growth, centered Sentiment, market*sentiment, size*sentiment, value*sentiment, profitability*sentiment, asset growth*sentiment. Predictors: Stock Returns

Table 4.43 displays results of interaction between APR premia and sentiment in their effects on stock returns. The effect of market risk was positive and significant in the main effects model (β = 0.7976, p<0.05) as illustrated in Table 4.43. The effect was however reduced in the interaction model (β =0.4342, p<0.05). The coefficient of the interaction term between market risk and sentiment was positively signed and significant in the long-run (β =0.3393, p<0.05) and short-run (β =0.3356, p<0.05). This indicates that the effect of market risk premium on stock returns varies at different levels of investor sentiment. It also illustrates that market risk and sentiment do not have independent effects on stock returns at the NSE. Hence, it was concluded that investor sentiment moderates the effect market risk on stock returns at NSE.

The effect of size risk was positive and significant in the main effects model (0.2035, p<0.05) as illustrated in Table 4.38. The effect was however reduced but significant in the interaction model (β =0.1626, p<0.05). A statistically insignificant coefficient of the interaction term between size risk and sentiment was noted (β =0.0936, p>0.05). This implies that sentiment does not moderate the effect of size risk on stock returns in the long-run. It was also interpreted to mean that changes in investor sentiment and size risk have independent effects on stock returns.

The effect of value risk was positive but insignificant in the first step of analysis (0.0171, p>0.05) as illustrated in Table 4.38. The effect was however much reduced and insignificant in the interaction model (β =0.0052, p>0.05). The interaction term between value risk and sentiment was nonetheless significant (β =0.2291, p<0.05). This implies that sentiment partially moderates the effect of value risk on stock returns. It can also be interpreted to mean that a high sentiment increases significantly the positive effect of value risk on stock returns.

The effect of profitability risk was negative and significant in the first step of analysis (β =-0.1368, p<0.05) as illustrated in Table 4.38. The addition of the interaction term did not alter the interpretation of profitability risk (β =-0.1298, p<0.05). The results further show that the coefficient of the interaction term between profitability and sentiment was negative but not significant (β =-0.0556, p>0.05). This implies that investor sentiment does not moderate the effect profitability risk on stock returns at NSE. The negative coefficient of the cross-product term illustrates that an increase in sentiment does not change the effect of profitability risk on stock returns.

The effect of asset growth risk was negative but insignificant in the first step of joint effect analysis (β =-0.0449, p>0.05) as illustrated in Table 4.38. The addition of the interaction term did not alter the interpretation of asset growth risk (β =-0.0112, p>0.05). Model 2 further shows that the interaction term between asset growth and sentiment was positive and significant (β =0.2344, p<0.05). The positive coefficient illustrates that an increase in sentiment reduces the negative effect of ASTG on stock returns.

The initial independent variables accounted for 81.03% of the variance in stock returns. The addition of the interaction terms explained an additional 8.11% of variation in stock returns, a statistically significant increase; R-square = 0.8914, adjusted R-square = 0.8762, F-stat = 58.7229 p<0.05. This implied that the interaction model explains 89.14% of the variation in stock returns. The coefficient of the lagged ECT is statistically significant at 5% level suggesting that the model convergence to LR equilibrium level is rapid at 98.93%.

Table 4.44: APR Premia Composite and Stock Returns

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
Long-run Estimates:				
APR premia	1.0000	0.0647	15.4565	0.0000
Intercept	0.0000	0.0019	0.0247	0.9804
CointEq(-1)*	-0.9136	0.0313	-29.1897	0.0000
Short-Run Estimates				
Avret (-1)	0.0864	0.0426	2.0285	0.0451
APR Premia	0.9136	0.0439	20.7970	0.0000
Intercept	0.0000	0.0017	0.0247	0.9804
R-squared	0.8103		Mean	-0.0056
Adjusted R-squared	0.8067		S.D.	0.0399
S.E. of regression	0.0176		Akaike info	-5.2189
Sum squared resid	0.0321		Schwarz	-5.1440
Log likelihood	282.2115		Hannan-	-5.1885
F-statistic	222.1602		Durbin-	1.8546
Prob(F-statistic)	0.0000			

Results in Table 4.44 show that APR premia composite was statistically significant (β =0.9136, *p*-value < .05) in the short-run and long-run (β = 1.0000, *p*-value < .05). This result demonstrates that for each additional unit of APR composite, stock returns would increase by 0.9136 units in the short-run and by 1 unit in the long-run. Thus, prior to the consideration of the cross-product term, APR composite had significant effect on stock returns. The R-square for the model was 0.8103 suggesting that the composite index for APR risk premia accounts for 81.03% of short-run variance in average stock returns at the NSE.

Table 4.45: Short-run Interaction Effects of APR composite and Sentiment

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
AVRET(-1)	0.0281	0.0258	1.0907	0.2780
APR Premia	0.5672	0.1336	4.2450	0.0000
SENT	0.0451	0.0109	4.1236	0.0001
APR Premia*SENT	0.0967	0.1329	0.7275	0.4686
Intercept	0.0014	0.0028	0.4898	0.6254
R-squared	0.8665	Mean dependent var		-0.0056
Adjusted R-squared	0.8613	S.D. dependent var		0.0399
S.E. of regression	0.0149	Akaike info criterion		-5.5328
Sum squared resid	0.0226	Schwarz criterion		-5.4079
Log likelihood	301.0054	Hannan-Quinn criter.		-5.4822
F-statistic	165.5309	Durbin-Watson stat		1.8287
Prob(F-statistic)	0.0000			

Predictors: (Constant), APR Premia, SENT, APR Premia*SENT Dependent Variable: (AVRET)

Results in Table 4.45 showed that both APR premia (β = 0.5672, p< .05) and SENT (β = 0.0451, p<.05) were statistically significant in explaining stock returns in the short-run. The coefficient of the interaction term (APR Premia*SENT) was however not significant at 5% level (β = 0.0967, p<.05). The R-square for model 2 was marginally higher (86.65%) implying that the interaction model explains 86.65% of variations in stock returns in the short-run. The change in R-square=0.0013 was statistically significant (F-stat =165.5309, p< .05) implying that the added variables were efficient.

Table 4.46: F-bounds test

Step	Test Statistic	Value	Signif.	I(0) Asymptotic: n=1000	I(1)
1	F-statistic K	402.3120 2	5%	3.79	4.85
2	F-statistic K	301.9681 3	5%	3.23	4.89

Table 4.46 shows estimation results of F-bounds test undertaken to establish the existence of a long-run relationship in a model before (step 1) and after interaction (step 2). The null hypothesis of no cointegrating relationship between variables is rejected if the F-bounds statistic is greater than the upper bound critical value $I(1)$. Results for F-bounds test in Table 4.46 show that the F-statistic = 402.3120 is greater than the upper bound critical value $I(1) = 4.85$ in the first step (before moderation). Similarly, the F-statistic = 301.9681 is greater than the upper critical bounds value $I(1) = 4.89$ in the second step (after moderation). Consequently, the Null hypothesis of no co-integrating relationship was rejected in both analyses and it was concluded that there exist a long-run relationship between average stock returns and the predictor variables at 5% level of significance. In this regard, the Error Correction Model representation to determine the long-run relationship was conducted.

Model Equation:

$$\Delta \mathrm{avret}_t = \alpha_0 + \sum \delta_i \Delta \mathrm{avret}_{t-i} \sum \varphi_i \Delta \mathrm{APR\ Premia}_{t-i} + \sum \xi_i\, \Delta(\mathrm{sent})_{t-i} + \sum \gamma_i \Delta(\mathrm{APR\ Premia} * \mathrm{sent})_{t-i} + \lambda \mathrm{ECT}_{t-1} + e_t \quad (4.15)$$

Results are summarized in Table 4.47

Table 4.47: Long-run Interaction Effects of APR Composite and Sentiment

Variable	Coefficient	Std. Error	t-Statistic	Prob.
APR Premia	0.5836	0.0874	6.6760	0.0000
SENT	0.0464	0.0072	6.4696	0.0000
APR Premia*SENT	0.0995	0.0998	0.9972	0.3210
Intercept	0.0014	0.0014	0.9783	0.3303
CointEq(-1)*	-0.9719	0.0276	-35.2619	0.0000
R-squared	0.9221	Mean dependent var		-0.0002
Adjusted R-squared	0.9214	S.D. dependent var		0.0523
S.E. of regression	0.0147	Akaike info criterion		-5.5889
Sum squared resid	0.0226	Schwarz criterion		-5.5389
Log likelihood	301.0054	Hannan-Quinn criter.		-5.5686
F-statistic	1243.398	Durbin-Watson stat		1.8287
Prob(F-statistic)	0.0000			

Predictors: (Constant), APR Premia, SENT, APR Premia*SENT Dependent Variable: AVRET

As shown in Table 4.47, results of second step of analysis (Model 2) show that in the long-run, both coefficients of APR premia (β = 0.5836, *p*-value < .05) and SENT (β =0.0464, *p*-value < .05) were statistically significant implying that the two variables have significant effect on average stock returns. The coefficient of the interaction term (APR Premia*Sent) was however not significant at 5% level (β =0.0995, *p*-value < .05). Subsequent to addition of the cross-product term in the equation, the R-square for the model increased to 92.21% implying that the interaction model explains 92.21% of variations in stock returns in the long-run. The change in R-square =0.0007 was statistically significant (F-stat =1243.398, *p*-value < .05) implying that the model is a good fit and the added variable is efficient.

The ECT is obtained from the residuals of the long-run equation. In this analysis, the coefficient of lagged error correction term is significant with a negative sign at 5% level in first step (λ = -0.9715, *p*-value < .05) and second step (λ = -0.9719, *p*-value< .05) respectively. This finding further confirms the results of bounds test for cointegration. A highly significant negative coefficient of ECT reinforces evidence of long-run convergence/reversion to equilibrium implying that we can infer long-run causal relationship between APR premia, investor sentiment and average stock returns in Kenya.

In summary, this study finds evidence to support the null hypothesis of no moderating effect of investor sentiment on the relationship between APR premia and stock returns at the NSE. The non-significant coefficients of the interaction term (APR premia*SENT) both in the short-run and long-run analysis means that the effect of APR premia on stock returns is not influenced by the level of sentiment at the Kenyan equity market. In a similar manner, the effect of sentiment variable on stock returns does not depend on the asset pricing risk at the NSE. It therefore suffices to conclude that APR risk premia and SENT are independent. This study also finds that investor sentiment has a direct positive influence on stock returns under the FF5F model framework at the NSE.

The current findings are not unique to this study since other researchers such as Ergu and Durukan (2018) in Turkey established a long-run positive relationship of sentiment and market returns in the presence of structural breaks. Moreover, Baker and Wurgler (2006) found a positive relationship and greater effect among growth stocks while Chung et al. (2010) concluded that the greater the magnitude of shift in the sentiment, the more impact it has on volatility of returns in Taiwan. There is however lack of convergence of the current findings vis-à-vis the empirical evidence in Ergun and Durukan (2017) who found a negative relationship between sentiment and excess returns which may be attributed to variations in methodology, variable conceptualization and context scope.

4.8.8 Optimal Model Determination

In order to determine the optimal model for the study, analysis of the variables was done in a two-step procedure. The first involved establishing the combined effect of the independent variables and investor sentiment on stock returns. The second step involved dropping all insignificant variables established in step one, from the analysis. The predictive power of the optimal model was assessed by examining changes in the adjusted R-square values, F-ratio and significant coefficients.

4.8.8.1 Optimum Model Coefficients

Using the selected ARDL and ECM model representation, the variables that were found to significantly explain stock returns were market, size, and profitability and investor sentiment. The optimum model and results for the study thus replicated in Table 4.48.

Table 4.48: Optimum Short-run Model Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
AVRET(-1)	0.0281	0.0385	0.7307	0.4667
MKT	0.4355	0.0629	6.9245	0.0000
SIZE	0.1391	0.0377	3.6906	0.0004
OPROF	-0.1157	0.0284	-4.0692	0.0001
SENT	0.0495	0.0073	6.7809	0.0000
Intercept	0.0027	0.0015	1.8118	0.0730
R-squared	0.8686	Mean dependent var		-0.0056
Adjusted R-squared	0.8621	S.D. dependent var		0.0399
S.E. of regression	0.0148	Akaike info criterion		-5.5301
Sum squared resid	0.0222	Schwarz criterion		-5.3802
Log likelihood	301.8606	Hannan-Quinn criter.		-5.4693
F-statistic	133.5646	Durbin-Watson stat		1.8483
Prob(F-statistic)	0.0000			

$$\widehat{avret} = 0.0027 + 0.0281 avret(-1) + 0.4355 market + 0.1391 size - 0.1157 oprof + 0.0495 sent \qquad (4.15)$$

Table 4.49: Optimum Long-run Model Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
MKT	0.4481	0.0694	6.4527	0.0000
SIZE	0.1432	0.0383	3.7364	0.0003
OPROF	-0.1190	0.0303	-3.9233	0.0002
SENT	0.0509	0.0073	6.9374	0.0000
Intercept	0.0027	0.0014	1.9407	0.0551
CointEq(-1)*	-0.9719	0.0273	-35.5696	0.0000
R-squared	0.9234	Mean dependent var		-0.0002
Adjusted R-squared	0.9226	S.D. dependent var		0.0523
S.E. of regression	0.0145	Akaike info criterion		-5.6049
Sum squared resid	0.0222	Schwarz criterion		-5.5549
Log likelihood	301.8606	Hannan-Quinn criter.		-5.5846
F-statistic	1265.1240	Durbin-Watson stat		1.8483
Prob(F-statistic)	0.0000			

$$\widehat{avret} = 0.0027 + 0.4481market + 0.1432size - 0.1190oprof + 0.0509sent \quad (4.16)$$

4.9 Test for Significance of the Intercept Term

A well specified equilibrium model is one whose intercept term is indistinguishable from zero which would imply that the endogenous variables are important in explaining returns. The general postulation is that if the spread in portfolio returns represent a compensation for risk as represented by the Fama and French factor premia, then the alpha of these portfolios should be jointly zero. The GRS test was performed in STATA version 13 to test the hypothesis that the intercept terms in all the 12-test portfolio regressions are simultaneously indistinguishable from zero. The GRS statistic, which follows an *F* distribution, tests the hypothesis that all alphas are jointly equal to zero. Low values for the GRS test are indicative of the effectiveness of the model in explaining the variations in stock returns. Using the GRS F-test for joint significance of coefficients, the null hypothesis is rejected for a *p*-value less than a given level of significance. Table 4.50 shows the result of GRS test. The GRS *F*-stat denotes Gibbons et al. (1989) test statistic for mean–variance efficiency while the *p*-(GRS) denotes its corresponding probability values.

Table 4.50: Results of GRS Tests

	Date >=ym(*,12)	GRS *F*-Stat	*P*-GRS
Model 1	2017	2.5805	0.0928
	2014	2.5260	0.0126
	2011	2.2123	0.0204
Model 2	2017	1.0905	0.4741
	2014	2.2895	0.0234
	2011	2.8690	0.0022
Model 3	2017	1.7366	0.2067
	2014	1.7254	0.0929
	2011	2.6050	0.0050

Model 1:

grstest P1 P2 P3 P4 P5 P6 P7 P8 P9 P10 P11 P12, flist (MKT SIZE VALUE OPROF ASTG) ret (PORT)

Model 2:

grstest P1 P2 P3 P4 P5 P6 P7 P8 P9 P10 P11 P12, flist (MKT SIZE VALUE OPROF ASTG SENT) ret (PORT)

Model 3:

grstest P1 P2 P3 P4
P5 P6 P7 P8 P9 P10 P11 P12, flist (MKT SIZE OPROF SENT) ret (PORT)

Table 4.50 reports the estimates of GRS statistics for 12 size sorted portfolios. At 5% significance level, the null hypothesis that all alphas are equal to zero cannot be rejected in all models when a three-year data prior is considered. When a period of 6-years is considered, only in model 3 (*F* stat = 1.7254, *p*-value < .05) are all alphas jointly not significant. The test is however rejected in all models when the entire sample period is considered. It therefore implies that the Fama-French APR premia are able to explain returns on the 12 test portfolios over a shorter time duration than when a longer duration is considered. Overall, the model that incorporates market, size, profitability and sentiment turns out to be the optimal model.

4.10 Model Stability

The study adopted the methodology used by Abdlaziz (2016) for checking the structure stability in the model. Cummulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ) statistics are updated recursively and plotted against the break points. If the plots of the CUSUM and CUSUMSQ statistics stay within the critical bonds of a 5% level of significance, the null hypothesis of all coefficients in the given regression are stable and cannot be rejected. The graphs representing the CUSUM and CUSUMSQ tests are presented in Figure 1 and 2 respectively.

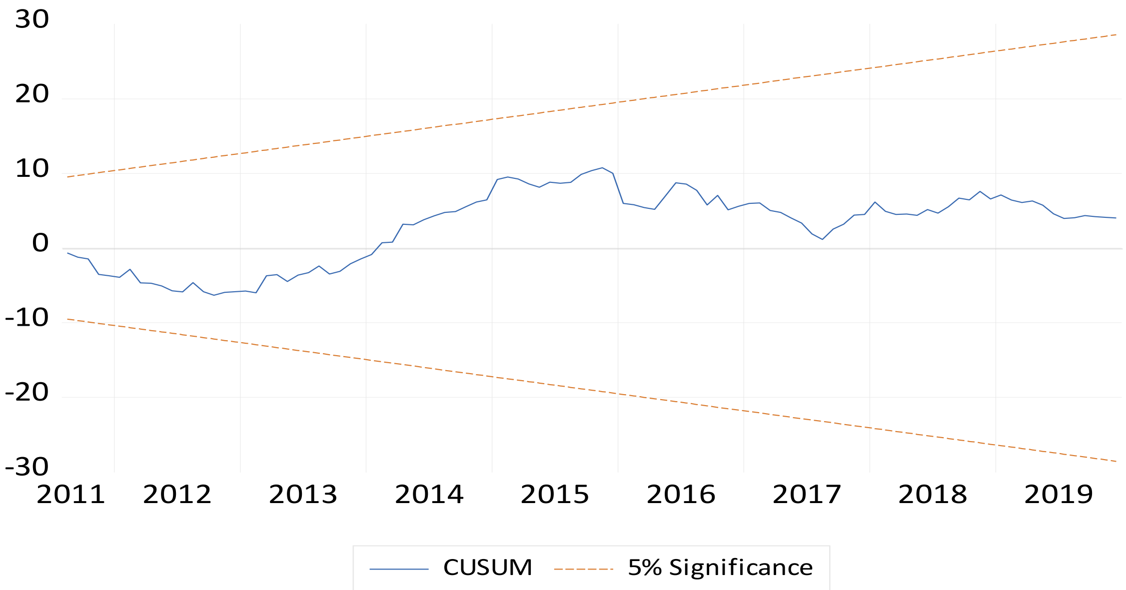

Figure 4.1: Graphs Representing the CUSUMQ Test

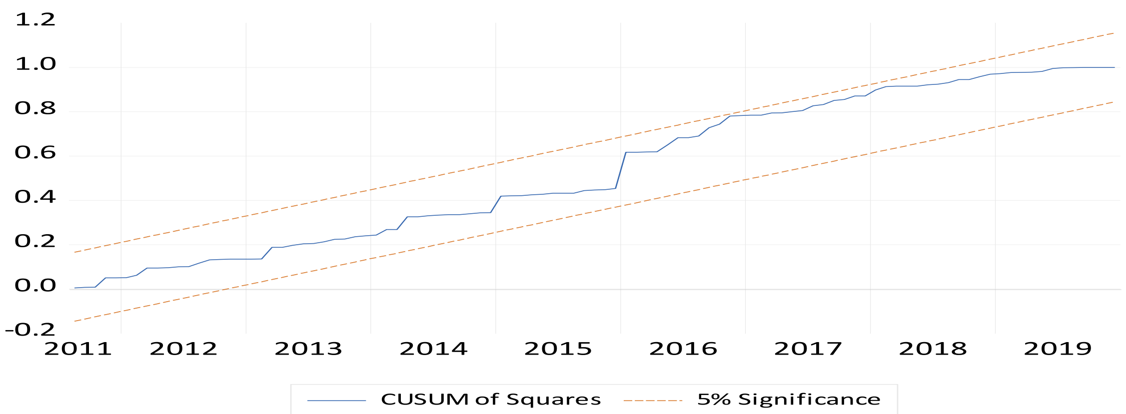

Figure 4.2: Representing CUSUMSQ Tests

As it can be seen from Figures 1 and 2, the plots of CUSUM and CUSUMSQ statistics lie within the critical bounds, implying that the coefficients in the error correction model are relatively stable. Hence, this estimated model can be used for policy decision-making purposes by market players at the Kenyan equity market.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the summary of findings of the study in accordance with the research objectives and the corresponding hypotheses as outlined in chapter one. Based on the empirical analyses, conclusions were drawn for each of the research objective. The chapter also lays out recommendations for managerial and policy consideration for an effective equity market environment in Kenya. Ultimately, suggestions for further research are made at the end of the chapter.

5.2 Summary of Findings

The broad objective of the study was to establish the effect of investor sentiment on the relationship between asset pricing risk premia and equity stock returns of listed firms on the Nairobi Securities Exchange. To achieve the objective, a conceptual structure of variables was formulated and analyzed. The dependent variable (stock returns) was measured as monthly return on each of the 12 equity stock portfolios over the sample period (2011–2019) as well as average return index. The regressors were the lagged values of the dependent variable, premium on market, size, value, profitability and asset growth. The moderator variable was investor sentiment. The study adopted short-run ARDL and long-run ECM model representation to assess statistical significance of variable linkage at 95% degree of confidence. The ARDL bounds test was done to establish long-run cointegration relationship among variables which would then require estimation using Error Correction Model representation. A summary of the findings on the objectives and various tests of hypotheses are indicated in the ensuing subsections.

5.2.1 Market Risk Premium and Stock Returns at the NSE

The first objective of this study was to explore the effect of market risk premium on stock returns of listed equity stocks in Kenya. The market premium was computed as excess return on the NSE 20 share index over the one month return on Kenyan treasury bills. The short-run effect was first analyzed by regressing portfolio returns on market risk premium using ARDL model representation. The loadings on market risk premium were all positive and statistically significant. The maximum sensitivity (β =0.9961, *p*-value < .05) was on big high book-market ratio portfolio. The lowest effect was observed on the portfolio of small stocks with aggressive investment policy (β = 0.6085, $p<0.05$). Consistent with Fama-French (1993), the coefficient on market risk premium increases as one moves from low through high B/M portfolios for both small and big stocks. The same pattern is observed on size-operating profitability sorted portfolios. This pattern, however, reverses when size-asset growth sorted portfolios are examined, in which case the coefficients on the market risk premium decrease. The single index model could not explain fully stock returns in 25% of cross-sectional regressions. Overall, the results show that market risk exerts a positive and significant influence on stock returns at NSE in the short-run (β = 0.7461, *p*-value < 0.05) and long-run (β = 0.8346, *p*-value < 5%). The study therefore found adequate evidence to support the hypothesis of significant effect of market risk premium on equity stock returns at the NSE.

The current findings affirm earlier conclusions by Ajlouni and Khasawneh (2017) in Italy, Iqbal and Brooks (2010) in Pakistani market and Coffie and Chukwulobelu (2013) who established evidence in support for market risk. The findings however conflict with Jónsson and Ásgeirsson (2017) in the European stock markets, Karp and Vuuren (2017) in South Africa and Okumu and Onyuma (2015) in Kenya. Meanwhile, this finding was in tandem with Efficient Market theory which postulates that an asset's return is proportional to its exposure to overall market risk for a properly specified model and efficient market.

5.2.2 Size Risk Premium and Stock Returns at the NSE

The second objective was to establish if size risk premium explains stock returns in Kenya. Size effect represents additional returns generated historically from investment in small market capitalization stocks. Monthly size risk premium was computed as value weighted returns on six small stock portfolios minus the value weighted returns on six big stock portfolios. All the big sized portfolios had negative coefficients, while all small sized portfolios had positive coefficients, indicating that big stocks yield comparatively lower returns. The highest size risk effect was observed on portfolios of small stocks with robust profitability (β =0.6909, p<.05) interpreted to mean that a unit increase in size risk would increase portfolio returns on robust profitable small stocks by 0.6909 units. The lowest loading was on less profitable big stocks (β = -0.6044, p<.05) suggesting that high size risk would lower portfolio returns on large less profitable stocks. Overall, the results signify that size risk has a positive and significant effect on stock returns at NSE in the short-run (β = 0.1773, p-value < 0.05). Long-run analysis also revealed positive significant effect of size risk coefficient (β = 0.1887, p<.05). The current study therefore established evidence to support the claim of significant effect of size risk premium on stock returns in Kenya at 5% level of significance. The one month lagged value of average returns was positive but insignificant (β = 0.0605, p-value > 0.05). This implies that average returns one month prior would insignificantly influence current month returns on size investment strategy at the NSE.

A positive size risk coefficient in the Fama-French regression is often interpreted as a signal for portfolios weighted towards small-cap stocks. The results further imply that investors at the NSE would on average demand higher returns for taking long position in high market capitalization equity stocks, which is apparently inconsistent with explanation in the equity valuation theory. This finding agrees with conclusion by Fama and French (1995) who noted that small companies are more sensitive to many risk factors as they are comparatively undiversified in nature and have little ability to undertake adverse financial situations and hence, they tend to outperform large ones. Similar findings were made by Rashid and Sadaqat (2018) whose study observed a positive significant SMB factor in Pakistan. The finding however differs with studies such as Faff (2001) who found a negative significant size factor in Australia.

5.2.3 Value Risk Premium and Stock Returns at the NSE

To explore the effect of value risk premium on stock returns in Kenya, the ARDL time series regression was conducted for main effects. Value risk premium refers to higher average returns on stocks with high ratios of book value of equity to the market value of equity (value stocks), than stocks with low book-to-market (B/M) ratio (growth stocks). Higher average returns are required by investors as compensation for exposure to value risk. The coefficients of value risk premium were positive and significant on big stocks with high B/M ratio and on small high-B/M portfolio at 5% level. The coefficients are however negative and significant on low B/M portfolios which suggests that value investing strategies are more beneficial for high B/M ratio stocks. Additionally, seven (7) out of twelve (12) portfolios had the expected positive loading on the value risk premium, suggesting that a high value risk premium would certainly increase returns on portfolios of equity stocks at the NSE.

Overall, short-run results show negative insignificant value factor (β =-0.0720, p >0.05). The long-run coefficient on value factor is also negative (β = -0.0809, p-value >0.05). Thus, the study could not reject the null hypothesis of no significant effect of value risk premium on stock returns in Kenya. This result is by implication means that in the long-term, increasing investment in value stocks by a unit would reduce the required rate of return returns by 0.0809 units though not significantly. This finding does not however invalidate the established theoretical linkage. According to the equity valuation theory, increasing investment in high B/M ratio stocks poses a high risk to investors who would in turn demand higher compensation in terms of required rate of return. Similar findings were observed by Araujo and Machado (2017) in Brazil, Auret and Sinclair (2006) in South Africa, Kilgard and Wittorf (2011) in UK and Anuradha (2011) in Srilanka who when HML factor is studied under the Fama-French (1993) model framework. The current results however in contrast with Odera (2010) and Shafana et al. (2013) who observed that portfolios containing glamour stocks have higher earnings and hence appear to be riskier as compared to value stocks. The low predictive power of value premium at the NSE could be as a result of low investor confidence in the accounting information from which value risk factor is derived. The existence of imperfect regulatory environment and weak surveillance systems in the emerging markets like NSE may account for problems such as failure by listed firms to make adequate disclosure of relevant information to the investors and insider-dealing.

5.2.4 Profitability Risk Premium and Stock Returns at the NSE

The fourth objective was to establish whether profitability risk premium explains stock returns at the NSE. Profitability risk premium is the return spread between stocks with robust profitability and stocks with weak profitability. According to risk-based explanation, more profitable firms tend to be growth firms whose cash flows are expected in the distant future which is more uncertain. Hence profitability investing strategies create more risk and should require a risk premium. It is noticeable that when size-profitability sorted portfolios are considered, robust profitability portfolio has the largest coefficient value while weak profitability portfolio has the least. This result is consistent with the conclusion by Novy-Marx (2013) that profitable firms earn substantially higher equity returns than unprofitable businesses. The negative loadings on profitability factor across 10 portfolios suggest that portfolio returns are likely to be lower for profitable investment strategy at the NSE. Further, a model that augments profitability risk with single index model reduces significantly the number of non-significant alphas.

On the overall, profitability risk factor is negative and significant both in the short-run (β =-0.1155, *p*-value<5%) and long-run (β =-0.1619, *p*-value<5%). The null hypothesis of no significant effect of profitability risk premium on stock returns was not supported and thereby concluded that profitability risk is a significant predictor of average stock returns in Kenya. It is further interpreted to mean that in the long-term, increasing investment in profitability stocks by a unit would significantly decrease average stock returns by about 0.1619 units. Therefore, the results suggest that investors exposed to high profitability risk at the NSE will on average demand lower returns, a contrary view of the equity valuation theory. According to the theory, increasing investment in robust stocks poses a higher risk to investors who will in turn demand higher compensation in terms of required rate of return. The current findings are consistent with empirical evidence by Mosoeu and Kodongo (2017) in South Africa and Kilsgard and Wittorf (2011) in the UK. The results however contrast the theoretical prediction and empirical evidence by Machado and Faff (2017) who did not find pricing effect of profitability factor in Brazilian market and Njogo et al. (2017) who observed weak but positive effect of profitability at the Kenyan equity market.

5.2.5 Asset Growth Risk Premium and Stock Returns at the NSE

This study also assessed the effect of asset growth risk premium on equity stock returns at the NSE. Asset growth risk premium was operationalized as the spread in returns of conservative stocks over the aggressive stocks. Results of ARDL regression show that an increase in ASTG risk tends to decrease required returns on big stocks but increase returns on small stocks. The coefficients on conservative portfolios were positive while those on aggressive portfolios were negative thereby validating the risk-based and mispricing based theoretical postulation that low investments are associated with high cost of capital while high investment intensity is associated with low cost of capital. Overall, the coefficient on asset growth risk factor was negative as expected (β = -0.0096, p-value<5%) signifying that asset growth risk exhibits a negative but insignificant influence on equity stock returns at NSE in the short-run. In the long-run, asset growth effect on average stock returns was negative though insignificant at 5% error rate (β = -0.0107, *p*-value >5%). Hence, the null hypothesis of no significant effect of asset growth risk premium on stock returns could not be rejected and thereby concluded that asset growth risk is not a significant predictor of average stock returns in Kenya.

The results show that investors exposed to high asset growth risk at the NSE will on average demand lower returns, though not significantly. This means that investors do not necessarily consider a company's total asset variation as an important factor for consideration when making decisions on investment at the NSE. The results in this study are somewhat consistent with conclusions by Cooper et al. (2008) that US firms with low asset growth earn superior annualized risk-adjusted average returns. Although Yao et al. (2017) indicated that firm investment and expected returns tend to exhibit a negative relationship after controlling for size and B/M ratio, the relationship is however somewhat different when the FF5F model is considered. It should however be noted that the difference in the conclusions could be attributed to different measurement for ASTG variable and methodology adopted by researchers for the analysis.

5.2.6 Asset Pricing Risk Premia, Investor Sentiment and Stock Returns at the NSE

To establish the moderating effect, this study conducted sequential moderated regression analysis which involves entering variables one at a time or in blocks according to the underlying causal model. The first sequential step involved regressing average stock returns on the individual APR premia in simultaneous regression. In the second sequential step, stock returns were regressed on the joint APR premia with investor sentiment, both short-run and long-run. In the third step, interaction terms were added sequentially. Moderating effect was tested by assessing the change in adjusted R-square and the significance of the interaction term between sentiment variable and the composite variable for APR premia. It was established that investor sentiment moderates the effect of market, value and asset growth risk premia. Investor sentiment does not however moderate the size and profitability effect.

The study further tested the moderating effect of investor sentiment on the relationship between asset pricing risk premia composite and stock returns at the NSE. It was revealed that subsequent to the introduction of the interaction term, the effect of APR premia composite and sentiment were both statistically significant. It implies that APR premia exerts positive significant influence on average stock returns in the short-run when investor sentiment is controlled for. The coefficient of the interaction term (APR Premia*SENT) was however not significant implying that APR premia composite and investor sentiment have independent effects on stock returns at the NSE in the short-run. The long-run results showed that both APR premia composite and sentiment variable are statistically significant in explaining average stock returns. The coefficient of the interaction term was however not significant as well in the long-run at 5% level, further demonstrating that APR premia and investor sentiment have independent effects on stock returns at the NSE.

The ECT term was highly significant with the expected negative coefficient thus implying that we could infer long-run causal relationship between APR premia, investor sentiment and average stock returns in Kenya. The study did not find evidence to reject the hypothesis of no significant moderating effect of investor sentiment on stock returns at the NSE. Related findings are documented by Baker and Wurgler (2006), Chung et al. (2010) and Yang & Chen (2014) who observed a positive and greater effect of sentiment among growth stocks. There is however lack of convergence of the current findings vis-à-vis the empirical evidence in Ergun and Durukan (2017) who found a negative relationship between sentiment and excess returns.

5.2.7 Model Performance

The *p*-values of the intercepts in the main effects model were all greater than 5%, suggesting that the regressors are good proxies for systematic risk at the NSE. For each time-series regression involving the addition of sentiment variable to the main effects model, the mean adjusted R-square was raised. This implies that the added factors are efficient and can explain stock excess returns better. The probability values of F-statistics were very small (less than 5%), suggesting that the overall model in each portfolio regression was significant. The ECT was negative and significant in all error correction regressions. The negative coefficient on ECT implies that in that particular model there is evidence of long-run convergence/reversion to equilibrium thus we can infer long-run causal relationship. Using GRS F-test in STATA 13, the null hypothesis that all alphas are jointly equal to zero cannot be rejected in all models when three-year data prior is considered. The test is however rejected in all models when the entire sample period of 9 years is considered. Overall, the model that incorporates market, size, profitability and sentiment turns out to be the optimal model.

5.3 Conclusion

The main objective of the study was to establish the link between APR premia, investor sentiment and equity stock returns of listed firms in Kenya. Six specific objectives were derived from the broad objective to address the research dilemma.

To achieve the specific objectives, six hypotheses were formulated anchored on existing theoretical and empirical asset pricing literature.

From the findings of the study, various conclusions were drawn:

Relating to the objective on market risk premium and stock returns of listed stocks at the NSE, the study concluded that market risk premium has positive and statistically significant effect -on risk-adjusted returns, controlling for other factors in the FF5F model framework. Overall, investors at the NSE will require high returns on their investment for every unit increase in the return on the market index. The required return will however vary according to portfolio composition.

From the analysis, it was concluded that size risk premium is a significant predictor of returns of listed equity stocks in Kenya. Consistent with literature, this study also concluded that small stocks earn relatively higher returns. This can be attributed to the fact that small firms are comparatively undiversified in nature and are therefore more sensitive to many risk factors, and hence they tend to outperform large ones.

It was also concluded that valuation risk premium not does not explain stock returns in Kenya both in the short-run and long-run. This means that in the long-term, investors will not demand a high required rate of return for taking position in high B/M equity stocks. The insignificant coefficient of value factor suggests that the Book-to-Market ratio does not influence return decisions at the NSE.

The analysis to establish whether profitability risk premium is priced at the NSE concluded that profitability risk premium bears a statistically significant inverse relationship with equity stock returns at the NSE. This result suggests that investors will demand low required rate of returns for taking long position in high profitability firms.

From the results of ARDL regression, it was concluded asset growth risk premium does not exert a significant pricing effect on stocks at the NSE, holding constant other factors in the FF5F model. It therefore implies that investors do not consider a company's total asset variation as an important factor when making decisions to invest in equity stocks at the NSE. Thus, changes in value of assets either through acquisition or disposal does not communicate relevant information to investors regarding the risk position of listed firms at the NSE.

The results showed that both APR premia composite and sentiment variable were positively statistically significant in explaining equity stock returns. The coefficient of the interaction term was however not significant at 5% level, further demonstrating that APR premia and investor sentiment have independent effects on stock returns at the NSE. The study therefore concluded that IS does not moderate the effect of APR premia on stock returns at the NSE.

5.4 Contribution of the Study to Knowledge

This study addressed major gaps in the previous studies that have been conducted to analyze the effect of asset pricing risk on stock returns. The study analyzed fundamental variables which account for largest variation in expected stock returns in Kenya whose return generating process is not well established and lack reliable historical data. Unlike previous studies which were anchored on the assumption of investor rationality, the current study represented a paradigm shift and reckoned that investor irrationality may play a major role in determining the interplay between asset pricing risk premia and equity stock returns. Thus, this study adds a new dimension in asset pricing studies by investigating if changes in investor sentiment, as proxied by the bull-bear spread, would moderate the effect of APR premia on stock returns at the Kenyan equity market. In order to ensure stable regression estimators, the current study is first of its kind to adopt a robust methodology for analysis using Auto-Regressive Distributed Lag (ARDL) and Vector Error Correction (VEC) estimation models. The models allow for analysis of short-run and long-run relationship among the study variables. Results of GRS F-test for joint significance of intercepts imply that the FF5F model is suitable for explaining returns in the short-run. The study establishes that an optimal model for estimating required rate of return at the Kenyan equity market is one that incorporates premium on market, size, profitability and sentiment variables as proxies for systematic risk in the investment decisions by market players in Kenya.

5.5 Recommendations and Policy Implication

Based on the findings and conclusions of this study, the following recommendations are made:

First, the existence of a positive significant effect of market risk premium on excess stock returns implies that equity investors at the NSE will require a high rate of return on their investments as market risk increases. Consequently, equity investors should monitor movements in the overall market index as a basis for making investment decisions in order to enhance their returns. Measures should hence be taken by regulatory and economic policy formulators to reduce volatility in the market-wide risk by ensuring a stable macro-economic environment.

Secondly, the study found that higher size risk premium is estimated to lower stock returns for large stocks but raise returns for small stocks after controlling for other premia in the model. The basis for this inference is that small companies are more sensitive to many risk premia as they are comparatively undiversified in nature and have little ability to undertake adverse financial situations and hence investors will require a high rate of return on small firms. In light of these findings, it is recommended that investment practitioners should endeavor to pursue strategies for investing funds in stocks with low market valuation that can provide comparatively higher returns on average.

Thirdly, the study found positive though insignificant relationship between value risk premium and stock returns suggesting that a high value risk premium increases excess returns on NSE listed stocks. The positive loading on value risk premium when value firms are considered and negative loading when growth firms are considered further imply that value stocks earn relatively high returns than growth stocks. The non-significance of value premium at the NSE can be attributed to low investor confidence in the accounting information from which valuation risk premium is derived. It is therefore recommended that the capital market regulator should institutionalize policies to ensure that listed firms make adequate disclosure of relevant accounting information to the investors. Additionally, investors should pursue strategy of investing in high B/M stocks when the sentiment in the market is high.

Fourthly, profitability risk premium was found to have statistically significant effect on stock excess returns. Overall, the coefficient on profitability risk premium was negative implying that firms with high profitability risk have low expected returns inconsistent with valuation theory. By implication, investors should pursue profitability investment strategies to gain higher returns. Further, investors should evaluate profitable (non-profitable) firms as possessing strong (weak) fundamentals for future growth and hence bid for low (high) required rate of return.

Fifthly, the study did not find evidence to support pricing effect of ASTG risk premium at the NSE, holding constant other factors in the model. Thus, portfolio managers who follow ASTG trading strategy may not earn significant returns from their investment. The study also observed negative coefficient on ASTG, in line with valuation theory, and therefore concluded that low investment intensity is associated with high cost of capital and vice versa. This also implies that investors at NSE tend to underestimate the action by managers to increase the company’s total assets and do not consider it as an important source of systematic risk for making investment decisions in equity stocks. It is therefore recommended that measures be undertaken by market regulators to put in place mechanisms for maintaining cost of capital at manageable levels which can stimulate investment and provide higher average returns to investors.

Finally, results show that adding sentiment variable to the FF5F model improves substantially the significance of size, value and profitability risk premia. The study also revealed that IS and pricing factors in the FF5F model are independent implying that sentiment has a direct rather than moderating effect on asset pricing. The positive and significant loadings on sentiment variable imply that investors have greater potential for making positive returns when variability of the sentiment is high. It therefore follows that investors, policy makers and portfolio managers in sentiment prone markets should consider IS as an additional source of systematic risk in their asset pricing decisions. This would help to minimize the effect of market bubbles or the possibility of market crash resulting from sentiment dynamics.

The study results showed significant effect of market, size and profitability on stock returns. The relationship is further enhanced by including IS in the modelling, in which case the effect of book-to-market characteristic is also significant. This finding has practical and useful implication for investors in simplifying their stock portfolio analysis and selection. Investors can select stocks and expect to obtain return premia based on the market, size, profitability and book-to-market characteristics of firms. The information on these firm characteristics should be made available and readily accessible for investors and practitioners.

This study proposes a five-factor model comprising factors formed on the basis of premium on market, market value of equity, profitability and investor sentiment. The proposed model provides good description in variation of excess stock returns in terms of adjusted R-square, Standard Error of Regression, Akaike Information Criterion (AIC), Schwarz Criterion (SC), Root Mean Squared Error, Mean Absolute Error and Theil Inequality Coefficient and GRS F-statistic. It is therefore recommended to use the proposed model for activities such as estimating the cost of capital, stock selection strategies and evaluating the performance of portfolio managers.

This study provides literature and vital information for capital market professionals to choose the most appropriate pricing model. By selecting a model that better explains stock return variations, market professionals will have a better estimate of a firm’s capital cost for capital budgeting and portfolio performance evaluation. It may also be used to estimate expected returns, to assess the performance of mutual funds, and to analyze market efficiency.

5.6 Suggestions for Further Research

Since asset pricing field has not been extensively explored in Kenya, the current study opens alternatives to develop future research studies. Based on the limitations identified in the current study, four aspects have been identified for consideration in the future.

To begin with, most asset pricing studies assume a one year holding period for investors. It is against this assumption that test portfolios are constructed and rebalanced every after one year. There is therefore need in future to consider studies where investor holding period is extended beyond one year period to see whether value and asset growth risk premia will be priced at the Kenyan market. Further research could be conducted to re-conceptualize variable linkage differently in light of the emerging theoretical arguments and current findings. A possible conceptualization would be to assess the intervening effect of excess returns in the relationship between FF5F premia and investor sentiment, moderated by either market timing strategies or industry classification. This could further widen the scope of the current study.

The current study utilized bull-bear spread, a trend in trade indicator as a proxy for measurement of investor sentiment. Future studies can utilize direct opinion surveys from established market data bases to see if it could provide more accurate results. Another suggestion would be to enlarge the sample period, use daily data to estimate the predictor variables or investigate whether the IS augmented FF5F model is able to explain excess returns on the basis of a three-dimensional sort like size-B/M-Profitability, as similarly performed by Fama and French (2013). The reason for these modifications is to examine whether the five-factor model does also capture anomalies that are not based on a two-dimensional sort.

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APPENDICES

Appendix I: Introductory Letter

JOMO KENYATTA UNIVERSITY OF AGRICULTURE AND TECHNOLOGY
NAIROBI CBD CAMPUS
Department of Commerce and Economics Studies

P.O. Box 62000
NAIROBI - 00200
KENYA

TEL: 020-221306
Email: cesncbd@jkuat.ac.ke

Ref: JKUAT/6/2/0027

Date: 10th February, 2020

TO WHOM IT MAY CONCERN

Dear Sir/Madam,

RE: LETTER OF INTRODUCTION –NEBAT GALO MUGENDA HD433-C004-2044/14

This is to confirm that the above named is a student pursuing PhD in Business Administration (Finance) at Jomo Kenyatta University of Agriculture and Technology, NCBD Campus.

He has successfully completed his coursework and is currently working on his research titled ***"Investor Sentment Effect on the Relationship Between Fama-French Five Factor Premia and Stock Returns at the Nairobi Securities Exchange."*** as partial fulfilment of the requirements of the Programme. As such, he will contact your organization for data collection.

Any assistance accorded to him will be highly appreciated. Please do not hesitate to contact the undersigned for any further information.

Yours sincerely,

Associate Chairperson
NAIROBI CBD CAMPUS

Joshua Matanda (PhD)
Ag. Associate Chair –CES

JKUAT is ISO 9001:2015 and ISO 14001:2015 Certified
Setting Trends in Higher Education, Research, Innovation and Entrepreneurship

Appendix II: Research Permit

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY & INNOVATION

Ref No: **843544**

Date of Issue: **05/August/2020**

RESEARCH LICENSE

This is to Certify that Mr.. NEBAT GALO MUGENDA of Jomo Kenyatta University of Agriculture and Technology, has been licensed to conduct research in Nairobi on the topic: INVESTOR SENTIMENT EFFECT ON THE RELATIONSHIP BETWEEN FAMA-FRENCH FIVE FACTOR PREMIA AND STOCK RETURNS AT THE NAIROBI SECURITIES EXCHANGE for the period ending : 05/August/2021.

License No: **NACOSTI/P/20/6011**

843544

Applicant Identification Number

Director General

NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY & INNOVATION

Verification QR Code

NOTE: This is a computer generated License. To verify the authenticity of this document, Scan the QR Code using QR scanner application.

Appendix III: Firm Level Monthly data

YEAR…………………./MONTH……………….

		Adjusted Closing Price Kshs.	Stock Return %
	Eaagads Ltd		
	Kapchorua Tea Co. Ltd		
	Kakuzi		
	Limuru Tea Co. Ltd		
	Rea Vipingo Plantations Ltd		
	Sasini Ltd		
	Williamson Tea Kenya Ltd		
	Car and General (K) Ltd		
	Barclays Bank Ltd		
	Stanbic Holdings Plc.		
	I&M Holdings Ltd		
	DTB Kenya Ltd		
	HF Group Ltd		
	KCB Group Ltd		
	National Bank of Kenya Ltd		
	NIC Group PLC		
	Standard Chartered Bank Ltd		
	Equity Group Holdings		
	The Co-op. Bank of Kenya Ltd		
	BK Group PLC		
	Express Ltd		
	Sameer Africa PLC		
	Kenya Airways Ltd		
	Nation Media Group		
	Standard Group Ltd		
	TPS Eastern Africa (Serena) Ltd		
	Scangroup Ltd		
	Uchumi Supermarket Ltd		
	Carbacid Investments Ltd		
	East African Breweries Ltd		
	Mumias Sugar Co. Ltd		
	Unga Group Ltd		
	Eveready East Africa Ltd		
	Longhorn Publishers Ltd		
	Atlas Dev’t and Support Services		
	Deacons (East Africa) Plc		
	Nairobi Business Ventures Ltd		
	Athi River Mining		
	Bamburi Cement Ltd		
	Crown Paints Kenya PLC.		

	E.A. Cables Ltd		
	E.A. Portland Cement Ltd		
	KenolKobil Ltd		
	Total Kenya Ltd		
	KenGen Ltd		
	Kenya Power & Lighting Co Ltd		
	Umeme Ltd		
	Jubilee Holdings Ltd		
	Sanlam Kenya PLC		
	Kenya Re-Insurance Corp. Ltd		
	Liberty Kenya Holdings Ltd		
	Britam Holdings Ltd		
	CIC Insurance Group Ltd		
	Olympia Capital Holdings ltd		
	Centum Investment Co Ltd		
	Trans-Century Ltd		
	Home Afrika Ltd		
	Kurwitu Ventures		
	Nairobi Securities Exchange Ltd		
	B.O.C Kenya Ltd		
	BAT Kenya Ltd		
	Kenya Orchards Ltd		
	Flame Tree Group Holdings Ltd		
	Safaricom PLC		
	Stanlib Fahari I-REIT		

Source: price list and trading summary (live.mystocks.co.ke)

Appendix IV: Firm Level Annual Data

YEAR…………………

		Market Cap. (ME) Kshs.	Total Assets (TA) Kshs.	Total Liabilities (TL) Kshs.	Operating Profit	BE=TA-TL	BE/ME	Asset Growth
	Eaagads Ltd							
	Kapchorua Tea Co. Ltd							
	Kakuzi							
	Limuru Tea Co. Ltd							
	Rea Vipingo Plantations Ltd							
	Sasini Ltd							
	Williamson Tea Kenya Ltd							
	Car and General (K) Ltd							
	Barclays Bank Ltd							
	Stanbic Holdings Plc.							
	I&M Holdings Ltd							
	DTB Kenya Ltd							
	HF Group Ltd							
	KCB Group Ltd							
	National Bank of Kenya Ltd							
	NIC Group PLC							

	Standard Chartered Bank Ltd							
	Equity Group Holdings							
	The Co-op. Bank of Kenya Ltd							
	BK Group PLC							
	Express Ltd							
	Sameer Africa PLC							
	Kenya Airways Ltd							
	Nation Media Group							
	Standard Group Ltd							
	TPS Eastern Africa (Serena) Ltd							
	Scangroup Ltd							
	Uchumi Supermarket Ltd							
	Carbacid Investments Ltd							
	East African Breweries Ltd							
	Mumias Sugar Co. Ltd							
	Unga Group Ltd							
	Eveready East Africa Ltd							

	Longhorn Publishers Ltd							
	Atlas Dev’t and Support Services							
	Deacons (East Africa) Plc							
	Nairobi Business Ventures Ltd							
	Athi River Mining							
	Bamburi Cement Ltd							
	Crown Paints Kenya PLC.							
	E.A. Cables Ltd							
	E.A. Portland Cement Ltd							
	KenolKobil Ltd							
	Total Kenya Ltd							
	KenGen Ltd							
	Kenya Power & Lighting Co Ltd							
	Umeme Ltd							
	Jubilee Holdings Ltd							
	Sanlam Kenya PLC							
	Kenya Re-Insurance Corp. Ltd							

	Liberty Kenya Holdings Ltd							
	Britam Holdings Ltd							
	CIC Insurance Group Ltd							
	Olympia Capital Holdings ltd							
	Centum Investment Co Ltd							
	Trans-Century Ltd							
	Home Afrika Ltd							
	Kurwitu Ventures							
	Nairobi Securities Exchange Ltd							
	B.O.C Kenya Ltd							
	BAT Kenya Ltd							
	Kenya Orchards Ltd							
	Flame Tree Group Holdings Ltd							
	Safaricom PLC							
	Stanlib Fahari I-REIT							

BE=Book Equity **ME**=Market Value of Equity

Source: Published Financial Statements and Annual Reports, 2011-2019

Appendix V: Market Index Monthly Data

Year :……………………..

Year	Obs. No.	91-Days T-bill rate	NSE 20 Index	Return on Market Index $\ell n(I_t/I_{t-1})$
	1			
	2			
	3			
	4			
	5			
	6			
	7			
	8			
	9			
	10			
	11			
	12			

Source: Central Bank of Kenya Website https://www.centralbank.go.ke/central-bank-rates/

Appendix VI: Factor Premia Monthly Data

Year:…………………..

Obs. No.	SIZE (SMB)	VALUE (HML)	OPROF (RMW)	ASTG (CMA)	Market Risk Premium (Rm-rf)
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					

Appendix VII: Investor Sentiment Monthly Data

Year:…………………..

Obs. No.	% of stocks UP (a)	% of stocks DOWN (b)	Bull-Bear Spread (c) = (a)-(b)
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			

Source: Price List and Trading Summary; live.mystocks.co.ke

Appendix VIII: Number of Stocks in a Portfolio

	Year								
Port.	2011	2012	2013	2014	2015	2016	2017	2018	2019
RBH	6	5	9	6	7	7	12	11	6
RBL	12	14	15	21	20	17	17	18	15
RBR	18	21	21	21	23	22	26	25	18
RBW	3	2	3	4	4	4	3	3	3
RBC	9	8	13	11	10	11	13	9	8
RBA	13	12	11	15	17	15	17	19	15
RSH	11	15	16	19	17	17	14	14	14
RSL	4	6	7	6	7	9	9	8	5
RSR	2	3	4	2	4	3	3	2	2
RSW	18	21	20	20	21	23	23	25	20
RSC	13	10	11	15	18	17	17	19	15
RSA	9	6	13	11	6	14	11	8	9

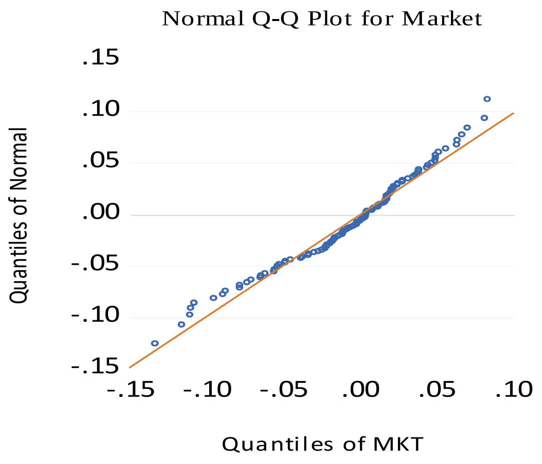
Appendix IX: Listings at the NSE-Kenya (As at 31st December 2019)

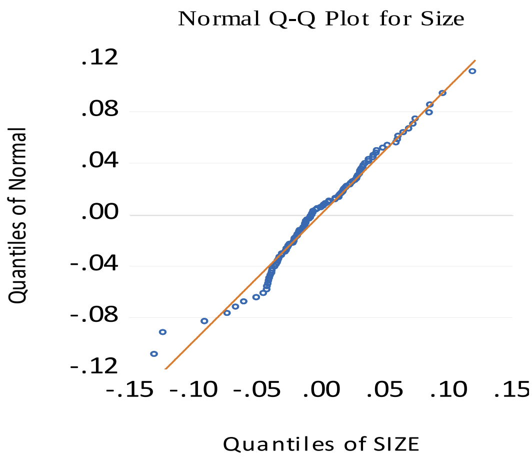
	Eaagads Ltd	33	Longhorn Publishers Ltd
	Kapchorua Tea Co. Ltd	34	Atlas Development and Support Services
	Kakuzi	35	Deacons (East Africa) Plc
	Limuru Tea Co. Ltd	36	Nairobi Business Ventures Ltd
	Rea Vipingo Plantations Ltd	37	Athi River Mining
	Sasini Ltd	38	Bamburi Cement Ltd
	Williamson Tea Kenya Ltd	39	Crown Paints Kenya PLC.
	Car and General (K) Ltd	40	E.A. Cables Ltd
	Barclays Bank Ltd	41	E.A. Portland Cement Ltd
	Stanbic Holdings Plc.	42	KenolKobil Ltd
	I&M Holdings Ltd	43	Total Kenya Ltd
	Diamond Trust Bank Kenya Ltd	44	KenGen Ltd
	HF Group Ltd	45	Kenya Power & Lighting Co Ltd
	KCB Group Ltd	46	Umeme Ltd
	National Bank of Kenya Ltd	47	Jubilee Holdings Ltd
	NIC Group PLC	48	Sanlam Kenya PLC
	Standard Chartered Bank Ltd	49	Kenya Re-Insurance Corporation Ltd
	Equity Group Holdings	50	Liberty Kenya Holdings Ltd
	The Co-operative Bank of Kenya Ltd	51	Britam Holdings Ltd
	BK Group PLC	52	CIC Insurance Group Ltd

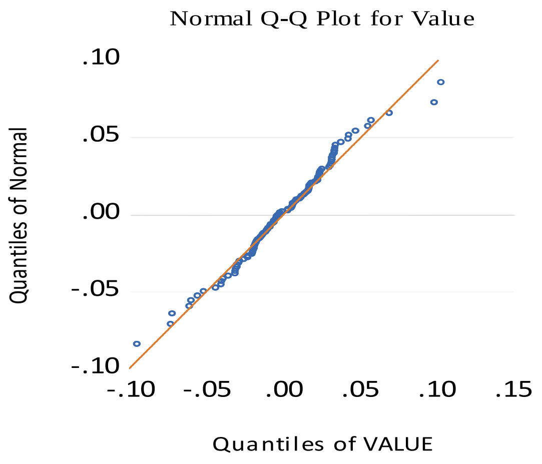
	Express Ltd	53	Olympia Capital Holdings ltd
	Sameer Africa PLC	54	Centum Investment Co Ltd
	Kenya Airways Ltd	55	Trans-Century Ltd
	Nation Media Group	56	Home Afrika Ltd
	Standard Group Ltd	57	Kurwitu Ventures
	TPS Eastern Africa (Serena) Ltd	58	Nairobi Securities Exchange Ltd
	Scangroup Ltd	59	B.O.C Kenya Ltd
	Uchumi Supermarket Ltd	60	British American Tobacco Kenya Ltd
	Carbacid Investments Ltd	61	Kenya Orchards Ltd
	East African Breweries Ltd	62	Flame Tree Group Holdings Ltd
	Mumias Sugar Co. Ltd	63	Safaricom PLC
	Unga Group Ltd	64	Stanlib Fahari I-REIT
	Eveready East Africa Ltd		

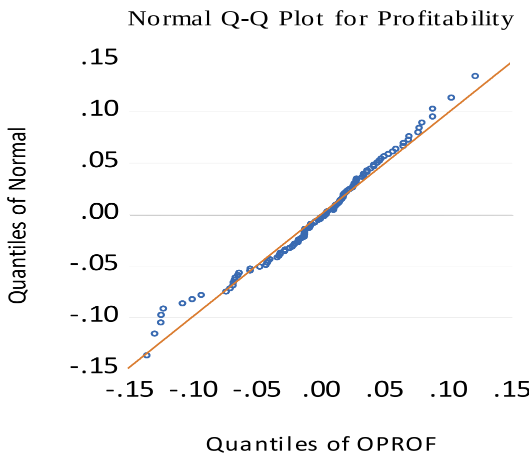
Source: CMA Annual Report, 2019

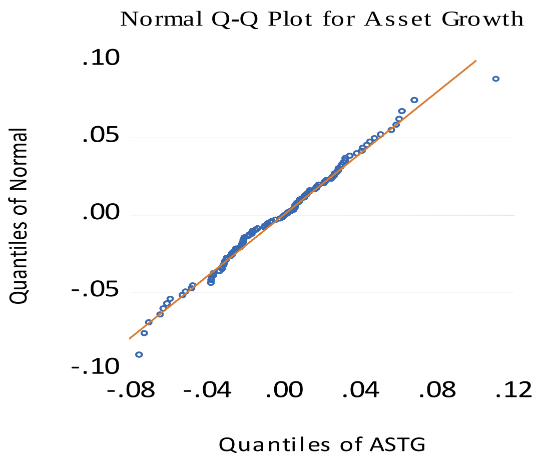
Appendix X: Q-Q Charts of Normally Distributed Residuals

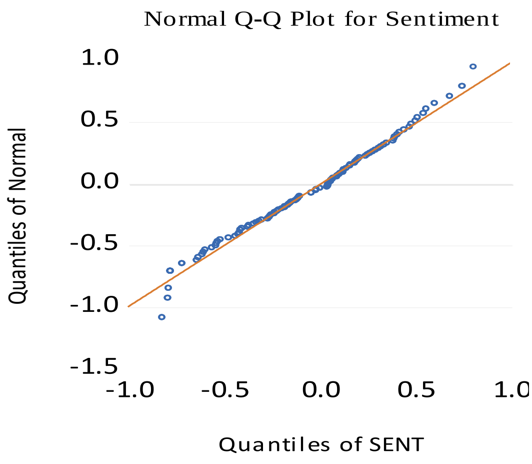


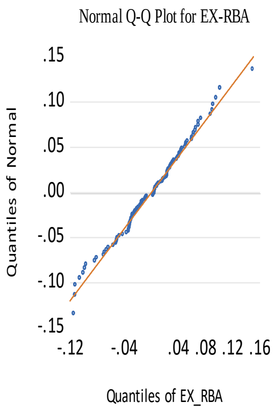


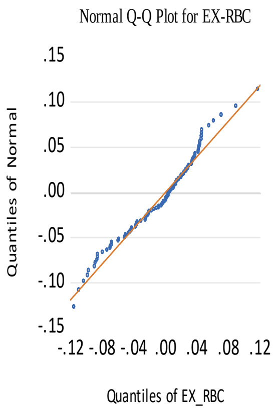


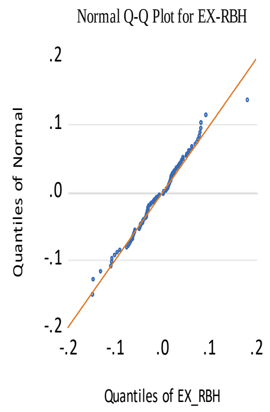


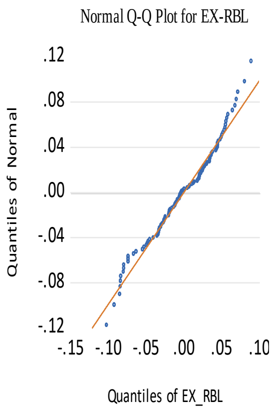


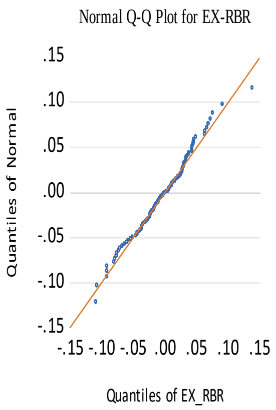


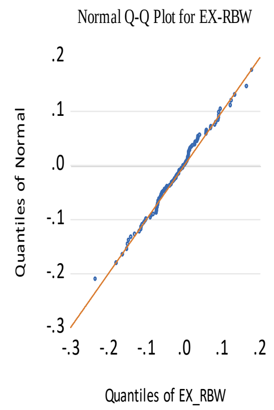

Normal Q-Q Plot for EX-RBA
Quantiles of Normal
.15 .10 .05 .00 -.05 -.10 -.15
-.12 -.04 .04 .08 .12 .16
Quantiles of EX_RBA

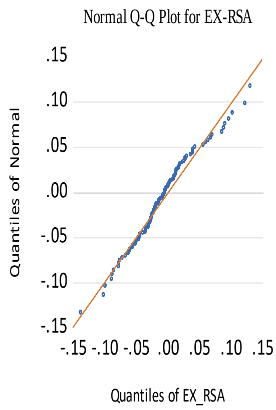

Normal Q-Q Plot for EX-RBC
Quantiles of Normal
.15 .10 .05 .00 -.05 -.10 -.15
-.12 -.08 -.04 .00 .04 .08 .12
Quantiles of EX_RBC

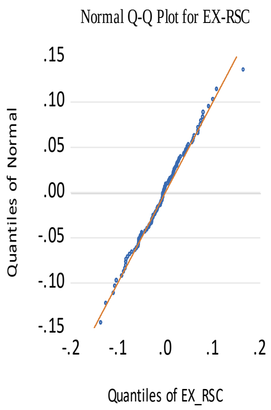

Normal Q-Q Plot for EX-RBH
Quantiles of Normal
.2 .1 .0 -.1 -.2
-.2 -.1 .0 .1 .2
Quantiles of EX_RBH

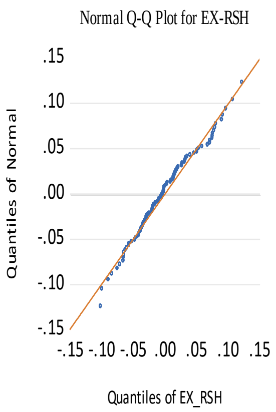

Normal Q-Q Plot for EX-RBL
Quantiles of Normal
.12 .08 .04 .00 -.04 -.08 -.12
-.15 -.10 -.05 .00 .05 .10
Quantiles of EX_RBL

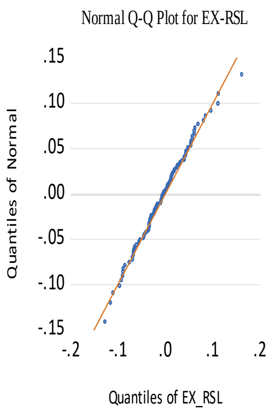

Normal Q-Q Plot for EX-RBR
Quantiles of Normal
.15 .10 .05 .00 -.05 -.10 -.15
-.15 -.10 -.05 .00 .05 .10 .15
Quantiles of EX_RBR

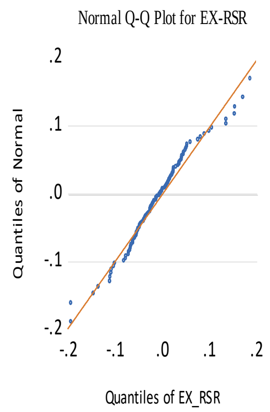

Normal Q-Q Plot for EX-RBW
Quantiles of Normal
.2 .1 .0 -.1 -.2 -.3
-.3 -.2 -.1 .0 .1 .2
Quantiles of EX_RBW

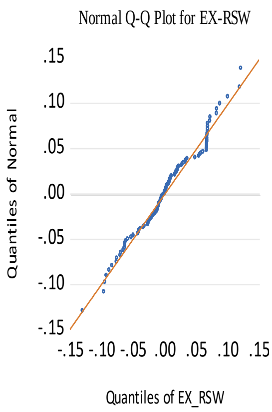

Normal Q-Q Plot for EX-RSA
Quantiles of Normal
.15 .10 .05 .00 -.05 -.10 -.15
-.15 -.10 -.05 .00 .05 .10 .15
Quantiles of EX_RSA

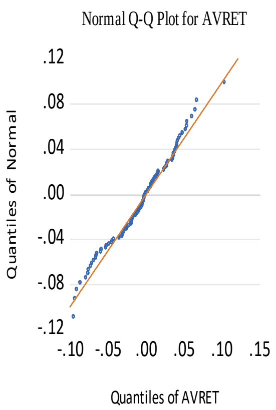

Normal Q-Q Plot for EX-RSC
Quantiles of Normal
.15 .10 .05 .00 -.05 -.10 -.15
-.2 -.1 .0 .1 .2
Quantiles of EX_RSC


Normal Q-Q Plot for EX-RSH
Quantiles of Normal
.15 .10 .05 .00 -.05 -.10 -.15
-.15 -.10 -.05 .00 .05 .10 .15
Quantiles of EX_RSH

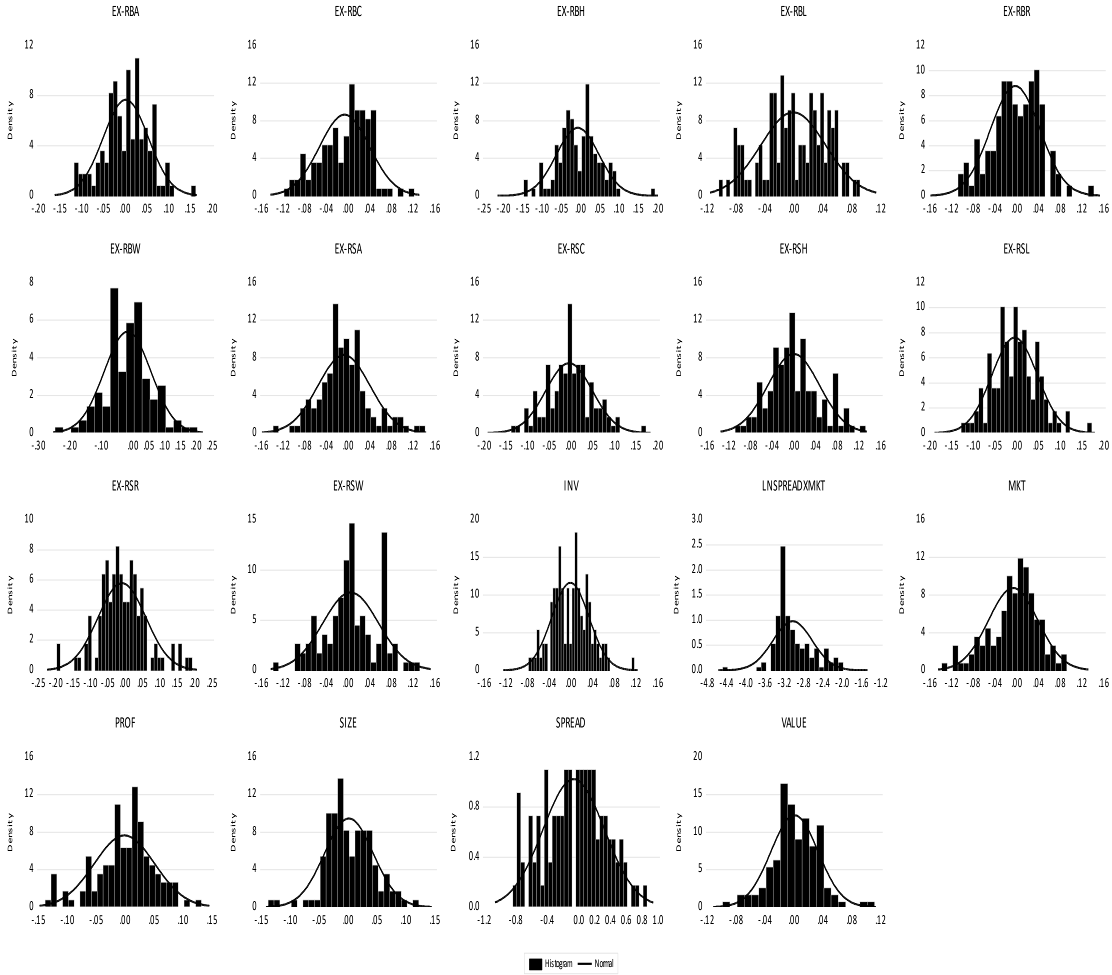

Normal Q-Q Plot for EX-RSL
Quantiles of Normal
.15 .10 .05 .00 -.05 -.10 -.15
-.2 -.1 .0 .1 .2
Quantiles of EX_RSL


Normal Q-Q Plot for EX-RSR
Quantiles of Normal
.2 .1 .0 -.1 -.2
-.2 -.1 .0 .1 .2
Quantiles of EX_RSR


Normal Q-Q Plot for EX-RSW
Quantiles of Normal
.15 .10 .05 .00 -.05 -.10 -.15
-.15 -.10 -.05 .00 .05 .10 .15
Quantiles of EX_RSW


Normal Q-Q Plot for AVRET
Quantiles of Normal
.12 .08 .04 .00 -.04 -.08 -.12
-.10 -.05 .00 .05 .10 .15
Quantiles of AVRET

Appendix XI: Normal Histogram Chart



Appendix XII: Predictor Variables Data

	VALUE	OPROF	ASTG	MKT	SIZE	SENT
2011	0.01215	-0.01644	-0.02647	0.00507	0.01913	0.39130
	-0.07221	0.00047	-0.03747	-0.05384	0.01844	-0.53488
	-0.02272	-0.02351	0.05943	-0.08914	-0.01639	-0.78261
	-0.00445	-0.01151	-0.03619	0.02789	-0.03296	0.20000
	0.05773	0.02624	0.02152	0.01575	0.02991	-0.47826
	-0.01918	-0.06334	-0.01404	-0.02945	-0.01098	-0.44186
	0.00657	0.03461	0.03510	-0.06174	0.02349	-0.78261
	0.02127	0.00082	0.00267	-0.07810	-0.00602	-0.79167
	0.02399	-0.03329	0.00881	-0.05578	0.05996	-0.54545
	0.00629	-0.03082	-0.02960	0.06362	0.01502	0.31818
	-0.02547	-0.00706	-0.02059	-0.10789	0.02896	-0.78261
	-0.00496	-0.02771	0.02556	0.01338	-0.04424	0.15556
2012	-0.01635	0.03728	0.01322	0.00375	0.03840	0.04348
	-0.05569	0.04665	-0.07228	0.02234	0.01606	0.19149
	-0.05169	-0.12460	0.05694	0.01676	-0.03959	0.08696
	0.03447	0.07819	-0.02221	0.04984	0.03365	0.74468
	0.01362	0.08876	0.00595	0.01786	0.06119	0.38776
	-0.02017	-0.01190	0.01423	0.02111	-0.02120	0.25000
	-0.03575	-0.01209	0.03272	0.03184	-0.02374	0.15556
	-0.03898	0.02078	0.02589	0.00877	-0.00602	-0.13043
	-0.00577	-0.00314	0.00874	0.02453	-0.01289	0.20833
	-0.01959	0.01827	0.02912	0.03873	-0.02963	0.27660
	0.00881	-0.02717	0.03879	-0.01781	-0.01858	-0.16667
	0.04285	-0.01659	0.02197	0.00973	-0.00514	0.10638
2013	-0.01362	0.01093	-0.01601	0.06405	-0.03877	0.54167
	-0.01817	0.01964	-0.00560	0.02053	-0.00713	0.51020
	0.04317	0.10337	-0.04695	0.07071	-0.00198	0.80392
	0.03159	0.05376	0.00132	-0.02210	0.08657	0.33333
	-0.00202	0.01252	0.00004	0.04719	-0.01306	0.68000
	-0.01247	-0.01154	-0.01752	-0.08746	0.02108	-0.79592
	-0.02825	0.01409	0.00636	0.03808	-0.01155	0.41667
	-0.01102	0.01083	0.04138	-0.02123	0.03553	-0.18367
	0.01539	0.04251	0.00635	0.01782	-0.01005	0.24000
	-0.01745	0.03337	0.01677	0.03852	0.05309	0.60000
	0.09887	0.07719	0.00578	0.01911	-0.00750	0.44000
	0.01685	-0.00092	-0.00640	-0.03698	0.03119	-0.26531
2014	0.03201	0.01226	-0.03016	0.00458	0.11980	0.18519
	0.02473	-0.04688	-0.01807	-0.00787	-0.03442	0.30769
	-0.00328	0.02913	0.01890	0.00024	-0.02706	-0.21569
	-0.09531	-0.07039	-0.02127	-0.00162	0.03257	0.13725
	0.00343	0.02736	0.04182	-0.01610	0.09646	0.05455
	-0.04030	0.06557	0.02714	-0.00159	0.01723	-0.11538
	-0.01451	0.01526	-0.04774	0.00202	0.02571	-0.01887

	-0.01058	0.05041	-0.02930	0.04413	-0.06589	0.03704
	-0.07323	-0.12957	-0.03044	0.02000	0.07510	0.38182
	0.05559	-0.03186	-0.03158	-0.01400	0.04481	-0.23636
	-0.02297	0.01749	0.03099	-0.00993	0.02024	-0.18519
	0.06973	0.01874	-0.06995	-0.01110	-0.07249	-0.25926
2015	-0.00205	-0.06776	0.06882	0.01683	0.02919	-0.02128
	0.04761	-0.00804	0.04566	0.04982	0.00249	0.28889
	-0.00415	0.03978	-0.01557	-0.04830	-0.01969	-0.52174
	-0.01311	0.00434	-0.00375	-0.03300	-0.01196	-0.33333
	0.02556	0.02580	0.01241	-0.06423	0.04961	-0.61702
	0.00765	0.01861	0.05136	0.02220	0.00689	0.09091
	0.02301	-0.02047	0.06086	-0.11010	0.06159	-0.72093
	0.01086	0.01123	0.02840	-0.05547	-0.02640	-0.63636
	-0.00845	0.03709	-0.00926	-0.00300	-0.01169	-0.31707
	0.03791	0.02200	0.00731	-0.07807	-0.01745	-0.82609
	-0.01686	0.00516	0.00260	0.03509	-0.03527	0.06977
	-0.04385	0.00546	-0.06240	0.00381	0.03836	0.10000
2016	-0.01004	0.05984	-0.03724	-0.07078	0.04154	0.12500
	-0.00959	0.06969	-0.00815	0.02110	-0.04148	-0.02128
	0.03032	0.04261	-0.01310	0.02833	-0.03791	-0.04545
	0.02390	0.01635	-0.02653	0.00456	-0.04017	-0.42857
	-0.06004	-0.02161	-0.06403	-0.04855	0.01811	-0.40909
	0.02410	0.00336	0.11152	-0.05238	-0.13004	-0.56522
	-0.04009	-0.01222	0.00416	-0.04495	0.01236	-0.12195
	0.01738	-0.10002	0.04402	-0.09523	-0.03741	-0.42222
	0.01635	-0.03128	-0.05082	0.01783	-0.01575	0.04545
	0.03182	-0.13557	-0.00149	-0.00656	-0.12312	0.18182
	0.02297	0.08038	-0.03600	0.00328	0.06997	-0.04545
	-0.00051	-0.10767	0.00666	-0.02123	-0.02003	-0.23810
2017	-0.00829	0.04816	0.00985	-0.13353	0.07333	-0.72093
	-0.02892	-0.05476	-0.03744	0.06692	-0.09055	0.26087
	-0.01779	0.02839	-0.00774	0.03636	-0.03167	0.34783
	0.01735	-0.06609	0.04810	0.01213	-0.01613	0.00000
	0.00653	0.06581	-0.01619	0.08362	-0.04987	0.47826
	0.01802	0.02360	-0.02154	0.04494	0.03148	0.40426
	0.03098	-0.01451	0.01157	0.04940	-0.02607	0.55556
	0.03370	0.05740	0.01136	0.05648	-0.03218	0.50000
	-0.03003	0.03468	-0.07501	-0.07331	-0.03722	-0.60870
	0.01876	-0.04125	0.01802	-0.00827	-0.00514	-0.11111
	-0.03125	-0.12452	-0.02024	0.01786	-0.01093	0.46939
	0.00606	-0.12261	0.03273	-0.02669	-0.04167	-0.30435
2018	0.03419	0.12203	-0.06052	0.00437	-0.02018	-0.20000
	0.00854	-0.00728	-0.05245	0.00111	0.03162	0.12195
	0.00535	0.08866	-0.03314	0.02516	-0.03316	0.04167
	0.01415	0.00607	0.03041	-0.03347	-0.00300	-0.41667
	-0.01868	0.07012	-0.05875	-0.11609	0.01208	-0.64444

	0.03256	-0.06418	-0.01994	-0.01675	-0.05955	-0.37778
	-0.01879	-0.04039	0.02281	0.00820	0.00067	-0.04545
	-0.00590	-0.07343	0.02681	-0.03818	-0.02470	-0.41667
	0.10327	0.02851	-0.03157	-0.11068	-0.02984	-0.54167
	-0.01499	-0.01962	0.02919	-0.02226	0.00747	-0.15556
	-0.00787	0.04495	0.00783	-0.01088	0.01512	-0.27273
	0.01205	0.02675	-0.00947	-0.00167	-0.01789	-0.16279
2019	0.03365	-0.01682	-0.02054	0.05174	0.00314	0.16000
	-0.03113	-0.00405	-0.02476	-0.02463	0.04436	-0.37255
	-0.00398	-0.06679	-0.03082	-0.01924	-0.02499	-0.22449
	0.00336	-0.04218	-0.02082	-0.01268	0.00460	-0.34615
	-0.00659	-0.01216	0.03179	-0.05342	0.08582	-0.25490
	-0.06098	-0.09300	0.06231	-0.01865	0.04210	0.12000
	0.03208	-0.00766	-0.02544	-0.00433	0.03437	0.05882
	-0.02991	0.01584	0.00043	-0.06474	0.06543	-0.60000
	0.01716	-0.05438	0.01400	-0.01619	0.02778	-0.10638
	-0.03067	-0.06796	0.01778	0.08193	-0.04049	0.04000
	0.01944	0.01174	0.02747	0.01080	0.03443	0.14894
	0.02261	-0.03897	-0.02446	0.01219	-0.00824	0.06383

Appendix XIII: Interacting terms Data

SENT	(SENT*SIZE)	(SENT*VALUE)	(SENT*OPROF)	(SENT*ASTG)
0.4591	0.0083	0.0053	-0.0068	-0.0115
-0.4670	-0.0081	0.0340	-0.0010	0.0168
-0.7148	0.0124	0.0166	0.0156	-0.0435
0.2678	-0.0091	-0.0013	-0.0026	-0.0093
-0.4104	-0.0119	-0.0235	-0.0115	-0.0094
-0.3740	0.0045	0.0074	0.0231	0.0047
-0.7148	-0.0161	-0.0043	-0.0259	-0.0261
-0.7238	0.0051	-0.0150	-0.0018	-0.0030
-0.4776	-0.0282	-0.0112	0.0151	-0.0049
0.3860	0.0054	0.0022	-0.0113	-0.0109
-0.7148	-0.0200	0.0186	0.0039	0.0137
0.2234	-0.0101	-0.0012	-0.0058	0.0060
0.1113	0.0042	-0.0019	0.0043	0.0016
0.2593	0.0039	-0.0146	0.0125	-0.0184
0.1548	-0.0063	-0.0081	-0.0190	0.0090
0.8125	0.0265	0.0276	0.0649	-0.0168
0.4556	0.0274	0.0060	0.0412	0.0034
0.3178	-0.0071	-0.0066	-0.0033	0.0050
0.2234	-0.0055	-0.0081	-0.0023	0.0076
-0.0626	0.0004	0.0025	-0.0014	-0.0017
0.2762	-0.0038	-0.0017	-0.0004	0.0028
0.3444	-0.0106	-0.0069	0.0069	0.0105
-0.0988	0.0019	-0.0008	0.0025	-0.0040
0.1742	-0.0011	0.0074	-0.0026	0.0041
0.6095	-0.0242	-0.0086	0.0077	-0.0089
0.5780	-0.0047	-0.0108	0.0123	-0.0024
0.8718	-0.0026	0.0372	0.0916	-0.0396
0.4012	0.0343	0.0125	0.0222	0.0011
0.7478	-0.0105	-0.0019	0.0106	0.0011
-0.7281	-0.0146	0.0095	0.0072	0.0117
0.4845	-0.0061	-0.0139	0.0076	0.0038
-0.1158	-0.0040	0.0013	-0.0014	-0.0050
0.3078	-0.0034	0.0046	0.0136	0.0024
0.6678	0.0348	-0.0120	0.0234	0.0122
0.5078	-0.0043	0.0499	0.0400	0.0037
-0.1975	-0.0060	-0.0032	-0.0001	0.0010
0.2530	0.0301	0.0080	0.0035	-0.0073
0.3755	-0.0133	0.0091	-0.0170	-0.0062
-0.1479	0.0041	0.0006	-0.0046	-0.0030
0.2051	0.0065	-0.0197	-0.0141	-0.0041
0.1224	0.0117	0.0004	0.0036	0.0053
-0.0475	-0.0008	0.0019	-0.0032	-0.0014
0.0490	0.0012	-0.0007	0.0008	-0.0023
0.1049	-0.0070	-0.0012	0.0055	-0.0029
0.4497	0.0333	-0.0332	-0.0575	-0.0130
-0.1685	-0.0074	-0.0093	0.0051	0.0051
-0.1173	-0.0023	0.0028	-0.0022	-0.0038
-0.1914	0.0141	-0.0132	-0.0039	0.0131
0.0466	0.0013	-0.0001	-0.0031	0.0033
0.3567	0.0005	0.0168	-0.0023	0.0168
-0.4539	0.0094	0.0021	-0.0188	0.0064
-0.2655	0.0034	0.0036	-0.0016	0.0006
-0.5492	-0.0267	-0.0137	-0.0151	-0.0076
0.1587	0.0009	0.0011	0.0032	0.0084

-0.6531	-0.0396	-0.0147	0.0123	-0.0407
-0.5685	0.0156	-0.0059	-0.0073	-0.0170
-0.2492	0.0032	0.0022	-0.0097	0.0019
-0.7583	0.0140	-0.0283	-0.0179	-0.0067
0.1376	-0.0050	-0.0024	0.0009	0.0006
0.1678	0.0063	-0.0075	0.0012	-0.0102
0.1928	0.0078	-0.0020	0.0119	-0.0069
0.0466	-0.0020	-0.0005	0.0033	-0.0003
0.0224	-0.0009	0.0007	0.0010	-0.0003
-0.3607	0.0149	-0.0084	-0.0065	0.0090
-0.3413	-0.0058	0.0207	0.0068	0.0213
-0.4974	0.0652	-0.0117	-0.0025	-0.0562
-0.0541	-0.0006	0.0022	0.0006	-0.0003
-0.3544	0.0136	-0.0060	0.0349	-0.0161
0.1133	-0.0019	0.0018	-0.0034	-0.0056
0.2497	-0.0310	0.0078	-0.0334	0.0000
0.0224	0.0015	0.0005	0.0018	-0.0008
-0.1703	0.0036	0.0002	0.0180	-0.0014
-0.6531	-0.0472	0.0058	-0.0325	-0.0074
0.3287	-0.0301	-0.0097	-0.0175	-0.0118
0.4157	-0.0136	-0.0076	0.0125	-0.0026
0.0678	-0.0012	0.0011	-0.0044	0.0034
0.5461	-0.0278	0.0033	0.0369	-0.0080
0.4721	0.0144	0.0083	0.0119	-0.0095
0.6234	-0.0169	0.0190	-0.0080	0.0081
0.5678	-0.0188	0.0188	0.0335	0.0073
-0.5409	0.0207	0.0165	-0.0197	0.0398
-0.0433	0.0003	-0.0008	0.0017	-0.0008
0.5372	-0.0064	-0.0171	-0.0660	-0.0101
-0.2365	0.0101	-0.0013	0.0286	-0.0081
-0.1322	0.0028	-0.0044	-0.0163	0.0078
0.1898	0.0058	0.0015	-0.0011	-0.0097
0.1095	-0.0037	0.0005	0.0099	-0.0035
-0.3488	0.0014	-0.0047	-0.0027	-0.0111
-0.5766	-0.0064	0.0111	-0.0414	0.0330
-0.3099	0.0188	-0.0099	0.0194	0.0057
0.0224	0.0000	-0.0004	-0.0009	0.0005
-0.3488	0.0090	0.0022	0.0250	-0.0099
-0.4738	0.0146	-0.0487	-0.0143	0.0143
-0.0877	-0.0006	0.0014	0.0016	-0.0027
-0.2049	-0.0029	0.0017	-0.0096	-0.0019
-0.0950	0.0018	-0.0011	-0.0027	0.0008
0.2278	0.0005	0.0075	-0.0035	-0.0043
-0.3047	-0.0132	0.0097	0.0007	0.0071
-0.1567	0.0041	0.0007	0.0102	0.0046
-0.2783	-0.0010	-0.0008	0.0113	0.0054
-0.1871	-0.0159	0.0013	0.0020	-0.0062
0.1878	0.0077	-0.0116	-0.0172	0.0120
0.1267	0.0042	0.0040	-0.0008	-0.0030
-0.5322	-0.0343	0.0162	-0.0093	-0.0010
-0.0385	-0.0010	-0.0006	0.0020	-0.0006
0.1078	-0.0045	-0.0034	-0.0071	0.0021
-0.0811	-0.0019	0.0016	0.0008	0.0021
0.1317	-0.0012	0.0029	-0.0049	-0.0030

Appendix XIV: Dependent Variables Data

RBA	RSA	RBC	RSC	RBH	RSH	RBL	RSL	RBR	RSR	RBW	RSW
						% RETURN					
6.0145	3.9778	-0.3321	5.0307	2.5740	7.8127	3.0967	4.8603	3.3731	0.5641	1.6341	5.5910
-3.0286	1.8276	-3.5864	-5.1094	-4.6232	-4.7312	-0.7643	5.8518	-2.4002	-5.2518	-5.9100	-1.8367
-6.3515	-5.9720	-8.5377	-10.2424	-6.9335	-10.1379	-7.3108	-5.2170	-7.9138	-7.7640	-1.7131	-9.2622
4.4552	1.7168	2.5556	-2.4626	-1.7470	2.0385	4.5478	-3.3655	2.8583	1.4892	7.1645	-0.5142
-3.1882	-4.9809	-8.5463	-1.8959	-2.2077	0.4120	-7.9343	-5.4068	-5.9787	-1.3394	-6.5303	-3.2274
-2.7918	1.8805	0.4274	-4.1462	-4.4829	-1.4251	-1.8563	-0.2163	-2.2578	-11.1330	0.8924	-1.6155
-10.6090	-6.6875	-4.6131	-5.6633	-8.9255	-5.2499	-6.5804	-8.9095	-7.6301	-2.8778	-11.2756	-6.1541
-9.8535	-8.6014	-8.8239	-9.0972	-7.4355	-9.9420	-10.1765	-11.4554	-9.1657	-10.2833	-9.9634	-9.6494
-6.9009	-1.9893	-8.6065	1.4782	-5.7128	-0.3000	-8.4393	-2.3712	-8.0126	-5.8656	-7.2853	0.0647
4.5623	8.5809	3.8403	3.3820	3.9193	9.2362	5.6547	6.2432	3.8420	-2.3164	0.9923	6.6970
-11.2644	-5.1379	-9.6633	-10.8573	-14.7317	-7.1006	-8.3597	-8.3786	-10.7610	-7.0771	-8.7864	-7.6404
1.4589	-3.5991	3.5067	-0.5348	2.9990	-1.5005	2.0853	0.4052	2.1111	-2.4941	5.9091	-0.7502
-1.6767	0.2644	-0.7737	2.0055	-5.8625	3.3006	1.3475	-0.6402	0.2732	1.2345	-8.0653	2.1162
5.0196	9.0708	0.0445	-0.4092	-4.8429	2.1362	7.2356	1.1965	3.0995	7.6088	0.3949	0.9833
0.9836	-7.7947	4.3509	0.2269	-6.5161	1.0313	3.4978	1.3557	-1.0189	-14.6309	5.9578	3.3133
6.2705	10.2908	4.4419	7.6765	8.1075	7.5686	4.5560	4.2265	6.3857	15.3442	0.6245	5.4672
2.5292	1.3527	-1.9811	7.0520	0.9438	6.8444	1.4258	3.6392	2.1011	13.5655	-5.6824	3.5972
2.8673	-2.5116	2.3797	0.8228	1.3108	-0.0759	3.1605	2.1084	2.5769	-4.7483	-1.8859	2.0937
2.1071	-4.4428	2.0588	2.1495	3.0986	-1.8284	2.8749	5.5446	2.4188	-4.2574	-0.2836	0.8630
0.8283	-3.4823	2.9301	-0.4052	1.9528	-0.8553	1.8473	7.0464	1.4612	-0.2914	-3.1913	0.2048
2.4051	-2.4359	1.5062	0.2115	-3.2444	1.8101	2.7969	-3.0774	1.2068	-3.0775	-2.3741	1.1324
3.3652	-2.0062	4.2474	2.9366	0.3623	0.1430	5.2780	-0.8554	4.3626	-1.7556	-1.2102	0.1637
-3.2131	-1.2839	2.3791	0.8809	-3.3219	-1.8790	-0.3662	-6.5958	-1.4394	-4.7818	1.3303	-2.1176
-4.9943	1.9335	1.4669	-0.1347	9.3630	-1.0196	-2.9341	2.7074	0.0230	-0.5944	2.9001	-0.1541
10.1894	1.3847	4.2824	4.0894	3.6938	3.1579	8.1314	1.4449	7.2977	1.7772	4.2059	2.6837
3.2211	2.3391	3.4188	1.0207	1.4454	2.7975	5.4258	2.4517	3.5343	4.5932	2.3162	1.8832
15.0210	0.6794	11.7949	6.9830	18.1551	10.8201	8.9900	11.3521	13.9313	17.1416	1.5698	8.8295
-1.8938	6.8454	-0.7553	5.9701	0.9463	7.6524	-1.8266	4.1067	-0.7746	10.5872	-6.7071	5.7682
5.1592	4.0027	6.1844	2.9856	1.6560	5.0968	6.8834	0.2737	4.4375	4.8950	3.7977	3.0303
-5.0691	-4.4889	-7.9115	-5.1501	-6.0338	-6.5509	-7.8631	-2.2268	-7.1415	-10.7843	-11.7230	-3.8944
5.1716	2.9873	4.6454	4.7862	2.5454	1.9353	7.0391	3.0908	4.9429	5.0383	3.7937	3.3702
-2.4740	-1.3974	-1.3618	5.7673	-2.9335	-0.9099	-0.9217	-0.7187	-2.0997	3.6176	-2.9085	2.2603
0.4534	0.2043	2.6950	-0.7679	2.0260	1.6179	2.1041	-1.5390	2.7462	-0.0172	-5.1356	-0.6376
2.4883	6.3999	4.6852	7.5567	2.7582	7.9478	4.4206	9.7753	3.3030	13.5952	2.9935	7.2306
6.0285	1.0006	3.7307	4.4535	6.3485	9.7151	2.6330	-6.3431	4.3525	18.7045	8.2782	-0.6587

-2.4882	-0.2575	-3.7256	-0.2999	-4.4825	1.6310	-3.1384	-3.0828	-4.0161	2.2003	-1.1524	-0.4801
2.2916	9.6873	-5.0451	10.9919	-1.1556	12.2531	-1.7216	6.4164	-0.2772	8.1824	-6.4952	11.9487
6.3068	1.2784	1.3975	2.5745	3.3586	3.3882	4.6405	-2.8406	2.8092	4.1544	13.5161	2.8231
0.5652	-5.5637	0.4281	-1.6456	0.8373	-2.8913	0.5307	-1.9291	1.1512	-5.1506	-7.1411	-2.6847
7.3845	5.6412	0.6181	8.1543	4.5099	3.2404	4.5263	8.6429	2.6079	0.7447	9.1537	8.2768
-3.2186	3.9823	-0.1742	9.3015	-2.7573	7.1500	-1.8536	5.5601	-0.8788	4.5404	-10.1350	8.3253
0.8314	-4.9533	-0.4617	1.7671	0.4001	-3.1358	-0.5410	5.8652	1.7103	5.2354	-6.8321	0.6640
2.3839	7.0759	-0.1533	0.0648	-4.6299	5.1832	2.1532	1.3013	0.7602	1.0155	-1.2869	0.0109
6.5271	-1.7698	0.7005	-4.8668	8.2584	-6.4300	3.8751	0.0684	6.4092	-1.0613	-3.6648	-3.3668
4.2008	4.3321	2.0961	16.6517	-1.6365	7.6131	4.3260	16.2966	3.0596	-1.9294	-2.0260	12.1171
-1.6028	12.2696	-3.6453	-2.5334	1.8362	5.9604	-2.9874	-0.3349	-2.2335	-2.1378	-5.4636	-0.4331
-2.7698	-2.2444	1.7643	1.8553	-2.9896	-1.6964	-0.2151	6.2131	-0.8303	0.0696	-2.6672	0.2365
0.2751	-1.8117	-3.0483	-12.4776	-0.6130	-5.6608	-2.4247	1.6208	-1.8584	-2.5793	1.3255	-9.5117
3.1519	-3.1049	3.6136	10.1973	4.1120	9.0688	2.3039	11.2868	1.6536	4.1010	9.2530	10.0544
4.4237	-2.1368	3.3652	8.0533	7.4718	8.1519	3.5065	2.5944	4.6484	2.1434	1.1486	7.2517
-5.6239	-3.4504	-3.4800	-8.7077	-3.9423	-8.3888	-4.6365	-6.8641	-3.3165	-5.6694	-8.6033	-8.3380
-4.2249	-2.9531	-2.3903	-5.5369	-3.0975	-6.2406	-3.4563	-3.2596	-2.6690	-7.6893	-6.9451	-4.2804
-7.0433	-7.6545	-8.9372	-3.2786	-5.9710	-0.0823	-7.8761	-3.2889	-5.7852	-4.8522	-14.5537	-1.2437
0.4881	-2.2196	3.8552	4.6862	5.6759	0.9262	-0.4751	5.5472	1.1932	5.9818	1.7503	1.7022
-11.2860	-7.2136	-6.9150	0.5880	-12.9962	0.4514	-8.3216	-8.8245	-9.1640	-6.8239	-10.9939	-0.9002
-5.1256	-13.7739	-4.9956	-8.2249	-3.5872	-5.6380	-5.4034	-5.9942	-4.5252	-6.6519	-7.1138	-6.3095
1.0811	-1.9544	-0.2874	-2.4381	1.9214	-2.9299	-0.4544	1.1364	1.0116	-1.2847	-5.7119	-1.9801
-6.6286	-9.9391	-6.9422	-8.1640	-5.7604	-6.5864	-7.3092	-12.6202	-6.7254	-4.5495	-6.8486	-8.8269
2.3864	1.3700	4.3005	-0.0248	1.4979	-0.4688	4.9126	-0.5124	4.3659	-0.6197	3.0770	-0.3634
-0.7766	-7.7304	3.4840	-0.2049	-3.1019	1.2897	2.5092	4.4494	0.9003	3.4302	1.3536	1.8855
-8.0816	-2.5139	-9.8134	-8.2293	-10.8330	-6.0322	-7.3316	-7.5266	-7.5895	-3.6321	-16.2009	-6.9890
0.5278	-2.6181	1.7525	-5.4719	1.9418	-4.5958	2.1704	-2.9061	3.4340	2.3081	-3.2086	-4.9875
2.7769	-2.7806	0.1516	-2.7749	2.2491	-0.1458	2.5934	-6.5532	3.0340	0.8877	-2.0114	-2.5880
-2.7601	-2.7958	-2.4487	-8.4125	4.2026	-7.4944	-6.2698	-1.8029	-0.5484	-2.5214	1.2809	-7.6199
5.3855	-2.9991	-2.0182	-1.5394	-3.3706	-3.9186	5.5607	-0.8426	-3.6167	-3.6963	-1.5319	-1.4587
-3.3171	-8.8579	-5.0750	-3.7455	-6.6705	-2.4896	-4.7714	-9.2081	-5.0930	-3.9308	-3.3213	-6.3738
-3.6501	-0.8393	-1.6962	-1.9614	-3.2248	-4.0725	-2.5314	3.2513	-2.3505	-7.1378	-5.8831	-1.1610
-8.3547	-10.1926	-4.2376	-5.5058	-6.2147	-4.2995	-4.4263	-9.5632	-7.2717	-19.3749	-6.7403	-5.3289
1.8250	2.7644	-2.2543	-3.3210	-1.4810	-0.6574	-1.0001	-4.4085	0.5402	-10.8681	-4.3722	0.3004
9.1662	-2.6180	7.1477	-0.8984	7.0764	-0.1441	5.0554	-4.4872	6.7282	-19.3771	9.7371	1.6477
-2.0911	2.5843	-6.7375	0.0305	-4.1119	1.4514	-3.9747	-3.2804	-3.7855	5.3062	-14.8729	0.3174
-3.1315	-1.1558	-2.4638	-0.4909	-0.8030	-0.5875	-0.5192	-0.7691	-2.3106	-6.1996	12.5315	0.4914

-11.4818	-6.2674	-10.9210	-4.8583	-14.6212	-1.9167	-8.2789	-6.6010	-10.8990	-3.8705	-17.8542	-6.5474
9.0642	1.2917	5.6124	-2.7438	8.3138	-3.6521	5.9364	4.5083	6.9311	-5.5230	12.3577	0.0031
4.0426	-0.6029	2.7093	-0.8183	3.5327	-2.1098	3.5847	1.3959	3.3981	1.9012	0.5604	-0.9386
-0.9288	-2.5969	2.0737	4.0214	2.2294	1.3596	-0.8055	0.9250	-0.5300	-3.5283	8.4892	0.6696
9.6104	0.0558	4.4423	1.9855	7.9417	1.7536	6.5181	1.8717	9.1874	2.4334	-0.6101	-0.9314
2.8180	8.8735	3.0320	4.3513	4.4290	7.1860	3.5371	4.4733	4.5445	0.0419	-6.2282	6.0940
6.9775	-0.8455	1.3914	7.0552	5.2884	2.6960	5.1359	-3.3473	4.6055	-1.3146	1.3398	4.8533
3.7752	0.4725	4.6196	1.9000	7.7017	1.3804	5.6212	-3.2788	7.6347	3.8989	-0.7383	0.7918
8.8083	-4.5493	-4.4435	-6.3002	-9.4724	-3.4658	-2.7848	-4.1475	-4.3346	-10.0888	-15.0286	-6.3309
-1.2411	-0.4242	0.8172	1.1216	0.3025	-0.2378	-1.9184	-1.7684	-1.3650	1.1952	7.2288	0.8518
2.3818	13.0610	9.0288	2.3653	1.5882	2.7213	2.3465	8.2138	3.0609	8.9455	18.0178	6.7253
-3.1844	-3.4210	1.1377	-1.1973	-2.8004	-2.8610	-3.3318	-3.5419	-3.6214	-6.7037	16.6386	-2.4416
1.7092	2.7863	0.2631	-7.8705	1.7175	-2.8562	0.7756	-8.7532	1.8059	15.4459	-1.2830	-5.8714
0.4602	6.0438	-3.5706	-0.4148	-2.9589	5.3785	0.8594	-0.1488	-0.1318	-6.2312	-6.9548	2.0471
4.1866	-2.2992	-1.0469	-3.6938	0.3708	-2.0028	3.7185	-6.4202	3.8702	3.6351	-6.1057	-4.1204
-2.3667	-8.8946	-4.2800	-0.8989	-2.9476	-1.8372	-3.2471	-4.3686	-2.6346	-3.3087	-4.5948	-2.5630
-5.1859	-3.9345	-10.2821	-10.5887	-10.6339	-8.9395	-4.8894	-10.9487	-5.3822	-11.0558	-23.4020	-7.0603
-1.4160	-0.4424	1.0910	-6.9372	1.2523	-3.4943	-1.9197	-6.8345	-1.0245	-6.5863	9.3380	-4.1128
-0.8915	-1.5065	0.4673	1.6973	-1.7672	-0.4394	-0.0371	1.5882	-1.4841	-2.0609	3.5598	0.9728
-2.9199	-4.4128	0.1365	-2.1075	-0.5433	-3.8039	-2.6091	-0.5583	-3.4823	-6.2307	6.0485	-1.0754
-10.0642	-3.0521	-5.9049	-13.5250	-7.1183	-6.4269	-9.1566	-5.1963	-9.1546	2.9081	1.1072	-13.0554
-4.6876	-1.4314	1.1645	-1.4447	-2.4378	-1.1110	-2.5597	2.0098	-2.0547	-5.4223	-2.4313	-1.1222
-2.1039	0.2986	0.1494	-0.3878	-3.1440	-2.6363	-0.2875	-3.9197	-1.6654	9.9319	0.2697	-0.9938
1.6736	-5.5124	-4.1901	-1.5421	1.8693	-3.0944	-1.5029	-2.1313	0.6899	-8.1083	-10.4815	-2.2873
6.6374	3.6579	0.8169	6.1158	6.3821	4.6591	3.7246	0.5864	2.8161	4.2005	3.6692	6.7119
-3.3258	-0.4934	-7.3357	-5.4626	-4.0478	-3.7990	-2.3873	0.7659	-2.9237	-2.4465	-11.2951	6.7354
2.9848	-0.5392	-2.0820	-5.9720	1.4478	-3.3379	1.1360	-2.2309	-0.2154	-13.5915	-7.1976	6.7489
0.6236	-1.8032	-2.4225	-7.4404	-2.3349	-3.3635	-3.2136	-3.1574	-3.0437	2.4830	1.1125	6.7630
-9.6483	-0.7694	-5.8307	6.2690	-6.2141	0.2944	-5.2041	0.6032	-3.5394	-5.0937	-12.9750	6.7748
-1.4140	1.0223	1.2452	2.6740	-10.0523	1.5098	-1.2807	4.9346	-4.3271	-5.4401	2.0508	6.7822
-0.6762	0.9579	-2.1453	-0.5098	-1.1521	3.5848	-1.0949	-2.8892	-1.1892	1.4256	-5.0132	6.7820
-2.9449	-6.0735	-11.5286	-3.1176	-10.6774	-4.0545	-3.2663	-5.4835	-6.3811	2.4273	-13.9418	6.8191
-1.4259	-0.2194	0.4272	3.0922	-3.3079	4.0268	-1.1003	-1.6125	-1.5807	-2.6086	-0.1571	6.8444
6.9960	-0.2295	4.7045	2.6041	5.7202	-1.9682	5.7714	4.1154	2.8795	-0.2905	9.3181	6.8620
3.9157	0.0408	-6.7379	-2.8208	-4.0234	-0.0404	1.9777	-2.1526	-1.6889	1.6318	-4.5769	6.8673
0.2648	1.1365	2.9450	-2.6758	5.2041	-0.0439	0.1166	0.5212	0.6472	-1.7045	-0.1316	6.8679