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Effect of Equity Risk Factors on the Return of Stock Portfolios of Companies Listed at the Nairobi Securities Exchange in Kenya Between 2009 and 2014

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Abstract
Investors and investment advisors strive to make the best investment decisions when forming a stock portfolio. However, at the Nairobi securities exchange in Kenya, most investors are not optimizing the return of their stock portfolios because they do not consider relevant factors when investing in stocks. In particular, they do not consider equity risk factors when forming stock portfolios. In the United States of America, Dimensional fund advisors have shown that if active investors tilt their stock portfolio towards equity risk factors such as value risk and size risk, the return of the stock portfolio formed is better than that of the market portfolio. Capital asset pricing model has been the generally accepted model for explaining the relationship between risk and stock portfolio return variations. However, the restrictive assumption of employing the market risk as the only source of risk in capital asset pricing model led to the introduction of multiple factors models that attempt to identify other sources of risks that are disregarded by the capital asset pricing model. Available empirical evidence suggest that much of the variation in stock returns related to size risk, value risk, momentum risk, profitability risk and investment risk is left unexplained by Capital asset pricing model. This motivated the researcher to examine a model that adds the five risk factors to capital asset pricing model. As a result, a six factors model was developed and used to determine the ability of the combined six equity risk factors in explaining the variation of stock returns at the Nairobi securities exchange in Kenya. The general objective of this study was to establish the effect of equity risk factors on the return of stock portfolios of companies listed at the Nairobi securities exchange in Kenya between 2009 and 2014. The study adopted the explanatory research design and the target population was 45 companies that were listed at the Nairobi securities exchange by January 2009 (after excluding companies that were not trading consistently and those that were delisted). A census of 45 companies was used to construct stock portfolios between 2009 and 2014. Data was analyzed using a modified Fama and French (1996) multivariate time series regression methodology. The study found out that market risk, size risk, value risk and investment risk have a significant effect while profitability risk and momentum risk have a weak positive effect on the return of stock portfolios at the Nairobi securities exchange. This study recommends a framework for enhancing factor investing strategies, introducing exchange traded funds index and reviewing policies on price determination of listed stocks. The study availed to investors, investment advisors and academia the equity risks that are worth considering when constructing a stock portfolio at the Nairobi securities exchange for optimal stock returns.
Keywords: Stock Portfolio, Equity risk factors, Stock Portfolio Return, Nairobi Securities Exchange in Kenya.

1. Introduction

Rational investors are interested in finding out why return of a given stock portfolio differs from that of another stock portfolio (Riro & Wambugu, 2015). Capital asset pricing model (CAPM) by Sharpe (1964) has been the generally accepted model for explaining why the return of a stock portfolio varies from one stock portfolio to another stock portfolio. It predicts a positive linear relationship between market risk and stock returns (Fama & French, 1993). As such, CAPM is based on the assumption that stock return variation is only explained by the market risk (Carhart, 1997) and no other factor should have the power in explaining stock return variations.

However, Fama and French (1992) test on CAPM using United States of America (US) stock market data found out that market risk alone could not fully explain the stock return variations. Further, Hebner (2014) study using US stock market data found out that CAPM explained about 70% of stock return variations while Riro and Wambugu (2015) study using Kenyan stock market data found out that market risk explained about 51% of stock return variations. This means that the explanatory power of CAPM differs from one stock market to another (Aroni, 2011) and changes in stock return should be of interest to investors since it can be used to determine appropriate stock investment strategies to be adopted.

The outcome of Fama and French (1992) test on CAPM led to search for other factors that could improve the explanatory power of CAPM. In 1993, Fama and French developed a three factor model for describing the relationship between US stocks return and risk factors. They found out that exposure to market risk, size risk and value risk explain much of the sources of risk that account for stock portfolio return variations. Hebner (2014) did a follow up empirical test on the Fama and French three factors model and found out that the

explanatory power of the three factors model on the US stock return was about 93%. Another study by Riro and Wambugu (2015) using Kenyan stock market data found out that Fama and French three factors model explained about 62% of stock return variations. Clearly, incorporation of size risk and value risk into CAPM boasted the explanatory power on stock return variations. This shows that Fama-French (1993) three factor model is an improvement of CAPM but it still leaves some unexplained stock return variations.

Available independent empirical studies suggest that much of the variation in stock returns related to size risk (Hunstad, 2015), value risk (Ameer, 2013), momentum risk (Jegadeesh & Titman, 1993), profitability risk (Novy-Max, 2010) and investment risk (Aharoni, Grundy & Zeng, 2013) is left unexplained by Capital asset pricing model. Thus, developing an elaborate asset pricing model by incorporating other significant equity risk factors apart from market risk remains a grey area in finance (Goyal, 2011). This motivated the researcher to examine a model that adds the five risk factors to Capital asset pricing model. As a result, a six factors model was developed and used to determine the ability of the combined six equity risk factors in explaining the variation of stock returns at the Nairobi Securities Exchange in Kenya.

Investors and investment advisors strive to make the best investment decisions when forming a stock portfolio (NSE, 2011). However, at the Nairobi Securities Exchange in Kenya, most investors are not optimizing the return of their stock portfolios because they do not consider relevant factors when investing in stocks (CMA, 2010). In particular, they do not consider equity risk factors when forming stock portfolios (Hebner, 2014). In the United States of America, Dimensional fund advisors have shown that if active investors tilt their stock portfolio towards equity risk factors such as value risk and size risk, the return of the stock portfolio formed is better than that of the market portfolio (Carison, 2013). This is due to the fact that in the long run small cap stocks generate higher stock returns than large Cap stocks and value stocks generate higher returns than growth stocks (Fama & French, 1993).

While many studies on equity risk factors and portfolio construction have been done elsewhere, in Kenya only a few known to the researcher have been done and documented. For example Kamanda (2001) study on the equity portfolios held by Kenyan insurance companies concluded that majority of insurance companies' maintained poorly diversified portfolios. Muiruri (2014) study on the effect of systematic risk on stock return found out that market risk and stock return had a strong negative autocorrelation. He concluded that apart from market risk, stock return could be a function of many other risk factors. However, he failed to identify the other risk factors. Riro and Wambugu (2015) study on asset pricing model tests concluded that Fama and French three factors model performs better than capital asset pricing model but did not capture other relevant equity risk factors influencing the return of a stock portfolio formed at NSE. The study also failed to capture other relevant equity risk factors responsible for the variation in stock return.

The indentified contextual gaps motivated the researcher to develop a six factors model for establishing the ability of market risk, size risk, value risk, momentum risk, profitability risk and investment risk in explaining the variation of the return of a stock portfolio at NSE. The general objective of this study was to establish the effect of equity risk factors on the return of stock portfolios of companies listed at the Nairobi securities exchange in Kenya between 2009 and 2014.

This study is structured as follows: Chapter one provides the background of the study, statement of the problem and the general research objective. Chapter two presents relevant theoretical reviews, empirical reviews and the conceptual framework. Chapter three provides details on the research design, target population, empirical modeling and data analysis while Chapter four covers data analysis results, presentations and discussions. Finally, Chapter five provides a summary of findings, conclusion, recommendations and suggested areas of future studies.

2. Literature Review

Theory of Investment behavior

Jorgenson (1963) theory of investment behavior was presented in his publication on capital theory and investment behavior. According to this theory, demand for a stock is motivated by the investors' desire to maximize their net worth. To test the theory of investment behavior, Jorgenson (1963) fitted a stochastic equation using quarterly data from US manufacturing companies between 1948 and 1960. The test concluded that the level of investment in stocks is determined by past changes in the price of the desired stock, the value of replacing the stock, the long term response of the stock price to the underlying market conditions, tax structure and future changes in the demand of the stock.

In their contribution to investment theory, Jegadeesh and Titman (1993) study on momentum stock trading strategies using US stock markets data noted that purchasing stocks of past winners and selling stock of past losers realized significant positive returns over a holding period of between 3 and 12 months. They attributed the realized positive return to delayed stock price reactions to firm specific information. However, Sharpe, Alexander and Baily (2006) attributed momentum effect to a market anomaly where stocks which outperform peer during the last 12 months tend to perform well also in future. Pure momentum portfolios are

created using stocks with the strongest momentum and selling stocks with the lowest momentum (stambaugh, Yu & Yuan, 2012).

Theory of Investment behavior therefore, enables investors to understand how market conditions, profitability, momentum and investment amount influence investment decisions. The theory of investment behavior was important in this study since it helped the researcher in explaining the effects of market, profitability, momentum and investment risks on the return of a stock portfolio at NSE.

Efficient Market Hypothesis Theory

Fama (1970) formulated the efficient market hypothesis and it states that it is impossible to beat the market since market efficiency causes the existing stock prices to always incorporate and reflect all the available information (Beechey, Gruen and Vickery, 2000). This means that Stocks will always trade at their fundamental or fair values, making it impossible for investors to sell them at inflated prices or purchase stocks that are undervalued (Fama, 1970). It is therefore not possible to outperform the market portfolio through technical analysis, fundamental analysis or market timing (Beechey, Gruen and Vickery, 2000). The only way an investor can obtain higher returns is by investing in riskier investments (Malkiel, 2003). Thus, there is a linear positive relationship between stock return and risk.

Njuguna (2015) study investigated the stock market efficiency of the Nairobi securities exchange in Kenya. He used the NSE 20 share index data from 2000 to 2015. After analyzing the data using run test and serial correlation test, he concluded that Nairobi securities exchange in Kenya is efficient in a weak form. He also noted a substantial improvement in the efficiency of the Nairobi securities exchange between 2000 and 2015. This suggests that the advancement in technology that was witnessed at the Nairobi securities exchange between 2000 and 2015 may have contributed to the increase in its efficiency.

Malkiel (2003) observed that EMH has been challenged by economists who stress that psychological and behavioral factors influence the determination of stock prices and by econometricians who argue that stock returns are predictable. Bergen (2011) also noted that there are many stock investors who have consistently beaten the stock market. For example warren buffet is considered as one of the greatest stock market investor of all times because he has beaten the stock market for many years. The net worth of warren buffet was $ 62 billion as of 2008.

EMH theory was important in this study since it aided in explaining the relationship between the return of a stock portfolio and portfolio risk. It was also helpful in explaining how EMH anomalies (such as size effect and value effect) at NSE could be exploited to earn superior returns.

Modern Portfolio Theory

Modern portfolio theory was proposed by Markowitz (1952) in his publication on portfolio selection. It is a theory in finance that explains how to maximize portfolio expected return for a given amount of portfolio risk or minimize risk for a given level of expected return, by carefully choosing the proportions of various assets constituting a portfolio. According to Markowitz (1952), a portfolio exhibits risk and return characteristics based on its composition and the way those components correlate with each other. For each level of risk, there is an optimal asset allocation that is designed to produce the best balance of risk versus return. An optimal portfolio will provide either the highest returns or the lowest risk of all possible portfolio combinations. It will attempt to balance the lowest risk for a given level of return and the greatest return for an acceptable level of risk. The meeting point of each level of risk and return was considered by Markowitz as the point where an optimal portfolio resides.

Fabozzi and Markowitz (2002) publication on the legacy of modern portfolio theory (MPT) postulated that portfolio theory helps investors to find a balance between maximizing portfolio return and minimizing portfolio risk. They further observed that portfolio theory provides a powerful tool to complement actively managed portfolios and it also assumes that investors expect a higher return for a higher level of risk. This implies that there is a positive linear relationship between expected return and risk (Manning & Napier, 2012). Once an advisor establishes investor's level of risk, he can construct a portfolio that maximizes expected portfolio return for a given level of risk (Manning & Napier, 2012). The theory was used to identify the equity risk factors components and to provide a linkage between risk diversification and the selection of stocks.

Capital Asset Pricing Model

Capital asset pricing model (CAPM) was developed by Sharpe (1964) using the foundation that was laid by Markowitz (1952) in his modern portfolio theory (Kisaka, Mbithi & Kitur, 2015). It was the first model to quantify a trade-off between stock return and risk and it is based on the assumption that market risk is the only explanatory variable in the variation of stock return (Fama & French, 2012). According to Campbell (2000), CAPM has been the generally accepted pricing theory that links stock return and risk. However, empirical studies such as Fama and French (1993), Novy-Marx (2010), Riro and Wambugu (2015) among others, have shown that the source of risk introduced by CAPM does not fully explain the stock return variations.

Therefore, other risk factors need to be identified and incorporated in a more comprehensive asset pricing model. CAPM was important in this study since it provided a link between market risk and stock return.

It also helped in measuring market risk and explaining the proportion in the variation of stock return that is explained by the variation in market risk.

Fama- French Three Factor Model

In 1993, Fama and French did a study on common risk factors in the returns on stocks and bonds using data from US stock market. Their study proposed a three factor model which is an improvement of the CAPM. The model's expected return of asset j is computed as follows:

$$R_{jt} - R_{ft} = \alpha_i + \beta_{jm}(Rmt - Rft) + \beta_{js}SMB_t + \beta_{jh}HML_t + \ell_{it}$$

where R_{jt} is the return of asset j for month t, R_{ft} is the risk free rate , R_{mt} is return of the market, SMBt=small minus big and is the difference between the returns on a diversified portfolios of small stocks and big stocks, HMLt= High minus low and is the difference between the returns on a diversified portfolios of high book to market (value) stocks and low book to market (growth) stocks and the betas are the slopes in the multiple regression measure of exposure of asset j to each of these sources of risk and ℓ_{it} is the idiosyncratic term . After analyzing their data using multivariate time series regression analysis, Fama and French (1993) found out that market risk, size risk and value risk are significant determinants of stock portfolio return. The results of the analysis also show that Fama and French (1993) three factors model has a better explanatory power than CAPM (Fama & French, 2012).

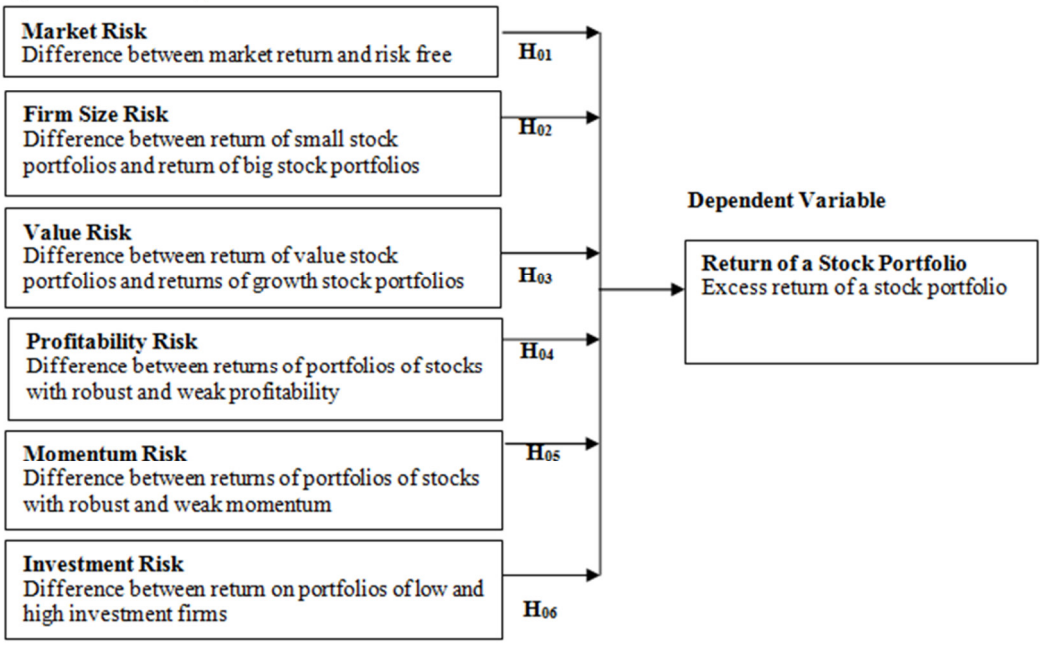
Later, Eraslan (2013) carried out a study to test the validity of the Fama and French three factor model using data from the Istanbul stock exchange. He constructed nine portfolios using size and book-to- market ratio of firms in order to explain variations in excess portfolio returns using market risk, size risk and book- to- market ratio risk factor. He found out that size factor had no effect on portfolios with big-size firms but could explain excess return variations of portfolios with small and medium sized firms. He also found out that Book to market ratio has an effect on portfolios with high book to market ratio firms. He concluded by observing that the three factor model has a power to explain variations on excess portfolio returns but this power fluctuated throughout the test period.

These studies have demonstrated that the three factors model has a better explanatory power than CAPM. However, the model still leaves some unexplained stock return variations. This study adopted the three factors together with other three risk factors to form a six factor model. The proposed model was expected to have a better explanatory power on stock return than the three factors model. Fama and French three factor model is important in this study since it provides some of the primary equity risk factors (market risk, size risk and value risk) that drive stock return and also provides a strategy for using equity risk factors in the construction of stock portfolios for a potentially higher expected long term stock return.

Conceptual Framework

A conceptual framework refers to a group of concepts that are broadly defined and systematically organized to provide a focus, a rationale, and a tool for the integration, presentation and interpretation of information (Cooper & Schindler, 2006). The conceptual framework depicted in figure 2.1 below shows the relationship between equity risk factors (Market risk, Size risk, Value risk, Profitability risk, Momentum risk and Investment risk) and return of a stock portfolio. Equity risk factors are the independent variables while the return of a stock portfolio is the dependent variable.

Figure 2.1: Conceptual framework



Author (2017)

3. Research Methodology

This study adopted the explanatory research design. The design is preferred in situations where a researcher in carrying a causal effect investigation (Cooper& Schindler, 2006) such as ‘’establishing the effect of equity risk factors on the return of stock portfolios of companies listed at the Nairobi securities exchange in Kenya’’. The target population was 45 companies that were listed at the Nairobi securities exchange by January 2009 (after excluding companies that were not trading consistently and those that were delisted). A census of 45 companies was used to construct stock portfolios between 2009 and 2014. Desk review research was used to collect secondary data from the Nairobi Securities Exchange data Bank and Central bank of Kenya (CBK) data bank. Secondary data on listed companies, listed companies’ monthly closing stock prices, number of shares traded, market capitalization, Book value, market value, Treasury bills rate and NSE20-share index values were extracted from the NSE and CBK data banks for six years (2009-2014). NSE 20-share index return was used as the proxy for market return while Kenya’ 91-day Treasury bill rate was used as the proxy for the risk free rate. The data collected was then used to measure stock returns and equity risk proxies for stock portfolios at NSE between 2009 and 2014.

Using a modified Fama and French (1996) procedure twenty four portfolios of stocks were constructed as follows: Six size and Value portfolios were constructed based on the intersection of the two market capitalization and three Book/market ratio sorts, Six size and momentum portfolios based on the intersection of the two market capitalization and three last 12 months average return sorts, Six size and profitability portfolios based on the intersection of the two market capitalization and three Gross profit ratio sorts, Six size and Investment portfolios based on the intersection of the two market capitalization and three growth in total assets sorts. This is presented in appendix I.

The study adopted a modified Fama and French (1996) multivariate time series regression methodology which involved running time series regressions to obtain the estimates of the risk factor loadings. Excess returns (R_{it}-R_{ft}) of the 24 portfolios constructed were regressed against the six equity risk factors and the coefficients of the risk factors estimated. The multivariate time series regression model was specified as follows:

$$R_{it} - R_{ft} = \alpha_i + \beta_{1i} MTR_t + \beta_{2i} SR_t + \beta_{3i} VR_t + \beta_{4i} PR_t + \beta_{5i} MR_t + \beta_{6i} IR_t + \ell_{i,t}$$

$Where: R_{it} = \text{Re}turn\ on\ stock\ portfolio\ i\ at\ time\ t, R_{ft} = Risk\ free\ rate\ at\ time\ t,$
$R_{it} - R_{ft} = Excess\ \text{Re}turn\ on\ stock\ portfolio\ i\ at\ time\ t, \alpha_i = Intercept, \beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6$
$= Coefficien\ ts\ of\ risk\ factors, MTR_t = Market\ Risk\ at\ time\ t, SR_t = Firm\ size\ Risk\ at\ time\ t,$
$VR_t = Value\ Risk\ at\ time\ t, PR_t = \text{Pr}ofitabilit\ y\ Risk\ at\ time\ t, MR_t = Momentum\ Risk\ at\ time\ t,$
$IR_t = Investment\ Risk\ at\ time\ t, \ell_{i,t} = The\ error\ terms, i = 1,...,24 = Number\ of\ portfolios,$
$t = 1,...,72 = Time\ period\ in\ months$

4. Results and Discussions

The Focus of this study was to establish the effect of equity risk factors on the return of stock portfolios of companies listed at the Nairobi securities exchange in Kenya. A modified Fama-French (1996) multivariate time series methodology was employed to test the null hypothesis that equity risk factors have no significant effect on the return of stock portfolios at NSE.

Diagnostic Tests

Diagnostic tests were done to assess the validity of the regression models and also to provide guidance for further stages of the regression analysis. Multi-collinearity tests, Autocorrelation tests, Heteroscedasticity tests and stationarity tests were done. The outputs of the diagnostic tests are presented in appendix II. Results of the correlation analysis between pairs of the independent variables indicated that the correlation coefficients were between -0.7 and +0.7. This implies that there is no multi-collinearity among the equity risk factors used in the model. Thus, the six equity risk factors can be used in the same model without causing problems of multi-collinearity (Cooper & Schindler, 2006). Autocorrelation test shows that there was no autocorrelation since the values of the Durbin Watson d-statistics for all the 24 portfolio models incorporating the six equity risk factors lies between 1 and 3. This means that the error terms of 72 months were not correlated. The efficiency of the estimators was therefore not affected and the standard errors were not distorted. Hence, the test-statistics computed and the conclusions made were reliable (Gujarati, 2003).

Breusch pagan test for heteroscedasticity shows that majority of the P-values are greater than 0.05 indicating constant variance of the error terms. This implies that the estimated coefficients of the 24 regression models are fairly unbiased. Finally Phillips Perron (1988) unit root test suggests that we reject the null hypothesis of a unit root in the variables since all the critical values at 1%, 5%, and 10% levels of significance are greater than the test statistics for all the variables. We therefore conclude that the time series of the variables was generated by a stationary process. Results of the diagnostic tests gave the researcher an assurance that the outputs of the 24 regression models were not spurious, t-ratios computed were not distorted and the significance tests done were valid.

Equity Risk Factors and Excess Return of a stock Portfolio

Using secondary stock data from NSE and CBK (between 2009 and 2014) and the help of Microsoft excel the researcher computed the returns of all the 45 stocks and then constructed 24 stock portfolios using the equity risk factors. Thereafter the returns of the 24 stock portfolios were computed as well as the equity risk values. The results of the relationship between equity risk factors and excess return of stock portfolios were then presented after adopting the Fama-French (1996) multivariate time series regressions. The statistical significance on the nature of the relationship between stocks portfolio return and equity risk factors was established after analyzing the modal values of the statistics in the summary of conclusions on the 24 stocks portfolio regression models. The results are presented in appendix III.

Hypotheses Tests

This study tested the statistical significance of the six risk factors used in the model at 5% level of significance. The t-values of the coefficients of the factors were used to test the following null hypotheses:

H_{01}: Market risk has no significant effect on the return of stock portfolios at NSE

After testing the null hypothesis, it was observed that all the absolute t-values of the coefficients of market risk for the six factors model were greater than the table critical t-statistic value of 1.96. These results lead the researcher to a conclusion that market risk is statistically significant in the proposed six factors model. The implication of this conclusion is that market risk has a significant effect on the return of stock portfolios at the Nairobi securities exchange. Further, the coefficients of market risk in the six factors model had a positive sign. This implies that there is a significant positive relationship between market risk and the return of stock portfolios at the Nairobi securities exchange. The higher the exposure of a stock portfolio to market risks, the higher the return of the stock portfolio. This means that the return of a stock portfolio moves in the same direction with that of the market portfolio.

These findings concur with those of other researchers. For example, Sharpe (1964) study found out that there is a strong linear relationship between market risk and the stock return of firms listed in the United States

of America stock markets while Heshmat (2012) study found a weak positive linear relationship between Saudi Arabian stock returns and market risk. In Kenya, Riro and Wambugu (2015) tests of asset pricing models found out that market risk was a significant predictor of stock return but does not fully explain the return of a stock portfolio formed at Nairobi securities exchange. The concurrence of the findings in different stock markets can be attributed to the fact that return of a stock portfolio moves in the same direction with that of the market portfolio.

H_{02}: Size risk has no significant effect on the return of stock portfolios at NSE

After testing the null hypothesis, it was observed that eighteen (18) of the size risk absolute t-values were greater than the table critical t-statistic value of 1.96. Only six (6) of the size risk absolute t-values were less than the table critical t-statistic value of 1.96. Thus, majority of the value risks were statistically significant. This implies that size risk is a statistically significant predictor of stock returns. Therefore, size risk has a significant effect on the return of a stocks portfolio at the Nairobi securities exchange. Further, majority (13) of the coefficients of size risk are negative. This is an indication that there is a significant inverse relationship between size risk and the return of a stocks portfolio at the Nairobi securities exchange. The higher the exposure of a stock portfolio to small size stocks, the higher the return of the stock portfolio.

These findings concur with those of other researchers. For example Banz (1981) study discovered that small size firms have higher returns than large size firms at the New-York stock exchange. In Kenya, Riro and Wambugu (2015) tests of asset pricing models found out that value risk was a significant predictor of stock return at Nairobi securities exchange. The concurrence of the findings in different stock markets can be attributed to the fact that small size companies are inherently riskier than large size companies and investors in small cap stocks demand a corresponding higher rate of return.

H_{03}: Value risk has no significant effect on the return of stock portfolios at NSE

Results of the null hypothesis test show that seventeen (17) of the value risk absolute t-values were greater than the table critical t-statistic value of 1.96. Only seven (7) of the value risk absolute t-values were less than the table critical t-statistic value of 1.96. This implies that value risk is a statistically significant predictor of stock returns. This lead the researcher to a conclusion that value risk has a significant effect on the return of a stocks portfolio at the Nairobi securities exchange. Further, majority (13) of the coefficients of value risk were positive. This is an indication that there is a significant positive relationship between value risk and the return of a stocks portfolio at the Nairobi securities exchange.

The results are in concurrence with Fama and French (1993) study on cross-section of expected stock returns using US stock data which found out that there is a positive relationship between value risk and the return of a stock portfolio. Further, Ameer (2013) study concluded that value risk is a significant determinant of Pakistan stock return and that value risk is international in character. The concurrence in the studies could be attributed to the fact that firms with high book value to market value ratio are perceived to be more risky and investors are compensated with higher returns.

H04: Profitability risk has no significant effect on the return of stock portfolios at NSE

A close analysis of the coefficients of profitability risk shows that majority (13) of them had a positive sign. This is an indication that there is a positive relationship between profitability risk and stock return at the Nairobi securities exchange. It was also observed that six (6) of the profitability risk absolute t-values were greater than the table critical t-statistic value of 1.96. On the other hand, eighteen (18) of the profitability risk absolute t-values were less than the table critical t-statistic value of 1.96. This implies that profitability risk has an insignificant positive effect on the return of a stocks portfolio at the Nairobi securities exchange. Since some of the profitability risk values were statistically significant, we can conclude that profitability risk has a weak positive effect on the return of stock portfolios at the Nairobi securities exchange.

Some of the studies that have found a strong and statistically significant relationship between profitability risk and stock return include Novy-Marx (2013) study which found out that profitability has a significant power of predicting stock returns of companies listed in the United States of America stock markets while Kisser (2014) empirical study concluded that an investment strategy based on sorting stocks on gross profitability generates substantial excess stock returns. Concurrence of a positive profitability effect in different stock exchanges is attributed to the fact that profitability shocks are positively correlated with stock return.

H_{05}: Momentum risk has no significant effect on the return of stock portfolios at NSE

An analysis of the coefficients of momentum risk shows that majority (16) of them had a positive sign. This is an indication that there is a positive relationship between momentum risk and stock return at the Nairobi securities exchange. After testing the null hypothesis, it was observed that four (4) of the momentum risk absolute t-values were greater than the table critical t-statistic value of 1.96. On the other hand, twenty (20) of the momentum risk absolute t-values were less than the table critical t-statistic value of 1.96. This implies that momentum risk has an insignificant positive effect on the return of a stocks portfolio at the Nairobi securities exchange. However, since some of momentum risk values were statistically significant, we can conclude that momentum risk has a weak positive effect on the return of stock portfolios at the Nairobi securities exchange.

Other similar studies done in other countries include Barberis, Shleifer and Vishny (1998) study which attributed momentum profits in the US stocks markets to inherent biases in the way investors interpret information while Pan (2010) study argued that profitability of momentum strategies for US stocks is attributed to the fact that short-term stock returns are positively correlated over short lags of time. In Kenya, Riro and Wambugu (2015) study observed that momentum risk and stock returns were positively related. The concurrence in the positive relationship between momentum risk and stock returns in different stock markets could be attributed to investors under reaction to stock market information.

H06: Investment risk has no significant effect on the return of stock portfolios at NSE

An analysis of the coefficients of investment risk shows that majority (16) of them had a negative sign. This is an indication that there is a negative relationship between investment risk and stock return at the Nairobi securities exchange. After testing the null hypothesis, it was observed that ten (10) of the investment risk absolute t-values were greater than the table critical t-statistic value of 1.96. On the other hand, fourteen (14) of the investment risk absolute t-values were less than the table critical t-statistic value of 1.96. This implies that investment risk has a significant negative effect on the return of a stocks portfolio at the Nairobi securities exchange.

These results are in concurrence with those of Cooper, Gulen and schill (2008) study that concluded that US firms with low investment in the current period measured by asset growth tend to have higher returns in the next period than firms with higher asset growth while Titman and Xie (2004) found out that financing choices for US firms that are associated with increase in capital investments results in negative stock returns. The concurrence in the negative relationship between investment risk and stock returns is attributed to the fact that asset growth has a forecasting power on stock returns.

5. Summary of findings, Conclusion and recommendations

The relationship between stock returns and risk factors in developed stock exchanges has been thoroughly documented in finance and investment literature. However, there is limited research on this topic in developing stock markets (Chawana, 2011).Establishing the effect of pre-specified equity risk factors on the return of stock portfolios at the Nairobi securities exchange in Kenya is a move towards contributing literature on the relationship between equity risk factors and return of stock portfolios in developing stock exchange markets. This study hypothesized that there is no relationship between equity risk factors and the return of stock portfolios at the Nairobi securities exchange. From the Fama-French (1996) methodology, the null hypothesis was rejected and it was concluded that equity risk factors have an effect on the return of stock portfolios at the Nairobi securities exchange.

Summary of Findings

Market Risk and Return of Stock Portfolios at NSE

Market risk has a significant positive effect on the return of stock portfolios at the Nairobi securities exchange. This type of risk captures the amount of exposure of a stocks portfolio to the overall market fluctuations as a result of factors that affect the overall performance of the stock market. Investors should therefore consider stock market factors such as day to day market news, recessions in the economy, changes in interest rate, inflation rate and currency risk when making investment decisions at the Nairobi securities exchange. Further, investors should establish the general performance of the market index before making investment decisions. This is because there is a general positive relationship between stock return and stock market return. An upward trend in the value of the NSE 20 share index indicates that there is a general increase in the prices of stocks at NSE. Such an upward trend is a signal for a possible profitable investment in stocks at the NSE.

Size Risk and Return of Stock Portfolios at NSE

The findings of this study have shown that size risk has a significant negative effect on the return of stock portfolios at the Nairobi securities exchange. This demonstrates the existence of value effect at the Nairobi securities exchange. They also show a concurrence on the existence of size effect in developing as well as developed stock exchanges. This was attributed to the fact that small size firms in all stock markets are riskier than stocks of big companies and as such investors are compensated with higher returns for investing in small size stocks. Further, the findings show that average excess returns of a stocks portfolio formed using market capitalization and Book/market sorts at the Nairobi securities exchange are higher for small size stocks than that of the big size stocks. This is an indication that stocks of small companies (small cap stocks) perform better than stocks of big companies (big cap stocks) at the Nairobi securities exchange. Therefore, company size which is measured using stock market capitalization is a significant determinant of stock returns at NSE. Finally, as an investment strategy, investors at NSE should allocate more investment resources to small cap stocks than on big cap stocks for return optimization.

Value Risk and Return of Stock Portfolios at NSE

Value risk has a significant positive effect on the return of stock portfolios at the Nairobi securities exchange. This type of risk captures the amount of exposure of a stock portfolio to value stocks (stocks with high book value to market value ratio) compared to growth stocks (stocks with low book value to market value ratio). The

greater the exposure to value stocks the higher the return. Firms with high book value to market value ratios seem to outperform those with low book value to market value ratios at the Nairobi securities exchange. This is attributed to the fact that firms with high book to market value ratio are perceived to be more risky and should therefore compensate investors with higher returns. These findings show that Book value/ market value ratio is an important determinant of stock returns at the Nairobi securities exchange. They also demonstrate the existence of value effect at the Nairobi securities exchange. Based on this finding, the study recommends a value strategy of investment that involves buying stocks with low prices (High book value to market value ratios) and selling stocks with high prices (low book value to market value ratios) in order to maximize the return of a stock portfolio at the Nairobi securities exchange.

Profitability Risk and Return of Stock Portfolios at NSE

Profitability risk has a weak positive effect on the return of stock portfolios at the Nairobi securities exchange. At NSE, profitability risk captures the amount of exposure of a stock portfolio to stocks of companies with robust profitability compared to companies with weak profitability. Positive effect of profitability on stock returns stems from profitable companies rewards for having chosen riskier financing options than less profitable companies. These findings indicated that stocks portfolios with robust profitability were associated with higher average stock returns than stocks portfolios with weak profitability. Thus, an investment strategy based on sorting stocks on gross profitability could generate substantial excess stock returns in the long run at NSE.

Momentum Risk and Return of Stock portfolios at NSE

Momentum risk has a weak positive effect on the return of stock portfolios at the Nairobi securities exchange. At NSE, momentum risk is attributed to a market anomaly where stocks which outperform peers during the last 12 months tend to continue performing well in the immediate future. These findings indicate that momentum effect is evident at the Nairobi securities Exchange. As an investment strategy, buying stocks that had performed well in the past and selling stocks that had performed poorly in the past at the Nairobi securities exchange can generate positive stock returns over a 12 months holding periods.

Investment Risk and Return of an optimal stock portfolio at NSE

Investment risk has a strong negative effect on the return of stock portfolios at the Nairobi securities exchange. This type of risk captures the exposure of a stock portfolio to stocks of companies with low asset growth rates at NSE. At NSE, firms with low investments in assets in the current period measured by asset growth tend to have higher returns in the next period than firms with higher asset growth. This is due to the fact that much of the available cash flows are used in ordinary operations that would generate higher returns. The ability of asset growth rate to predict stock return is also attributed to the fact that asset growth rate is able to capture common return effects across components of a firm's total investments and these components vary from one firm to another. As an investment strategy, investors at NSE should invest in firms whose financing choices are associated with asset contraction (such as share repurchases, debt repayments, dividend payments and so on) since such choices are followed by periods of high stock returns.

Conclusion

Capital asset pricing model has been the most applied model in portfolio and investment analysis. However, its inadequacy in explaining the return of stocks has given rise to the popularity of multifactor models that aims at capturing the unexplained stock return variations. In this study, a six factors model was developed using independently and empirically tested equity risk factors to explain the stock portfolio return variations at NSE. The results of the hypotheses tests leads to a conclusion that market risk, size risk, value risk and investment risk have a significant effect while profitability risk and momentum risk have a weak positive effect on the return of stock portfolios at the Nairobi securities exchange. The six factors models have a high explanatory power and their F-statistics indicates that it is an adequate model for explaining stock portfolio return variations at the Nairobi Securities Exchange in Kenya.

Recommendations of the Study

This study recommends a policy framework for enhancing factor investing strategies at the Nairobi securities exchange. Factor investing policy framework is based on equity risk factors that have been proven empirically by researchers to earn a stock return premium in the long run. In adopting a factor investment strategy, retail investors, stock brokers and investment advisors at NSE should allocate more investment resources to small cap stocks than in big cap stocks, invest more in value stocks than in growth stocks, buy stocks with the strongest momentum and sell stocks with the lowest momentum, allocate more investment resources to stocks of firms with robust profitability than those with weak profitability and finally invest more in stocks of firms with low growth in assets in the current period than firms with high growth in assets in the current period for stock return optimization.

The results of the study can also be used to develop a policy on the concept of exchange traded funds (ETFs) investments at the Nairobi securities exchange. ETFs attempt to replicate the performance of a specific

index such as stocks, bonds, currencies and commodity indices. Specifically, the results of this study can be used in structuring a stock ETFs consisting of small cap stocks, value stocks, growth stocks and momentum stocks. Introduction of ETFs investments at the Nairobi securities exchange could help managers of the mutual funds, trust funds, and pension funds to optimize their investment in stocks at the Nairobi securities exchange in Kenya. Finally, Capital markets Authority could use the study findings to review and strengthen the legal and regulatory framework of stock investment policies. Some of the policies that could be reviewed include price determination of listed stocks using fundamental factors and market forces of demand and supply, policy on temporary halts in the trading of a security as a result of unusual movements in the price of a security and regulations in the growth enterprise market segment.

Areas for Further Research

This study will act as a reference point for future research studies on portfolio construction, risk diversification and pricing of stocks. Based on the results obtained, the following are the suggested areas for further study: Using the same methodology, a similar study should be extended to other developing and developed countries to establish whether the results are consistent. Other methodologies (such as GARCH, Panel data, Quantile regression, and others) could be used on the same study. Researchers could also explore the inclusion of other factors not captured by the six factors model.

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Appendices

Appendix I: ***Portfolio Formation***

		Value (Book/Market ratio)			Momentum (Last 12 months average return)		
		High (H)	Medium(M)	Low(L)	Winners (W)	Neutral (N)	Losers (L)
Size	Big (B)	(1) B/H	(2) B/M	(3) B/L	(7) B/W	(8) B/N	(9) B/L
	Small(S)	(4) S/H	(5) S/M	(6) S/L	(10) S/W	(11) S/N	(12) S/L
		Profitability (Gross profit ratio)			Investment (Growth in total assets)		
		Robust (R)	Medium(M)	Weak(W)	High (H_I)	Medium(M_I)	Low(L_I)
Size (Market capitalization)	Big (B)	(13) B/R	(14) B/M	(15) B/W	(19) B/H_I	(20) B/M_I	(21) B/L_I
	Small(S)	(16) S/R	(17) S/M	(18) S/W	(22) S/H_I	(23) S/M_I	(24) S/L_I

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Appendix II: ***Diagnostic Tests***

Correlation Matrix for the six Equity Risk Factors

	Market Risk	Size Risk	Value Risk	Momentum Risk	Profitability Risk	Investment Risk
Market Risk	1					
Size Risk	-0.202	1				
Value Risk	0.179	-0.101	1			
Momentum Risk	0.026	0.205	0.083	1		
Profitability Risk	-0.044	0.305	0.087	0.453	1	
Investment Risk	0.117	0.112	0.307	-0.076	0.069	1

Author (2017)

Durbin Watson d-statistic test for autocorrelation (or Serial Correlation) (For the six Equity Risk Factors)

Model	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
d- Statistic	2.306	1.764	2.012	2.073	1.713	2.204	1.972	2.032
Model	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
d-Statistic	1.789	1.780	2.342	2.286	1.720	2.226	1.950	1.932
Model	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**
d-Statistic	2.188	2.019	2.111	2.114	2.313	2.102	1.940	1.805

Author (2017)

Breusch pagan test for heteroscedasticity (For the six Equity Risk Factors)

Model	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
P-Value	0.627	0.257	0.004	0.000	0.002	0.110	0.297	0.010
Model	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
P-Value	0.000	0.001	0.253	0.000	0.506	0.003	0.327	0.081
Model	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**
P-Value	0.326	0.014	0.191	0.001	0.984	0.218	0.769	0.001

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Phillips Perron (1988) unit root test (For the six Equity Risk Factors)

Variable	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value	P -Value
BH1	-9.084	-3.551	-2.913	-2.592	0.000
BM2	-6.849	-3.551	-2.913	-2.592	0.000
BL3	-7.631	-3.551	-2.913	-2.592	0.000
SH4	-7.603	-3.551	-2.913	-2.592	0.000
SM5	-6.991	-3.551	-2.913	-2.592	0.000
SL6	-6.439	-3.551	-2.913	-2.592	0.000
BW7	-7.582	-3.551	-2.913	-2.592	0.000
BN8	-7.312	-3.551	-2.913	-2.592	0.000
BL9	-7.074	-3.551	-2.913	-2.592	0.000
SW10	-7.444	-3.551	-2.913	-2.592	0.000
SN11	-7.534	-3.551	-2.913	-2.592	0.000
SL12	-8.593	-3.551	-2.913	-2.592	0.000
BR13	-8.105	-3.551	-2.913	-2.592	0.000
BM14	-7.922	-3.551	-2.913	-2.592	0.000
BW15	-7.048	-3.551	-2.913	-2.592	0.000
SR16	-7.373	-3.551	-2.913	-2.592	0.000
SM17	-8.31	-3.551	-2.913	-2.592	0.000
SW18	-7.334	-3.551	-2.913	-2.592	0.000
BH19	-6.543	-3.551	-2.913	-2.592	0.000
BM20	-8.033	-3.551	-2.913	-2.592	0.000
BL21	-8.545	-3.551	-2.913	-2.592	0.000
SH22	-8.01	-3.551	-2.913	-2.592	0.000
SM23	-7.85	-3.551	-2.913	-2.592	0.000
SL24	-7.077	-3.551	-2.913	-2.592	0.000
Market Risk	-8.284	-3.551	-2.913	-2.592	0.000
Size Risk	-7.856	-3.551	-2.913	-2.592	0.000
Value Risk	-8.054	-3.551	-2.913	-2.592	0.000
Momentum Risk	-8.33	-3.551	-2.913	-2.592	0.000
Profitability	-8.225	-3.551	-2.913	-2.592	0.000
Investment Risk	-9.335	-3.551	-2.913	-2.592	0.000

Author (2017)

Appendix III: ***Multivariate Time Series Regressions Results (six Equity Risk Factors)***

Fist row	α_i	β_{1i}	β_{2i}	β_{3i}	β_{4i}	β_{5i}	β_{6i}	**R^2**	**F- Stat**
Second row	**t** α_i	**t** β_{1i}	**t** β_{2i}	**t** β_{3i}	**t** β_{4i}	**t** β_{5i}	**t** β_{6i}	**Adj. R^2**	**P-value**
1- B/H	**-.009**	**1.200**	**-.209**	**.293**	**-.073**	**.103**	**.029**	**.754**	**33.249**
	-1.76	12.127	-1.685	2.982	-.743	.758	.256	.732	.000[a]
2-B/M	**.017**	**.994**	**-.120**	**-.084**	**-.006**	**-.061**	**-.245**	**.709**	**26.351**
	3.688	11.754	-1.128	-1.00	-.067	-.528	-2.51	.682	.000[a]
3-B/L	**.006**	**.896**	**-.254**	**-.167**	**-.065**	**.066**	**-.130**	**.780**	**38.416**
	1.861	13.792	-3.118	-2.59	-1.01	.746	-1.74	.760	.000[a]
4-S/H	**.011**	**.944**	**.947**	**.687**	**-.101**	**.052**	**-.258**	**.843**	**58.102**
	2.729	12.983	10.381	9.516	-1.41	.528	-3.07	.828	.000[a]
5-S/M	**.008**	**.898**	**.477**	**.209**	**.067**	**-.033**	**.010**	**.631**	**18.536**
	1.632	9.349	3.961	2.187	.711	-.255	.094	.597	.000[a]
6-S/L	**-.008**	**1.111**	**.941**	**-.835**	**.026**	**.018**	**-.195**	**.754**	**33.236**
	-1.35	10.336	6.977	-7.82	.248	.125	-1.57	.731	.000[a]
7-B/W	**.004**	**1.015**	**-.209**	**-.242**	**.171**	**.031**	**-.144**	**.748**	**32.128**
	.848	12.688	-2.086	-3.04	2.171	.285	-1.56	.725	.000[a]
8-B/N	**.007**	**.969**	**-.303**	**-.210**	**.079**	**.024**	**-.142**	**.751**	**32.737**
	1.687	12.569	-3.130	-2.74	1.036	.226	-1.60	.728	.000[a]
9-B/L	**.009**	**.897**	**-.061**	**.104**	**-.552**	**.079**	**-.409**	**.661**	**21.166**
	1.666	8.901	-.481	1.040	-5.55	.577	-3.51	.630	.000[a]
10-S/W	**.013**	**.982**	**.927**	**.550**	**.741**	**.116**	**.017**	**.787**	**39.940**
	2.182	8.556	6.434	4.823	6.536	.740	.130	.767	.000[a]
11-S/N	**.006**	**.915**	**.617**	**.236**	**.035**	**.009**	**-.310**	**.585**	**15.254**
	.956	8.432	4.536	2.190	.328	.060	-2.48	.546	.000[a]
12-S/L	**.005**	**.929**	**.714**	**.227**	**-.366**	**-.021**	**.162**	**.573**	**14.529**
	.723	7.477	4.584	1.845	-2.98	-.121	1.126	.533	.000[a]
13-B/R	**.011**	**.878**	**-.336**	**-.175**	**-.144**	**.317**	**.019**	**.702**	**25.538**
	2.603	10.888	-3.318	-2.19	-1.81	2.877	.203	.675	.000[a]
14-B/M	**-.006**	**.804**	**-.202**	**-.004**	**.088**	**-.008**	**-.375**	**.370**	**6.363**
	-.692	5.308	-1.064	-.028	.587	-.038	-2.14	.312	.000[a]
15-B/W	**.007**	**1.009**	**-.098**	**-.123**	**.034**	**-.207**	**-.138**	**.857**	**64.666**
	1.382	18.343	-1.414	-2.26	.621	-2.76	-2.17	.843	.000[a]
16-S/R	**.006**	**1.064**	**.793**	**.229**	**-.150**	**.594**	**-.314**	**.673**	**22.251**
	.933	9.302	5.530	2.015	-1.33	3.802	-2.38	.642	.000[a]
17-S/M	**.006**	**.850**	**.581**	**.338**	**.137**	**.065**	**-.001**	**.702**	**25.546**
	1.297	9.688	5.272	3.886	1.580	.539	-.010	.675	.000[a]
18-S/W	**.010**	**.932**	**.555**	**.177**	**-.327**	**-.882**	**-.157**	**.698**	**25.022**
	1.736	8.724	4.143	1.667	-3.10	-6.05	-1.27	.670	.000[a]
19-B/H	**.006**	**.851**	**-.210**	**-.083**	**.208**	**-.047**	**-.725**	**.594**	**15.850**
	.955	7.203	-1.418	-.708	1.780	-.289	-5.32	.557	.000[a]
20-B/M	**.006**	**.934**	**-.178**	**-.007**	**-.156**	**.063**	**-.089**	**.824**	**50.878**
	1.986	16.005	-2.431	-.127	-2.71	.793	-1.33	.808	.000[a]
21-B/L	**.010**	**.962**	**-.262**	**-.215**	**.076**	**.032**	**.187**	**.701**	**25.394**
	2.050	11.031	-2.391	-2.48	-.886	.271	1.859	.673	.000[a]
22-S/H	**.009**	**1.128**	**.762**	**.285**	**-.118**	**.025**	**-.672**	**.697**	**24.891**
	1.570	10.691	5.750	2.722	-1.13	.176	-5.51	.669	.000[a]
23-S/M	**.005**	**.859**	**.473**	**.204**	**.024**	**.100**	**-.063**	**.726**	**28.754**
	1.389	11.643	5.111	2.785	.325	.997	-.735	.701	.000[a]
24-S/L	**.005**	**1.017**	**.813**	**.417**	**.166**	**-.054**	**.415**	**.748**	**32.078**
	.945	9.644	6.148	3.982	1.596	-.372	3.408	.724	.000[a]

Author (2017)