SEGMENTAL MARKET RISK APPRAISAL OF EQUITY INVESTMENTS AT THE NAIROBI SECURITIES EXCHANGE

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Abstract
The Nairobi Securities Exchange (NSE) is one of the most vibrant financial securities markets in Africa. The equity securities of the companies listed at the market have for a long time been subdivided into Agricultural; Commercial and Services; Finance and Investment and Manufacturing and Allied segments. This longitudinal empirical survey investigates the market riskiness of the returns of the various segments of the NSE using Capital Asset Pricing Model (CAPM) of Sharpe (1964) to vis-à-vis the market returns. The study covers the period January 2008 through December 2011, a period over which the NSE All Share Index (NASI) which is used to indicate market returns has been in existence. Ordinary least squares method (OLS) is used to estimate segmental betas which are then used to test two null hypotheses. First that the market segmental betas are statistically insignificant in determining the NSE investment portfolio returns and second there is no significant difference between the inter-segmental market betas (indicators of segmental systematic risk) in the various segments of the market. The study rejects the first null hypothesis for all the four segments and finds that beta is a statistically significant indicator of market risk for those segments. With regard to the second null hypothesis, the various segments are found to have betas with significant difference in means indicating that each of the segments have unique risk factors relative to the all the companies listed at the NSE. In a nutshell, the agricultural sector is found to be the most risky sector with the highest volatility while the Finance and Investment sector is the least risky for the study period. Industrial and allied as well as the finance and investment sectors generally exhibit less volatile returns than the overall NSE. From the findings it can be concluded that the various equity investment segments of the NSE exhibit unique idiosyncratic factors that influence segmental market risk.

Key words: Segmental market risk, market beta, return volatility, capital asset pricing model, equity market

1 Introduction

The practice all over the world has been to fragment equity securities markets into various segments that mirror specified unique characteristics (Fabozzi *et al.,* 2002). Accordingly companies that are quoted in a particular segment or sector of an equity market often have some idiosyncrasy distinct from those that are quoted in the different market segments. Fabozzi *et al.* (2002) indicate that when the quotation is dependent on the size or capitalization of the companies, the classification is often taken as main investment segment for the large capitalization companies and alternative investment segment for the small cap companies. Another common approach involves segmenting securities in accordance to the parent industry. In this case companies could come from the agricultural, industrial, educational, communications, banking, services or any other industries of the economy.

Each market segment is expected to have its unique segmental market beta in concomitant with the attendant risk factors in that market segment. Market risk is the possibility of the value of an investment and/or trading portfolio fluctuating as a result of the changes in the market risk factors. The four standard market risk factors identified by Dorfman (1997) and generally agreed upon in investment theory are stock prices, interest rates, foreign exchange rates, and commodity prices. Market risk is often taken as the systematic risk or non diversifiable risk and is said to be the residual risk that cannot be further spread out after investing in a well diversified portfolio. It is usually a function of the market wide factors that affect all the investment portfolios in the market. The systematic risk is usually measured by market portfolio or investment beta (β_p). Beta describes the volatility of returns or cash flows from an asset or portfolio (r_p) of investment assets in relation to the overall market volatility (Variance of market returns, Var r_m). It is the quotient of the covariance between portfolio returns and market returns and the variance of the market returns. This is taken as:

$$\beta_p - \frac{COV(rp.rm)}{Var(rm)}$$

The main equity securities investment sector of the Nairobi Securities Exchange (NSE), formerly called the Nairobi Stock Exchange has for a long time been divided into four segments namely the Agricultural sector; the Industrial and Allied sector; the Commercial and Services sector and the Finance and Investment sector. The categorization is based on type of products and services provided by the companies whose equity securities are listed in those sectors. The glaring literature gap in the Kenyan scenario is that the studies thus far on the Kenyan capital markets do not reflect the segmental risk evaluation with relative to overall market volatility. In the context of the Kenyan financial markets, studies including Dickson and Muragu (1994) have largely focused on market efficiency and determination of market anomalies to the exclusion of evaluation of segmental risk for the four sectors listed at the NSE.

This gap is critical because whereas equity securities markets are segmented into various sectors based on identified bases, it is not clear how the segmental return volatility influences the entire market performance. In the context of the NSE, the volatilities of the different four segments have not been identified and neither have they been considered vis-avis the entire market. By empirically evaluating the segmental market risk of equity investments within the various segments of the market, we aim to achieve two objectives. Firstly, we establish the degree of monthly return volatility in the various sectors of the NSE. Secondly, we evaluate the relative segmental differences in the levels of return volatilities given the implied operational and risk idiosyncrasies in each of the segments.

We null hypothesize that there is no significant difference between the volatility of the monthly returns of the various individual sectors as indicated by their respective segmental betas. Since the segmental market risk as reflected in the segmental return volatilities are estimated using beta (β) it is expected that if the volatilities of the sectors mimic those of the overall market, then the sectoral portfolio betas (β_s) are expected to be equivalent to 1. Accordingly, the null hypothesis is that the segmental betas are equal to one. We further present the hypothesis that for the NSE, there is no significant difference between the volatilities in the equity returns of the various individual sectors which if we fail to reject would point to similar risk factors for each of the market segments.

The rest of this paper is organized into five sections. The remaining part of this section I appraises theoretic and empirical literature in the context of the research hypotheses. In section II we present the data and research methodology. In section III we present the findings of the study which we subsequently discuss in section IV. We ultimately make the conclusion and suggestions for further study in section V.

Both theoretic and empirical literature indicates that whereas investors have long recognized the need for minimizing investment risk while maximizing investment returns, the mechanism of achieving this twin objective has not always been obvious (Fabozzi *et al*., 2002). Investment and portfolio theory has however developed diverse tools for accomplishing this objective. One of the most innovative of these tools in the market portfolio developed by Tobin (1958), extended by Markowitz (1959) and concretized by Sharpe (1964) in the now popular and widely applied capital asset pricing model (CAPM). In this model, the expected returns on an investment are the sum of the risk free returns and the risk premium in the investment market. The CAPM model implies that all investors should hold the market portfolio, leveraged or deleveraged with positions in the market risk free assets. It is on the backbone of this that it is possible to measure market risk and where the market is subdivided to numerous segments, the various idiosyncratic segmental market betas.

CAPM's beta shows the statistical variance of the assets returns that cannot be eliminated through diversification of assets as reflected in an investment portfolio of numerous risky assets because of the nature of the correlation of its returns and the returns of the other components of the portfolio (Tofallis, 2008). It mirrors the sensitivity of the portfolio's returns to the market and therefore is used to measure the market non diversifiable or systematic risk. Higher beta portfolios are expected to be more volatile than the market but they also should have potential for higher returns than on average.

Investment portfolio return and cash-flow performance implied in the CAPM is dependent on the risk attributes of the securities in the portfolio. The perception of risk by investors depends on their attitudes towards risk and general risk profile. In this regard the common risk attitudes are identified as risk aversion, risk neutrality and risk seeking investor behaviors. This is in turn are rooted in a number of theories. Firstly in the efficient market hypotheis (EMH), Fama (1970) persuasively argues that in an active market that includes many well-informed and intelligent investors, securities will be appropriately priced and will reflect all the available information. If a market is efficient, no information or analysis can be expected to result in out- performance of an appropriate market benchmark.

The EMH places investor rationality at the central pillar in the investors' decision making process. This by necessity requires investors to be fully informed to operate in a market devoid of information asymmetry and noise trading. If this assumption is critically evaluated, EMH comes under great criticism given that real markets seldom have investors with perfect information. Even in very competitive markets, corporate insiders always have the advantage of insider information.

Critics like Tofallis (2008) contend that in the real world, the investor is not faced with risk as EMH assumes, but rather uncertainty. Accordingly, noise trading arises from the fact that investors facing an uncertain future cannot possibly make rational decisions rather they rely on their opinions about future expectations and advice from others which cannot stand the test of rationality. Despite these arguments, finance research has shown that some markets are efficient. In the absence of a plausible and robust alternative, EMH has continued to form the theoretical basis of most studies on financial markets.

Secondly, portfolio theory attempts to explain how investors can benefit from investing in asset combinations as opposed to single asset investment strategies. After the introduction of the preliminary portfolio model by Markowitz (1952), extensive modifications by Tobin (1958), Markowitz (1959), Sharpe (1964), Lintner (1965) and Mossin (1966) resulted in the called the capital asset pricing model (CAPM) that is widely used in market asset pricing and risk evaluation. The model is based on the assumption that risk averse investors would prefer some compensation over and above the risk free level in order to invest in a market portfolio instead of the risk free assets. Essentially, required returns on an investment are a function of the risk free rate of return (R_f) and the market risk premium represented by $\beta(R_m - R_f)$ which indicates the return over and above the risk free return as a function of the market return (R_m). This model and its modifications are used for beta evaluation in this study.

There have been numerous studies with mixed findings on beta and its applicability in portfolio construction and measurement of market risks. Koustubh (2010) for instance uses the Indian Stock Market to investigate the stability of beta over five market phases. The study uses data set of 30 selected companies from the Bombay Stock Exchange. It utilizes a ten year period from 1999 to 2009 at that stock exchange to compute monthly returns for the computation and evaluation of the stability stock beta over the market phases identified as bullish, bearish, bullish, bearish and bullish for the respective phases I, II, III, IV and V respectively. Data analysis for investigation of beta stability relies on time as a variable, dummies as variables and the chow test econometric models. The findings of the study indicate that there is no consistent stability of beta for all the 30 stocks studied at the market. Accordingly the beta values at this market do not show any particular pattern but in the overall phase almost all the stocks are statistically significant. The findings support the fact that beta is a short term single period evaluation model that performs dismally is assessment of market risks over an elongated period of time.

Koo and Olson (2008) investigate if beta is related to the return of a portfolio conditional on the market risk premium. Their study uses data from 288 publicly traded companies at the S&P 500 in the USA for one year from November 1, 2005 to November 1, 2006. It relies on building different investment portfolios based on researcher hindsight based on covariance and correlation relations between stocks and their risk factors. They had three different sets of portfolios built for the study ranging from low those with small beta (around 0.5), those with market beta (around one), and those with large large beta (around two). Using the standard t test, they reject the null hypotheses for all the three categories of stocks and conclude that CAPM is not applicable in all the three cases and may not be a relevant measure of market risk at least for this study sample.

In contrast to the two studies above, Clare and Priestley (1998) using data from three emerging South East Asian stock markets Hong Kong, Malaysia, and Singapore show that there is a positive and significant relationship between beta and average stock returns in these markets. This indicates that whereas the beta in the US and other developed markets seems insignificant, for the developing markets in south East Asia markets, the value is significant and a positive influence on returns. Clare and Priestley (1998) attribute this result to the efficiency of the one step beta estimation technique

employed by them as opposed to the usual two-step procedure in other similar studies. The other finding and conclusion that emerges from the study is that it is possible to have an idiosyncratic domestic version of the CAPM various markets, like these three markets In South East Asia. This they argue can be augmented by a proxy for world risk.

In the context of the African markets, Jecheche (2009) investigates the applicability of capital asset pricing model on the Zimbabwe Stock Exchange over the period January 2003 to December 2008. The three objectives are to firstly determine whether higher beta yield higher expected return, secondly whether average risk free rate and the slope of the security market line equals the average risk premium and finally whether there exists linearity between stock beta and the expected monthly stock returns for the sample companies. The study employs time series analysis test as well as a cross sectional test using the regular linear CAPM model to test the three objectives. The findings fail to provide evidence that higher beta provide higher returns for the study sample. In addition the security market line is found to have a downward sloping curve. It clearly establishes that there is a distinct difference between average risk free rate, risk premium and their estimated values. For the last objective, the study establishes a linear relationship between beta and return. Accordingly, the conclusion from the study is that CAPM does not fully hold for the Zimbabwe stock exchange. This could however be attributed to the small size of the market that has serious implications on market efficiency.

On the overall, although beta has sometimes been criticized for its efficacy in determining portfolio returns (Tofallis, 2008), the appraisal of literature indicates that beta is nevertheless an important indicator of market systematic risk and has been used widely not only in measuring risk, but also in estimating returns. The studies thus far do not reflect the segmental risk evaluation with relative to overall market volatility. This study is carried out to fill this gap by identifies segmental betas and their relative differences among the four sectors of the market that include Agricultural; Commercial and Services; Finance and Investment and Industrial and Allied sectors. Arising from the evaluation of literature, segmental beta evaluation is facilitated by interrelating historical returns of market segments as determined by the size weighted returns from the individual companies quoted in those segments. The structure of the conceptual framework is presented in Figure 1.

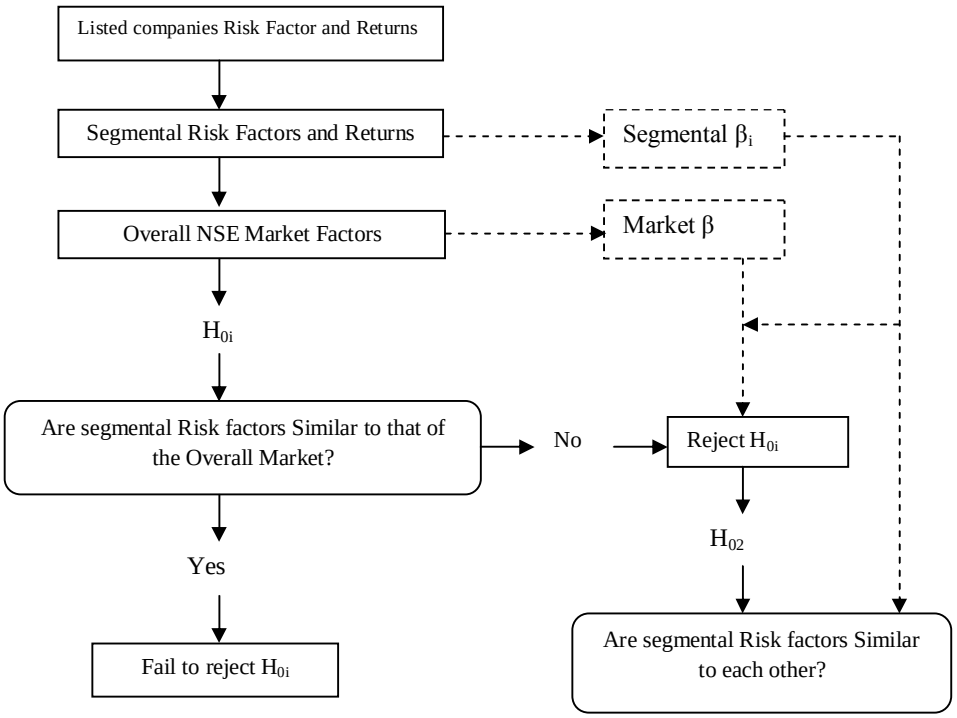

Figure 1: Structure of the Conceptual Framework

From the diagrammatic portrayal of the conceptual model, the independent variables are determined as the returns of the individual segmental returns as influenced by the component company returns and the attendant risk factors. These when looked at together help in determination the portfolio excess returns which are taken to be a function of market beta. Logically the excess returns are determined as the portfolio returns or market returns as adjusted for the risk free rate of return. It is from this interrelationship that it is possible to estimate the betas for each of the various segments given their portfolio returns, the returns of the market as indicated by NASI and the returns on the risk free government short term debt instrument (91 day TB rate).

1.1 Research Data And Methodology

The historical cross sectional correlational survey design used in this study relies on the population all the 59 companies that have been quoted in the equity securities market of the Nairobi Securities Exchange for the four year period between January 2008 and December 2011 (48 months) as delineated in appendix 1. This time period is considered because it coincides with the time the Nairobi All Share Index (NASI) has been operational at the NSE. NASI is a price index that shows the daily performance of all the equity securities quoted at the NSE.

Secondary was data obtained from the NSE (NASI, monthly stock prices, segmental price and volume information, company and segmental capitalization) and the Central Bank of Kenya (CBK) databases (91 day TB risk free rates). The annual market capitalization data for determining the proportionate size of each of the companies in the various segments was obtained at the beginning of the each of the four years. This is because portfolio rebalancing was done at the beginning of each of the years to implement the relevant data cleaning exclusion criteria. For this purpose each company's respective size is determined as a quotient of its capitalization and the segmental capitalization.

Although a census of all the equity securities quoted at the NSE is used in the study, data cleaning for analysis purposes led to the exclusion of some companies in some of the periods under the study. For this purpose, dormancy, delisting and listing in the course of a financial period were identified as the exclusion criteria. For the dormancy criterion, companies that did not trade in a given financial year were excluded from evaluation in that period. Companies delisted or listed in the course of a financial period do not have full year trading results for computation of annual returns for that period and were also excluded from analysis for the specified listing or de-listing year. Monthly returns for the month t+1 for the individual stocks and NASI returns are taken as:

$$LnHPR_{SHARE} = LnP_{t+1} - LnP_t \text{----------(i)}$$

$$HPR_{NASI} = LnNASI_{t+1} - LnNASI_t \text{----------(ii)}$$

The risk free returns are approximated from the monthly returns on the 91-day Government treasury bills.

Both descriptive and inferential statistics are used to test the null hypotheses postulated in the study. Once the monthly segmental and market returns are obtained for the 48 month period their description in terms of mean, mode, deviation, variance, range and standard deviation and subsequently the coefficient of variation (CV) are given. To test null hypothesis 1 that there is no significant difference between the volatility of the monthly returns of the various individual sectors (Agricultural; Commercial and Services; Industrial and Allied and Finance and Investment) and the overall monthly returns of the NSE market, the portfolio excess returns are regressed against the market excess returns.

The portfolio excess returns are taken as the difference in portfolio returns and the risk free returns.

$$Segmental\ Porfolio\ Excess\ Returns = Returns_{Segm\,i,j} - R_{rf\,i,j} \text{----------(iii)}$$

$$= \sum_{i}^{n} W_{i,t} LnHPR_{shares_{i,t}} - R_{rf,t} \quad Where\ W_{i,t} = \frac{Company\ Capitalisation_t}{Segmental\ Capitalisation_t}$$

$$Company\ Cap = Company\ Capitalisation = Market\ Price\ per\ Share * No.of\ Shares\ Issued$$

Segmental Portfolio Excess returns = α+ {Market Excess Returns}β----------(iv)

$$\overline{Porf\ Exc\ Rets_t} = \hat{\alpha} + (Mkt\ Excess\ Rets)\hat{\beta}$$

The regression of portfolio excess returns against the market excess returns helps estimate β an indicator of segmental risk taken as the quotient of the covariance between the segmental returns and those of the market and the market variance of return. In the regression estimate it is the coefficient of the market excess returns indicating the proportionate changes in the segmental portfolio excess returns given a unit change in market excess returns. The inferential statistics are used by testing the significance of β_{Agricl}, β_{Comms}, β_{Indus} and β_{Finai} at 95% confidence interval. By running the regression equation, the value of β_i and their 2-tail statistical significance at 95% confidence interval is determined.

To test the null hypothesis II that there is no significant difference between the volatilities in the equity returns of the various individual sectors of the Nairobi Securities Exchange, the single factor ANOVA test is used to test the difference in the variances and means of the various segmental betas. This combined with null hypothesis 1 helps infer from the regression and F-test results the relative levels of market risk in the various segments of the NSE.

2 Results and Analysis

The descriptive statistics portray the central tendency and dispersion characteristics of not only the segmental portfolios and overall market returns, but also of the risk free returns as proxied by the 91-day Government Treasury Bill (TB) returns. Table 1 reflects the coefficient of variations of returns from the sectors and the overall market.

Table 1: Cross Segmental Comparison of the Return Descriptive Measures

	Mean Returns	δ Deviation Returns	Median Returns	CV
Agricultural	-0.0008	0.1189	-0.0098	-144.45
Commercial & Allied	-0.0133	0.0880	-0.0040	-6.6010
Finance & Investment	-0.0212	0.1010	-0.0010	-4.7610
Industrial & Allied	-0.0096	0.0686	-0.0044	-7.1630
Overall Market	-0.0305	0. 1885	-0.0400	-0.1620

With a mean of about -0.0008 and a median of -0.0098, the average monthly returns from the agricultural sector over the study period tend to be mostly negative alluding to a general tendency towards decline in prices. A meaningful statistic is obtained by computing the segments coefficient of variation ($CV_{AgricSeg}$) which is the mean variance per unit of return. This value in this case is obtained as:

$$CV_{AgricSeg} = \frac{\delta_{AgricSeg}}{Mean\ Returns_{AgricSeg}} = -144.454$$

This indicates that the sector is very volatile when viewed from the standard deviation of segmental portfolio returns. This situation could be attributed to the few companies in the sector. Originally there were 4 companies in 2008 but these were subsequently left to Kakuzi, Rea Vipingo Plantations Ltd and Sasini Ltd after the transfer of Unilever Tea to the alternative investments section in 2009. The few companies exposes the sector to the undue influence of the larger company in the sector arising from the resulting larger weighting factors of that company in this case Sasini Ltd. Besides, they provide very little room for diversification of the portfolio risks given that all the companies deal in related items of tea and coffee.

With a mean of about -0.013 and a median of -0.004, the average monthly returns from the commercial and services sector exhibit the same attributes as those of the agricultural sector over the study period. The segment's coefficient of variation of -6.601 indicates that although the sector is very volatile relative to the market, the segmental portfolio risk is significantly lower than that of the agricultural sector. This could be attributed to the higher number of companies (12) than the case of the four companies in the agricultural sector. This helps diversify the portfolio return variability across the numerous companies leaving only a low value of diversifiable risk. This is particularly the case because companies in the sector are involved in a wider range of activities like marketing, merchandising and communications unlike the narrow range of activities observed in the agricultural sector.

The mean of monthly returns of the finance and investment segment portfolio over the four year period is about -0.0212 while the median is an average of -0.001. The returns also tend toward the negative direction pointing towards a general tendency towards decline in prices. The segment's coefficient of variation of -4.761 indicates a lower average risk than that registered in the agricultural sector and the commercial and services sector. Again this could be as a result of the higher number of companies in the sector and the diverse nature of the equities quoted in this

section ranging from the banking, insurance to investment companies. This suggests a superior ability to diversify away risks and leave an overall lower level of diversifiable risk.

The mean of monthly returns of the industrial and allied segment portfolio over the four year period is about -0.0096 while the median is an average value of about of -0.0044. The segment's coefficient of variation of -7.163 shows that is still higher than the positions observed in the commercial and allied and the finance and investment sectors although lower than that of the agricultural sector. Again this could be as a result of the large number of diverse companies in the sector which can help in reducing the diversifiable risk of a sector to the bare minimum.

From the descriptive statistics and the measure of relative risk, the finance and investment sector is the least risky while the agricultural sector comes out as the most risky. This when looked from the fundamentals is largely because the performance of the companies in the agricultural sector is largely dependent on weather conditions. Accordingly, in additional to the other risk factors that face companies in the remaining three sectors, the agricultural stocks are also prone to weather conditions and their related unpredictability.

The average return of the overall market mirrors those of the component segments at -0.0305 and -0.040 for the mean and the median returns respectively. This translates to a CV of -0.162 the least of the five considered. This is expected because the market evaluates all the returns from all the sectors which help in risk diversification. It therefore provides all the opportunities for diversification of all the diversifiable risk to leave only the systematic risk.

The first null hypothesis tests the proposition that there is no significant difference between the volatility of the monthly returns of the various individual sectors. This would be the case if segmental beta is estimated to be 1. For the agricultural segment, the segmental portfolio excess returns are regressed against the NASI excess returns and the findings are shown in table 2.

Table 2: Regression Output Results for the Agricultural Sector

R	*0.8858*
R Square	*0.7846*
Adj. R Sq.	*0.7843*
Std Error	*0.1009*
Observ	*48*

ANOVA	*df*	*SS*	*MS*	*F*
Regression	*1*	*16.162*	*16.162*	*1588.961*
Residual	*46*	*0.468*	*0.010*	
Total	*47*	*16.630*		

	Coeffs	*SE*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95%*	*Upper 95%*
Intercept	*-0.04094*	*0.04611*	*-0.88794*	*0.37919*	*-0.13375*	*0.05187*	*-0.13375*	*0.05187*
$R_m - R_f$	*2.97314*	*0.02441*	*121.8000*	*0.00000*	*0.92400*	*1.02228*	*0.92400*	*1.02228*

The R square of this estimated regression equation is 0.7846 indicating robust results. The regression output serves two purposes. Firstly it helps estimate the agricultural segmental volatility of returns measured by beta (β_{agric}) as 2.97314. In this case beta is more than 1 indicating that agricultural sector is more volatile than the market returns. This confirms the results identified in the descriptive statistics.

Secondly, the output is used to test if β_{agric} is statistically significant. In this instance the significance test is taken at 95% confidence interval using the t-statistic. The regression t from the equation is determined as 121.8000. Accordingly we reject the null hypothesis and concludes that the NSE agricultural segmental beta is not equal to 1 and that since it is statistically significant and more than one, the returns from the agricultural portfolio are more volatile than those of the overall market portfolio.

For the commercial and services sector the findings are shown in table 3 the R square of this estimated regression equation is 0.9932 again points to a robust model. The segmental volatility of returns measured by beta (β_{comms}) is *1.97691* pointing towards a more volatile sector than the market. This confirms the results identified in the descriptive statistics and was explained it could be attributed to the narrow range of equities with which to diversify away the segmental risk.

Table 3: Regression Output Results for the Commercial and Services Sector

R	*0.99658*							
R Square	*0.99316*							
Adj. R Sqre	*0.99302*							
Std Error	*0.04937*							
Observs	*48*							
ANOVA	*df*	*SS*	*MS*	*F*				
Regression	*1*	*16.2876*	*16.2876*	*6682.84*				
Residual	*46*	*0.1121*	*0.0024*					
Total	*47*	*16.3997*						
	Coeffs	*SE*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95%*	*Upper 95%*
Intercept	*-0.04669*	*0.02257*	*-2.06885*	*0.04421*	*-0.09213*	*-0.00126*	*-0.09213*	*-0.00126*
$R_m - R_f$	*1.97691*	*0.01195*	*165.4318*	*0.00000*	*0.95285*	*1.00096*	*0.95285*	*1.00096*

For this sector, we again reject the null hypothesis and conclude that the NSE commercial and services segmental beta is not equal to 1 and that since it is statistically significant and more than one, the returns from the commercial and services portfolio are more volatile than those of the overall market portfolio. The model is equally robust for the finance and investment sector of the NSE with a coefficient of determination of 0.9858 as indicated in table 4. The estimated beta, β_{fininv}, of 0.91532 corroborates the findings in the descriptive statistics that this is the least risky sector of the NSE. In this regression output, the beta is statistically significant with a t statistic of 50.8794. Since the value is less than 1, the study rejects the null hypothesis that the sector is equally as risky as the overall market and concludes that the finance and investment sector is less volatile than the general volatility of returns experienced in the NSE.

Table 4: Regression Output Results for the Finance and Investment Sector

R	*0.9929*
R Square	*0.9858*
Adj. R Sqr	*0.9854*
Std Error	*0.0743*
Observs	*48*

ANOVA

	Df	*SS*	*MS*	*F*
Regression	*1*	*17.594*	*17.594*	*3183.972*
Residual	*46*	*0.254*	*0.006*	
Total	*47*	*17.848*		

	Coeffs	*SE*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95%*	*Upper 95%*
Intercept	*0.01426*	*0.03398*	*0.41959*	*0.67674*	*-0.05415*	*0.08267*	*-0.05415*	*0.08267*
R_m - R_f	*0.91532*	*0.01799*	*50.8794*	*0.00000*	*0.97910*	*1.05154*	*0.97910*	*1.05154*

Finally with regard to hypothesis 1, we test the significance of the industrial and allied segmental beta in the determination of the segmental returns and its comparability with the market return volatility. Accordingly when the segment's portfolio excess returns are regressed against the NASI excess returns, the results are as indicated in table 5. The resultant estimating model has a highly significant F of 5969.79 that is confirmed by an equally high coefficient of determination of 0.99 indicating that most of the variations (about 99%) of the changes in the segments excess returns are determined by the segments risk premium and that only about 1% of the variations are due to other factors indicated in the random disturbance term. In that regard, the segmental beta computed from the model of 0.98431 is highly relevant in representing the average volatility of the average segmental returns.

Table 5: Regression Output Results for the Industrial and Allied Sector

R	*0.99617*
R Square.	*0.99235*
Adj. R Squ.	*0.99219*
Std Error	*0.05263*
Observations	*48*

ANOVA

	df	*SS*	*MS*	*F*
Regression	*1*	*16.536*	*16.536*	*5969.79*
Residual	*46*	*0.127*	*0.003*	
Total	*47*	*16.663*		

	Coeffs	*SE*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95%*	*Upper 95%*
Intercept	*-0.02967*	*0.02406*	*-1.23300*	*0.22384*	*-0.07810*	*0.01877*	*-0.07810*	*0.01877*
Rm - Rf	*0.98431*	*0.01274*	*77.26442*	*0.00000*	*0.95867*	*1.00996*	*0.95867*	*1.00996*

The fact that the corresponding t value from the regression output is highly significant with a value of 77.26442 at 95% confidence interval and 47 degrees of freedom indicates that the null hypothesis that the market volatility is equal to the segmental volatility of the industrial and allied sector is rejected. Instead a conclusion that the segment is less volatile than the market is made since the computed beta for the segment is less than 1. This is most likely attributable to the large number of companies listed in this segment and the diversity of the products and services offered by these companies.

To test the null hypothesis II that there is no significant difference between the volatilities in the monthly equity returns of the various individual sectors of the Nairobi Securities Exchange, the segmental betas and their respective means are subjected to a single factor ANOVA test at 0.05 level of significant. The results are indicated in Table 6. The resulting F value of 12.6195 is greater than the critical F of 5.987378 hence the study rejects the null hypothesis and concludes that the variances of the segmental betas are different from each other at 95% confidence interval.

Table 6: Single Factor ANOVA Results for Differences in Segmental Betas

Groups	*Count*	*Sum*	*Average*	*Variance*		
Segmental Betas	*4*	*6.84968*	*1.71242*	*0.941627487*		
Segmental means	*4*	*-0.0449*	*-0.011225*	*7.17092E-05*		
ANOVA						
Source of Variation	*SS*	*Df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	*5.941904*	*1*	*5.94190*	*12.6195*	*0.0012*	*5.987*
Within Groups	*2.825098*	*6*	*0.47084*			
Total	*8.767002*	*7*				

Combining this with the findings from the tests of hypothesis I imply that the magnitudes of the betas as indicated in Table 7 can be used to rank the relative risks of the various segments of the NSE.

Table 7: Cross Segmental Market Beta Comparison	**Beta**	**Standard Unitary Beta**	**Variance**
Agricultural	*2.97314*	*1*	*1.97314*
Commercial and Allied	*1.97691*	*1*	*0.97691*
Finance and Investment	*0.91532*	*1*	*-0.08468*
Industrial & Allied	*0.98431*	*1*	*-0.01569*

The nature of beta as a measure of variability is such that when beta is 1, the variability of a portfolio is equal to that of the overall market. Accordingly betas of less than 1 represent less volatile returns than that of the market while those higher than 1 relate to the portfolios that have greater volatilities than that of the market. Computing the variance as the difference between the segmental beta and the unitary beta gives the extent of the differences in variability between the market portfolio and the segmental portfolio. Accordingly, the findings in table 7 indicate that the least volatile and hence least risky segment of the NSE for the study period was the Finance and investment followed by the industrial and allied sector. These two showed volatilities less than that of the market. The agricultural sector was the most risky as indicated by a very high beta with a variance of about 1.97 from the unitary level. Hence in that sector, for every unit change in returns of the market portfolio, the returns of the agricultural portfolio were expected to change by 2 units. The commercial and services sector though not as volatile as the agricultural sector, also registered

higher volatilities than not only the finance and investment as well as the industrial and allied sectors but also of the overall market in general.

2 Discussion

The descriptive results of this study were concerned about the dispersion and central tendency of the returns of the equity securities of the various companies quoted in the four segments of the NSE. This is important because dispersion including range, variance and standard deviation are established measures of riskiness of returns of investment portfolios in finance. Four important findings emerged from the study. Firstly, over the study period, all the four segments at the NSE had average negative monthly returns. This implies that the monthly prices and therefore holding period returns had a general declining tendency. This could be attributed to several factors. It is during this period that the Kenyan Economy had registered sluggish economic growth. Economic analysts attribute this to the shock effects of the post election violence experienced after the country's 2007 elections. Instructively, the NASI index has barely not rose back to the 2008 base levels and by December 2011 the end month of this study, the index was had fallen to 68.03 relative to the 2008 base levels.

Secondly, the agriculture segment had the most volatile risk of returns as shown by the variance and standard deviation in returns. This was comparison with the commercial and services sector and the industrial and allied sectors which had moderate risk and the finance and investment sector which reported the lowest relative risk among all the four sectors. The chief explanation for the high risk levels on the agricultural counters is the relative size of the sector with only three to four listed companies. The variability one company has a great weighted average influence on the sectoral returns. Besides the sector has companies that deal in weather responsive products yet the Kenyan market has very volatile weather conditions which reflects in the volatility of the returns of the companies in the sector. Looked from a different perspective, the other three sectors are of relatively larger sizes with a larger number of counters that enable equity investors to diversify their investment portfolio that could partly explain their low levels of risk.

Thirdly, the coefficient of variation (CV) that relates the segmental diversifiable risk to the segmental average returns irrespective of size corroborates the conclusions arrived at the size unadjusted risk measures. It confirms the cultural sector as the most risk with commercial and services as well as the industrial and allied following in that order. The finance and investment sector again emerges as the least risky after this adjustment. Accordingly is size considerations are not made, then the agricultural sector seems to have more risk factors than the other sectors. This could be attributed to the market perception about the return prospects from the respective sectors. Market beta is used as a measure of the market risk given a diversified portfolio. The beta is such that $-\infty \leq \beta \leq +\infty$.

This implies that beta can have negative, positive or unitary values. When beta is unitary, the indication is that the variability of returns of a specified investment portfolio is equal the variability of the overall market. When used in the context of this study, beta as a measure of risk shows how the securities quoted in a particular market segment vary relative to the variations in the market portfolio. If β of a segment is less than 1, the indication is that the segment has returns that are less volatile than that of the market. The opposite applies to betas that are higher than 1.

From this perspective the agricultural and the commercial and services sectors record betas higher than 1 of 2.97 and 1.97 respectively. This indicates that besides the fact that these two sectors have the widest dispersion in returns, they also present the highest market risk. The finance and investment as well as the industrial and allied sectors seem to have risk levels perceived lower than those of the market since their betas fall slightly below 1. In fact their betas could easily be

approximated to 1 indicating an equal level of risk in these segments to that observed in the entire market. Perhaps this is not surprising because most of the companies at the NSE fall under these sectors and their sheer sizes have a heavy influence on the market returns. This explains why they approximate market conditions in terms of risk levels.

The implication of this is that a Kenyan investor can diversity away most of the risk at the NSE market by constructing a portfolio that mimic the finance and investment and the industrial and allied sectors. This is particularly true because some of the most profitable and stable companies like Barclays Bank of Kenya, Standard chartered bank, East African Breweries Ltd, British American Tobacco Ltd and Bamburi Ltd fall in this category of companies.

On average, the findings imply that the systematic risk in each of the market segments is unique and distinct from each of other remaining segments. This conforms to theoretical expectations given the idiosyncrasies in operations of each of the companies in the respective sectors. Accordingly some unique factors affect each of the sectors differently from the way it affects any other. This implies that an investor can optimize on his/her investment risk return matrices by judiciously identifying the counters to invest it from each of the segments.

3 Conclusion

The study rejects both hull hypotheses that firstly **t**here is no significant difference between the volatility of the monthly returns of the various individual sectors and the overall monthly returns of the NSE market and secondly that there is a significant difference between the volatility of the monthly returns of the various individual sectors and the overall monthly returns of the NSE market. The study shows that the various markets have their own unique betas pointing towards the fact that the NSE tends towards an informationally efficient market such that prices of the various companies reflect the risk levels of each of the companies and segments. This also shows that each of the market segments have their own unique risk factors such that they exhibit unique levels of systematic risk.

However it can also be concluded that that large size sectors are less risky than the small size sectors of the NSE. Investors are likely to experience reduced uncertainties in their returns if their portfolio has higher weightings of companies in two sectors namely the finance and investment and industrial and allied sectors. It is also instructive that the agricultural sector is very risky. This is attributed to the high return volatilities as a consequent of weather patterns. Indicatively, stocks in the agricultural sector are more weather elastic than those of the other sectors.

The study however faced some limitations that may require further studies to bridge the gap in the current knowledge about risks and returns in financial markets. The first limitation relates to the differences in the sizes of the various segments of the market as reflected by the differences in the number of companies quoted at each segment as well as the values of segmental capitalization. This could easily make inter-segmental comparison of return deviation based risk very difficult. However, the study overcomes this problem by employing the use of the coefficient of variation statistic (CV) which relates risk measures to average returns. This facilitates the cross-segment comparison.

The second limitation is mainly structural emanating from the fact that the NASI index which is used to determine overall NSE market returns is a relatively new innovation that came into practice in January 2008. This meant that the study could not be carried out for a longer period than the 55 months between January 2008 and July 2012. Despite this, it is taken that a study for four years is long enough to generate acceptable market beta. Significantly, similar studies on market trends have taken comparable time into consideration (Koustubh, 2010; Koo and olson, 2008; Jecheche, 2009).

Another structural problem that presented a limitation to the study is the relatively small size of the market with a market capitalization that has fluctuated between KSh.700 billion (US$8.3 billion) and one trillion Kenya shillings (US$12 billion) over the study period. Accordingly, the study is limited to only an average of 54 companies quoted at the bourse. With the sub-division into five sectors including the alternative investments market segment (AIMS), the equity securities that fall into each segment are understandably small in number. This is however not a particularly limiting problem because the study uses all the relevant companies as opposed to reliance on a sampling mechanism.

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