International Journal of Economics, Commerce and Management
United Kingdom Vol. V, Issue 8, August 2017
http://ijecm.co.uk/ ISSN 2348 0386

THE RELATIONSHIP BETWEEN PORTFOLIO SELECTION AND PERFORMANCE OF LARGE CAPITALIZATION STOCKS IN KENYA

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Abstract

The NSE provides one of the platforms for investment into the Kenyan economy and as such, it has generated the interest of many investors which has resulted to the development of various Indices in NSE and has made it necessary to analyze the performance of the Kenyan Stock Market which will help in guiding investors on their diversification strategies. The study aimed at analyzing the relationship between portfolio selection and performance of the NSE with specific reference to the large cap stocks in Kenya. The study applied the Sharpe Single Index model for analysis. According to Sharpe, the SIM and Markowitz Portfolio construction model are closely related. The study found out that the optimal portfolio size is affected by the performance of the economy. Portfolios constituting of fewer securities are made up when the large capitalization stocks are performing well. On the other hand, an optimal portfolio having many securities is created when minimizing losses resulting from adverse financial market conditions.

Keywords: Cut-off rate, beta, market return, Sharpe's single index model, NSE

INTRODUCTION

A rational investor's intent is to maximize return while minimizing risk and due to this concept, the portfolio theory was developed by Harry Markowitz in 1952. Investors continually deal with the trade-off between risk and return while striving to maximize their growth potential with the minimum possible risk hence facing conflicting objectives of maximizing expected return and minimizing uncertainty or risk which must be balanced against each other. Thus, to make wise decisions in investment, there is a need for knowledge on security analysis and portfolio management (Nalini, 2014).

The objective in portfolio selection is reducing the investment downside risk while maximizing the intended returns for wealth maximization. Risk refers to the probability of financial loss facing an investor who has committed funds into an asset or assets. It occurs when the actual returns differ from the expected return that had attracted an investor into investing in a particular asset or combination of assets. Markowitz (1952) settled on the idea that investors would demand higher returns on a market portfolio than a risk-free investment, the relationship between risk and return has been subjected to extensive theoretical and empirical enquiry (Mandimika and Chinzara, 2010).

Statement of the problem

Stock markets provide an opportunity to earn significantly higher returns on investing in them. However, it involves significant proportions of risk. Unlike dealing in riskless investments where investors are certain of gaining some return without worry of losing their capital, when investing in the securities exchange, investors face a higher level risk of losing their money should their stocks fall in value. Risk and return analysis is important in making any decision regarding investing and the determination of an optimal portfolio within stocks can be achieved by the use of the Single Index (beta) Model as projected by Sharpe. Mbithi (2014) says that most investors want to maximize returns without considering risk and this is attributed to the herd mentality. This study will help establish the optimal portfolio size among the large cap stocks in the NSE Index.

Objectives of the study

a) To determine the relationship between portfolio risk and performance of large cap stocks in Kenya
b) To establish the relationship between portfolio return and performance of large cap stocks in Kenya

c) To determine the relationship between security weights and performance of large cap stocks in Kenya

Scope of the Study

Investing in the securities market requires thorough security analysis. Given the hands-off nature of most investors, security analysis is a huge challenge. However, the Single Index Model of portfolio selection can be best used in coming up with the optimal portfolio. The model can be applied over multiple periods to come up with the best investment combination. Investors taking up an active investment strategy can greatly benefit by using this model.

Limitations of the Study

1. Optimal Portfolios are constructed using only risk and return
2. Study is limited only to the Large Cap Stocks listed in the Nairobi Securities Exchange
3. The Stock prices available for analysis were for only 2 years. Thus, the factual bearing with regards to the Large Cap stocks in the NSE cannot be generalized.
4. All computations could not have been brought into this report.
5. This research focused on short-term investment strategies.

LITERATURE REVIEW

Nyariji (2001) determined the risk reduction benefits of diversification at the NSE and by using the mean-variance model of analysis; he found out that there was a significant risk reduction at the NSE as the portfolio grew in size up to 13 securities after which risk reduction became insignificant. The period under consideration was between 1996 and 2000 where he used the data of 49 companies listed on the NSE and used the weekly data of share prices and dividend distributions of the quoted securities.

Kamanda (2001) sought to find the relationship between the different equity portfolios of insurance companies and the NSE-20 share index where he used primary and secondary data to generate the portfolio returns and applied regression analysis to derive the beta. He used four models; the Sharpe, Jenssen, Treynor, and coefficient of variation models to determine the relative performance and the extent of diversification. He found out that quoted equity portfolios by the Kenyan insurance companies' were defectively diversified and portfolios held by the insurance companies were outperformed by the market portfolio.

Zayimtsyan (2006) carried out a study that focused on theoretical and practical issues of portfolio management, particularly in constructing an optimal investment portfolio which would best suit the specific preferences of the investors. He considered preferences of investors in

terms of their willingness to be exposed to risk and their expectations in terms of return from those investments they make. Expected portfolio return and standard deviation were used as quantitative measurements of investment decision making factors. He used the Markowitz's mean-variance model is used to determine the optimal investment portfolio, utilizing time series data on a number of financial instruments available to the Central Bank of Armenia (as the exemplary investor) to estimate the efficient investment frontier evaluating the investor's degree of risk aversion on the basis of previous research. He concluded that investors consider the risk and return in making their investments.

Tapon and Alexeev (2012) studied five developed markets (Australia, Japan, United States of America, Canada and the United Kingdom) to analyze the sizes of portfolios required for achieving most diversification benefits. They obtained their data from Thomson Reuters Data stream and consisted of daily total return observations on common stocks listed on the NYSE-AMEX, the NASDAQ, the London, Tokyo, and Australian stock exchanges between 1975 to 2011.They computed several widely-accepted measures of risk and used an extreme risk measure to account for black swan events. They found that investors concerned with extreme risk achieved diversification benefits with a relatively small number of stocks. The optimal portfolio size also changed from time to time depending on various market situations. For example, an Australian investor who takes standard deviation as a risk measure, the optimal portfoliosfrom1991 to 2007on average would be made up of 22 to 30 stocks in order to attain a 90% diversification. As from 1975 to 1987, to achieve a similar 90% diversification 90% of the time, the Australian investor would have needed to hold between 31 and 39 stocks which is a higher portfolio size. While considering the period between1988 and 2011, the portfolio size changed to between 34 and 52 shares. Based on their research, the number of assets that would yield maximum benefits of diversification varied from period to period depending on the economic factors across the different countries under consideration.

Omisore, Munirat and Nwufo (2012) reviewed the relevance of the modern portfolio theory as an investment portfolio tool in portfolio decision making. They established that many inherent flaws of the theory have marred the efficacy of the theory and along other considerations; the simplistic assumptions and direct correlation of risks and returns as per the MPT were identified as significant flaws. They figured out that despite the limitations of the theory, the modern portfolio theory encourages for asset diversification. By utilizing the alpha and the beta coefficients which gauge an investment's performance, investors can be able to come up with a portfolio's risk and returns to coincide with their investment objectives while at minimum risk.

Sakar (2013), in his study of the Optimal Portfolio Construction in the Dhaka Stock Exchange in Bangladesh, he moved out to determine the optimal portfolio size by using Sharpe's single index model. He used monthly closing prices of 164 stocks of the firms listed in the Dhaka Stock Exchange (DSE) and DSE all share price index from July 2007 to June 2012.From their findings, the optimal portfolio consisted of thirty three securities.

Ramanathan and Jahnavi (2014) in a study to Construct an Optimal Equity Portfolio using the Sharpe Index model With Reference To Banking And Information technology sectors in India they considered the single sector of media and entertainment for consideration in constructing the optimum portfolio. They had a sample population of 50 securities but took a sample size of 20 securities. They found out that 5 assets make up an optimal portfolio after using the Sharpe index model and furthermore they determined the equivalent proportion of investment that should be made in each asset to derive the maximum returns.

Mbithi (2014) conducted a study to determine the optimal portfolio size for investors where he used the mean variance optimization model to obtain the optimal portfolio in the Nairobi securities Exchange. He used data from forty three listed firms in the Kenyan securities exchange and found out that the optimal portfolio size was made up of between 18 and 22 securities.

Sen and Fattawat (2014) conducted a study on the Sharpe's Single Index Model and its Application in Portfolio Construction. Their objectives were to get an insight into the Single Index Model of Sharpe, to construct an optimal portfolio and to determine the return and risk of the optimal portfolio constructed by using Sharpe's Single Index Model. They used data from the Bse Sensex index for the time period of January 2010 to December 2013 on monthly basis. They found out that there exists a significant difference between the total risk of the optimal portfolio calculated using the Single Index Model and the Markowitz's model respectively. Also, they observed that the Sharpe's Single Index model gives an easier mechanism of constructing an optimal portfolio for rational investors by analyzing the reasons behind the inclusion of stocks in the portfolio and with their relevant weights. So far as the construction of optimal portfolio is concerned, there was similarity between the SIM and the Markowitz's model. Only Four securities were found to make the optimal using the SIM.

Waithaka (2014) conducted a study to determine the effectiveness of the NSE-20 share index in representing the overall market performance at the NSE. He used all securities in the NSE-20 Share Index and a sample from the NASI as from January 1st 2013 to December 31st 2013 for analysis and found out that there was a strong positive correlation between the market performance and NASI and a stronger positive correlation existed between the Market performance and the NSE-20 Share index. From the study, he concluded that there is no

significant difference between the two indices and that the NSE20 Share index is a better market measurement index as compared to the NASI

By determining the optimal portfolio size among the large cap stocks, the results would reflect on the performance of the Stock exchange and it will be of help to individual and institutional investors alongside the corporate managers assisting them in identifying the best investment securities and the best portfolio size and furthermore assist corporate managers in their decision making and improve performance.

METHODOLOGY

The data collected was analyzed using the basic Statistical measures which are; the mean, Beta, the variance and the standard deviation.

The Sharpe Single Index Model

The single index model is based on the notion that stocks fluctuate together due to the common movement in the securities market and that there are no special effects outside the market that account for the stocks co-movement. Sharpe's Model proposes that the relationship between each pair of securities can indirectly be measured by comparing each security to a common factor 'market performance index' that is shared amongst all the securities and this has helped to reduce the burden of large input requirements and difficult calculations required in Markowitz's mean-variance approach (Nalini, 2014).The expected return, standard deviation and co-variance of the single index model represent the joint movement of securities.

According to Sharpe, efficient portfolios created using the Single Index Model have considerable similarity to those constructed using the Markowitz model. However, according to Benari (1988) the SIM performs better as compared to the Markowitz portfolio construction model. This was attributed to the simplicity of application of SIM. It has fewer input requirements thus performing better. As per Sinaee and Moradi (2010), the Model further represents a better practical improvement in portfolio evaluation, analysis and construction.

a) Estimating the stock return.

$$R_i = \frac{(P_t - P_o)}{P_o} \times 100$$

Where:

Ri is the expected return on security I; Po is the price at beginning of the month and Pt is the price at end of the month.

b) Excess Return

The excess return to beta ratio measures the additional return on a security (excess of the riskless assets return) per unit of systematic risk or non-diversifiable risk.

Excess return = $\frac{Ri-Rf}{\beta i}$

Where;

Rf is the Risk Free of return and it is given by the rate of return of the Government securities and βi is the Systematic risk of stock i.

βi is given by;

$$\beta = \frac{\sum(R_m-\overline{R_m})(R_i-\overline{R_i})}{(R_m-\overline{R_m})^2}$$

β is the beta; Rm is the return of the market index,$\overline{R_m}$ is the mean return of market index, Ri is the return of individual stock while $\overline{R_i}$is the mean of individual stock.

c) Cut–off rate

This ranking represents the attractiveness of any stock for inclusion in the portfolio. The choices of the stocks depend on the cut-off rate such that the stocks with higher ratios of (Ri - Rf) /βi are included while those with lower ratios are left out. The cutoff point is denoted by C* is given by;

$$C^* = \frac{\sigma^2 m \sum_{i=1}^{n} \frac{(Ri-Rf)\beta_i}{\sigma_{ei}^2}}{1+\sigma_m^2 \sum_{i=1}^{n} \frac{\beta_i^2}{\sigma_{ei}^2}}$$

Where;

C^* is the cut off rate, σ_{ei}^2 represents the unsystematic Risk of the individual securities; $\sigma_m^2 i$s the Variance of the market index; Ri - return of the stock I; Rf - Risk free return while βi is the Systematic risk of stock i.

The Index Return

The rate of return of the FTSE Kenya 15 Index will be computed using monthly closing points as:

$R_m = \frac{P_t-P_o}{P_o} \times 100$

Where;

R_m is the return of the index; P_t is the index price at current period while $P_o$is the index price at end of previous period.

The variance of the Index movement is computed as under:

$$\sigma 2 = \frac{\sum(R_m-\overline{R_m})2}{N-1}$$

The variance of the Stock price movement is computed as under:

$$\sigma 2 = \frac{\sum(R_i-\overline{R_i})2}{N-1}$$

d) Computation of weight of each security to be included to form the optimal portfolio

The percentage of funds to be invested in each security is estimated as follows;

$X_i = \frac{z_i}{\sum_{i=1}^{N} Z_i}$

Z_i is computed as;

$$Z_i = \frac{\beta^2 i}{\sigma_{ei}^2}\left[\frac{Ri - Rf}{\beta_i} - C^*\right]$$

Where;

The first expression (X_i) indicates the weights on each security and they sum up to one. The second (Z_i) shows the relative investment in each security.

The Beta of portfolio is given by;

$$\beta_p = \sum_{i=1}^{n} X_i \beta_i$$

The portfolio return is given by;

$$R_p = \sum_{t=1}^{n} X_I \; R_I$$

e) The portfolio unsystematic risk is given by;

$$\sigma_p = \sqrt{\beta_p^2 + \sum_{i=1}^{n} X_i \, \sigma_{ep}^2}$$

RESULTS AND DISCUSSION

To select the securities to constitute the optimal portfolios over the different periods, first, all securities were ranked based on their promised excess returns. The security with the highest excess return was ranked first while the one with the lowest excess return was ranked last. After ranking, the *Ci* for each security is computed with an aim of coming up with the optimum *Ci* value. The supreme*Ci* value is then considered to be the optimum *Ci*.This supreme *Ci* is then considered as the cut-off point denoted as C*. From the tables presented for the various periods other than the third period, a cut-off point is attainable. However, during the third period, none of the Large Cap stocks meet requirements to be selected as a constituent of an optimal portfolio. This can be largely attributed to the risk factor surrounding the securities market over the period which negatively impacted on operations of firms listed in the NSE.

Optimal portfolio construction under period 1

Table 1. Table showing the Excess Returns and Ranking during the first period

Security	Mean Return	Beta Values	Excess Return	Ranking
Saf	4.38144	0.89917	-5.18855	5
Barclays	-0.29497	0.82768	-11.27021	9
Equity	5.80484	0.21874	-14.82081	12
KCB	1.93958	0.61950	-11.27071	10
East	0.22586	3.24034	-2.72223	4
KQs	-0.21044	1.50281	-6.15996	6
Coop	0.78523	1.17721	-7.01792	7
CFC	8.75769	-0.40663	0.71099	3
KENGEN	-7.20327	0.5390	-17.03537	13
NIC	-0.50048	-0.21397	44.62077	1
KPLC	-1.48898	0.40308	-26.13343	14
Britam	4.20892	-1.26493	3.82461	2
Scan	-1.84491	1.11110	-9.80263	8
NMG	0.04083	0.21722	-41.45956	15
Centum	2.94686	0.47201	-12.92343	11

Cut-off point

Table 2. Table Showing the Cut-Off point for the first period

	Securities	Ri-Rf/Bi	(Ri-Rf)*βi	(Ri-Rf) βi/σ 2ei	Σ(Ri-Rf)βi/σ 2ei	βi2/σ 2ei	Σ βi2/σ 2ei	C
1	NIC	44.62077	2.04279	0.12466	0.12466	0.00279	0.00279	2.05678
2	Britam	3.82461	6.11961	0.08730	0.21196	0.02283	0.02562	0.78569
3	CFC	0.71099	0.11756	0.00216	0.21412	0.00304	0.02866	5.19924
4	EABL	-2.72223	-28.58290	-1.13238	-0.91826	0.41598	0.44464	1.06719
5	Saf	-5.18855	-4.19495	-0.13013	-1.04839	0.02508	0.46972	-1.98735
6	KQ	-6.15996	-13.91189	-3.45306	-4.50145	0.56057	1.03028	0.77708
7	Coop	-7.01792	-9.72562	-0.09788	-4.59934	0.01395	1.04423	-4.17346
8	Scan	-9.80263	10.05192	0.23835	-4.36098	0.02927	1.07350	-0.05539
9	Barclays	-11.27071	7.70985	2.15669	-2.20429	0.19135	1.26486	-1.66654
10	KCB	-11.47260	-4.40290	-0.50097	-2.70526	0.04367	1.30852	0.18923

11	Centum	-12.92343	-2.87921	-0.04584	-2.75110	0.00355	1.31207	-2.00827
12	Equity	-14.82081	-0.70916	-0.00944	-2.76054	0.00064	1.31271	0.00349
13	KENGEN	-17.03537	-15.50098	-0.51579	-3.27633	0.03028	1.34299	-2.33890
14	KPLC	-26.13343	-4.24593	-0.14233	-3.41866	0.00545	1.34843	0.04235
15	NMG	-41.45956	-1.95631	-0.21752	-3.63617	0.00525	1.35368	-2.57612

Table 2..

C = Cutoff points.

The Ci as such is the benchmark since the cumulative ratios after it are lower than it. This means that the securities coming after it do not meet the predetermined standards for consideration as a component of the optimal portfolio. Moreover, it can be noted that securities whose excess return is greater than its specific cut-off point are desirable securities. These securities are the ones adapted for the construction of the optimal portfolio.

Proportion of securities to be included in the optimal portfolio

Table 3*:* Proportion of securities to be included in the optimal portfolio for the first period

	Securities	**βi^2/σ 2ei**	**[(Ri-Rf)/βi]-C**	**Zi**	**ΣZi**	**Xi**
1	NIC Bank	0.00279	42.56399	0.11891	0.11891	0.63158
2	Britam	0.02283	3.03892	0.06937	0.18828	0.36842

Portfolio Return

Table 4: Table showing optimal portfolio Return

S. No.	**Company**	**Xi**	**Ri**	**Xi*Ri**
1.	NIC Bank	0.63158	-0.50048	-0.31609
2.	Britam	0.36842	4.20892	1.55064
			∑	1.23455

Portfolio Beta

Portfolio beta represents the risk attribute of the portfolio. It relates the performance of the optimal portfolio to the changing market factors. By creating a portfolio, the aim is to combine securities with different reactions to the market in order to minimize risk. This involves combining the volatile and less volatile stocks in order to reap maximum returns at a given level of risk or to yield the lowest level risk at a given rate of return.

Table 5: Portfolio beta for the first period

S. No.	Company	Xi	Xi2	βi	Xi.βi
1	NIC Bank	0.631582	0.398896	-0.213965	-0.135137
2	Britam	0.368418	0.135732	-1.264935	-0.466024
				B_p	-0.601161

Optimal portfolio construction under period 2

Table 6: Table showing the Excess Returns and Ranking during the Second period

Security	Mean Return	Beta Values	Excess Return	Ranking
Safaricom Ltd	1.07543	0.22217	-35.13228	14
Co-operative Bank	0.73340	0.13822	-58.94613	15
Britam	8.26919	4.44985	-0.13745	5
KCB Group Ltd	1.19481	1.05765	-7.26705	8
EABL	0.28163	-0.22299	38.56252	1
KQ	-5..68356	-0.69485	20.96047	2
Barclays Bank	-0.77311	0.42027	-22.97062	12
CFC Stanbic	-1.38080	-0.57971	17.70129	3
Kengen	1.04852	-0.56582	13.84237	4
Equity	1.91884	2.42248	-2.87390	7
KPLC	2.13164	0.41308	-16.34074	11
KenolKobil	-0.16483	0.79871	-11.32525	9
CIC	-0.99567	0.86275	-11.44768	10
Kenya-Re	-1.03108	0.35094	-28.24379	13
Centum	7.92405	5.17628	-0.18484	6

Cut-off point under period 2

Table 7: Table Showing the Cut-Off point for the second period

	Securities	Ri-Rf/Bi	(Ri-Rf)*βi	(Ri-Rf) βi/σ 2ei	Σ(Ri-Rf)βi/σ 2ei	βi2/σ 2ei	Σ βi2/σ 2ei	C
1	EABL	38.56252	1.91756	0.04979	0.04979	0.00129	0.00129	0.91639
2	KQ	20.96047	10.12005	0.13018	0.17997	0.00621	0.00750	2.97270
3	CFC Stanbic	17.70129	5.94876	1.70117	1.88113	0.09610	0.10361	12.00901
4	KENGEN	13.84237	4.43167	0.02203	**1.90316**	0.00159	0.10520	12.02745
5	Britam	-0.13745	-2.72163	-0.01968	1.88348	0.14321	0.24841	6.24806

6	Centum	-0.18484	-4.95247	-0.13836	1.74512	0.74855	0.99697	1.66201	Table 7.
7	Equity Bank	-2.87390	-16.86520	-0.46587	1.27925	0.16210	1.15907	1.05539	
8	KCB	-7.26705	-8.12910	-0.73851	0.54074	0.10162	1.26069	0.41160	
9	KenolKobil	-11.32525	-7.22488	-0.16156	0.37918	0.01427	1.27496	0.28553	
10	CIC	-11.44768	-8.52093	-0.07508	0.30410	0.00656	1.28152	0.22787	
11	KPLC	-16.34074	-2.78759	-0.04059	0.26351	0.00248	1.28400	0.19708	
12	Barclays Bank	-22.97062	-4.05728	-2.25848	-1.99498	0.09832	1.38232	-1.38988	
13	Kenya-Re	-28.24379	-3.47848	-0.11888	-2.11385	0.00421	1.38653	-1.46839	
14	Safaricom	-35.13228	-1.73413	-0.03914	-2.15300	0.00111	1.38764	-1.49443	
15	Co-operative Bank	-58.94613	-1.12612	-0.02067	-2.17367	0.00035	1.38800	-1.50841	

C = Cut-off points.

Proportion of securities to be included in the optimal portfolio

Table 8: Proportion of securities to be included in the optimal portfolio for the second period

	Securities	**βi/σ 2ei**	**[(Ri-Rf)/βi]-C**	**Zi**	**ΣZi**	**Xi**
1	EABL	0.00129	37.64613	0.04860	0.04860	0.06843
2	KQ	0.00621	17.98777	0.11172	0.16032	0.15729
3	CFC Stanbic	0.09610	5.69227	0.54705	0.70737	0.77021
4	KENGEN	0.00159	1.81492	0.00289	0.71026	0.00407

Portfolio return

Table 9: Table showing optimal portfolio Return for the second period

S. No.	Company	Xi	Ri	Xi*Ri
1.	EABL	0.06843	0.28163	0.01927
2.	KQ	0.15729	-5.68356	-0.89397
3.	CFC Stanbic	0.77021	-1.38080	-1.06351
4.	KENGEN	0.00407	1.04852	0.00426
			∑	-1.93394

Portfolio Beta

This is a representation of the risk facing the optimal portfolio during the period under investigation.

Table 10: Portfolio beta for the second period

S. No.	Company	Xi	Xi2	βi	Xi.βi	σei2	Xi2* σei2
1.	EABL	0.06843	0.00468	-0.22299	-0.01526	38.51588	2.63564
2.	KQ	0.15729	0.02474	-0.69485	-0.10929	77.73948	12.22762
3.	CFC Stanbic	0.77021	0.59323	-0.57971	-0.44650	3.49686	2.69333
4.	KENGEN	0.00407	0.00002	-0.56582	-0.00230	201.19909	0.81808
				B_p	**-0.57335**		18.37468

Optimal portfolio construction under period 3

Table 11: Table showing the Excess Returns and Ranking during the Third period

Security	Mean Return	Beta Values	Excess Return	Ranking
Safaricom	3.10520	0.66662	-8.01467	9
Co-operative Bank	-2.63965	0.62822	-9.24569	11
BRITAM	-3.80081	1.94878	-6.28536	4
KQ	-1.36182	1.10725	-8.85957	10
CIC Group	-1.75329	1.78986	-5.69946	3
Centum	3.05272	0.84268	-6.40250	6
KENGEN	-0.13983	1.07716	-7.97260	8
CFC Stanbic	-2.46220	0.71671	-15.22255	14
KCB	1.29092	1.11935	-6.39392	5
EABL	2.28455	1.77142	-3.47937	1
Equity Bank	-0.65077	0.91528	-9.94094	12
KenolKobil	-0.27850	1.115029	-7.58629	7
KPLC	3.29103	1.20566	-4.27727	2
Kenya-Re	0.58924	0.77546	-10.13431	13
Barclays Bank	-0.50829	0.47743	-18.75927	15

Cut-off point

Table 12: Table Showing the Cut-Off point for the Third period

	Securities	Ri-Rf/Bi	(Ri-Rf)*βi	(Ri-Rf) βi/σ 2ei	Σ(Ri-Rf)βi/σ 2ei	βi2/σ 2ei	Σ βi2/σ 2ei	C
1	EABL	-3.47937	-10.91797	-0.62312	-0.62312	0.17909	0.17909	-2.66244
2	KPLC	-4.27727	-6.21749	-0.15943	-0.78256	0.03727	0.21637	-2.88429
3	CIC	-5.69946	-18.25882	-0.19854	-0.98110	0.03484	0.25120	-3.20461

Table 12...

4	Britam	-6.28536	-23.87016	-0.69219	-1.67329	0.11013	0.36133	-4.01963
5	KCB	-6.39392	-8.01123	-0.25849	-1.93178	0.04043	0.40176	-4.22980
6	Centum	-6.40250	-4.54645	-0.08758	-2.01936	0.01368	0.41544	-4.29298
7	KenolKobil	-7.58629	-10.03800	-0.21368	-2.23305	0.02817	0.44360	-4.47905
8	KENGEN	-7.97260	-9.25045	-0.85095	-3.08400	0.10673	0.55034	-5.09509
9	Safaricom	-8.01467	-3.56160	-0.09602	-3.18002	0.01198	0.56232	-5.15176
10	KQ	-8.85957	-10.86190	-0.08697	-3.26699	0.00982	0.57213	-5.20980
11	Co-operative Bank	-9.24569	-3.64888	-0.19046	-3.45744	0.02060	0.59273	-5.33816
12	Equity Bank	-9.94094	-8.32788	-0.21804	-3.67549	0.02193	0.61467	-5.48892
13	Kenya-Re	-10.13431	-6.09410	-2.50057	-6.17606	0.24674	0.86141	-6.73976
14	CFC Stanbic	-15.22255	-7.81943	-0.13398	-6.31004	0.00880	0.87021	-6.82046
15	Barclays Bank	-18.75927	-4.27599	-0.35564	-6.66567	0.01896	0.88917	-7.06019

C = Cut-off points.

Optimal portfolio construction under period 4

Table 13: Table showing the Excess Returns and Ranking during the fourth period

Security	**Mean Return**	**Beta Values**	**Excess Return**	**Ranking**
Safaricom	0.80205	1.11445	-10.90766	7
Co-operative Bank	-2.84166	1.12601	-14.03164	10
BRITAM	-5.65983	0.79389	-23.45152	13
ARM	-8.86038	1.78678	-12.21104	9
CIC Group	-3.47601	0.51565	-31.87037	14
Centum	-5.76296	0.86364	-21.67692	12
KENGEN	-4.06419	-1.34062	12.69736	2
CFC Stanbic	-3.40304	0.04914	-332.92580	15
KCB	-5.41563	0.902010	-19.96922	11
EABL	-1.90280	1.55757	-9.54105	5
Equity Bank	-2.40229	1.16434	-13.19234	8
KenolKobil	0.08432	-1.14268	11.26633	4
KPLC	-4.48987	1.52397	11.44899	3
Kenya-Re	3.52458	-0.06277	150.29552	1
Barclays Bank	2.22267	1.59092	-9.54213	6

Cut-off point

Table 14: Table Showing the Cut-Off point for the fourth period

	Securities	Ri-Rf/Bi	(Ri-Rf)*βi	(Ri-Rf) βi/σ 2ei	Σ(Ri-Rf)βi/σ 2ei	βi2/σ 2ei	Σ βi2/σ 2ei	C
1	Kenya-Re	150.29552	0.59211	0.07031	2.61880	0.00047	0.21932	9.35679
2	KENGEN	12.69736	22.82034	0.54969	0.54969	0.04329	0.04329	5.29296
3	KPLC	11.44899	26.59023	1.30749	1.85717	0.11420	0.15749	8.51706
4	KenolKobil	11.26633	14.71054	0.69131	**2.54849**	0.06136	0.21885	9.12081
5	EABL	-9.54105	-23.14693	-0.60723	2.01157	0.06364	0.28296	5.85567
6	Barclays Bank	-9.54213	-24.15136	-0.77235	1.23923	0.08094	0.36391	2.91949
7	Safaricom	-10.90766	-13.54730	-0.95357	0.28565	0.08742	0.45133	0.55804
8	Equity Bank	-13.19234	-17.88473	-0.56892	-0.28326	0.04312	0.49445	-0.51037
9	ARM Cement	-12.21104	-38.98485	-0.40319	-0.68645	0.03302	0.52747	-11.33490
10	Co-operative Bank	-14.03164	-17.79066	-2.21718	-2.90363	0.15801	0.68548	-3.89204
11	KCB	-19.96922	-16.90569	-0.65705	-3.56069	0.03290	0.71839	-4.57115
12	Centum	-21.67692	-16.16824	-1.01136	-4.57205	0.04666	0.76504	-5.53782
13	Britam	-23.45152	-14.78058	-0.20395	-4.77600	0.00870	0.77374	-5.72455
14	CIC	-31.87037	-8.47432	-0.19762	-4.97362	0.00620	0.77994	-5.91745
15	CFC	-332.92580	-0.80404	-0.03741	-5.01103	0.00011	0.78005	-5.96115

C = Cut-off points

Proportion of securities to be included in the optimal portfolio

Table 15: Proportion of securities to be included in the optimal portfolio for the fourth period

	Securities	βi/σ 2ei	[(Ri-Rf)/βi]-C	Zi	ΣZi	Xi
1	Kenya-Re	0.00047	140.93873	0.06594	0.06594	0.07730
2	KENGEN	0.04329	7.40441	0.32055	0.38648	0.37580
3	KPLC	0.11420	2.93193	0.33483	0.72131	0.39255
4	KenolKobil	0.06136	2.14552	0.13165	0.85296	0.15435

Portfolio return

Table 16: Table showing optimal portfolio Return for the fourth period

S. No.	Company	Xi	Ri	Xi*Ri
1.	Kenya-Re	0.07730	3.52458	0.27246
2.	KENGEN	0.37580	-4.06419	-1.52734
3.	KPLC	0.39255	-4.48987	-1.76249
4.	KenolKobil	0.15435	0.08432	0.01301
			∑	**-3.00436**

Portfolio Beta

This represents the risk associated to the optimal portfolio created during the period.

Table 17: Portfolio beta for the second period

S. No.	**Company**	**Xi**	**Xi2**	**βi**	**Xi.βi**
1.	Kenya Re	0.07730	0.00598	-0.06277	-0.00485
2.	KENGEN	0.37580	0.14123	-1.34062	-0.50381
3.	KPLC	0.39255	0.15409	-1.52397	-0.59823
4.	KenolKobil	0.15435	0.02382	-1.14268	-0.17637
				B_p	**-1.28326**

CONCLUSIONS

The process of constructing an optimal portfolio for both individuals and large investment institutions is a challenge. However, the Sharpe's Single Index Model as applied in this study is a simplified model that can assist to ensure for a rational and optimal decision making while investing in the securities market. Using the SIM, optimal portfolio construction is simplified and it specifies the number and actual securities that are to be considered in making up the optimal portfolio. The challenge facing investors with respect to the difficulty faced when deciding on the proportions attributable to each security for making an investment is catered for when applying the model. As per the study, it also shows that investors can use portfolio construction in either maximizing on returns or mitigating against risk. However, for an investor to make the best decision, all factors that influence security prices should be taken into consideration so as to best analyze all possible scenarios. By using SIM in constructing an optimal portfolio investors are able to create a good portfolio that would satisfy their investment needs. From the study, there is an inverse relationship between portfolio return and Portfolio risk towards performance

of large Cap stocks in the Nairobi Securities. However there is a positive relationship between Security weights and performance of Large Cap Stocks in the NSE.

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