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EFFECTIVENESS OF DIVERSIFICATION AND FUND ALLOCATION OF SHARIAH COMPLIANT EQUITY PORTFOLIOS

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Abstract: *Shariah compliant equity portfolios grow very fast in mutual fund industry in Malaysia. These portfolios complement the conventional portfolios in providing variety to the common investors and devout Muslims an alternate investment to avoid conventional investments. Performance evaluation of these Shariah compliant portfolios is very important to boostconfidence and hastenthe growth of these funds. Diversification and allocation of funds are important parameters in determining the portfolio's risk. Markowitz variance covariance model is usually applied to assess the portfolio Sharpe Ratio by allocating funds heuristically by fund managers. In this article, apart from the heuristic method we applied seven other methods for allocating funds among the shares which are included in real Islamic portfolios to find whether any mathematical model or method consistently show stable portfolio Sharpe Ratio. We have chosen four Islamic equity funds which have different life span and different size in terms of Ringgit and also in terms of number of shares included in the portfolio and applied eight methods of allotment of funds. The results are inconclusive due to two main assumptions. Ignoring portfolio turnover and constant standard deviations which we apply in estimating the Sharpe Ratio are the main reasons for the inconclusive results.*

Keywords: *Diversification, Eigen Value, Eigen Vector, Heuristic, Islamic Equity Portfolio, Markowitz, Shariah, Sharpe Ratio.*

INTRODUCTION

Islamic finance is spreading across the globe at an astonishing speed and registered impressive growth rates even in non-Islamic countries like Japan, China and UK in the recent past (Ainley *et. al.*, 2007; Zamir and Tsubota, 2009). The growth started in Sukuk (Islamic bonds) (Engku, 2009; Kamil, 2008) first and slowly but steadily encompassing other areas of finance like equity, mutual funds and

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derivative products like swaps and asset backed securities recently (Ghani, 2009). Shariah compliant equivalent investment financial products are designed by Muslim scholars matching the Islamic principles with financial products' attributes in all the segments of finance, fulfilling personal, corporate and government requirements. These Islamic financial products not only enhance liquidity and confidence among Muslim investors but also they complement and create a healthy competitive environment for the conventional products leading to an efficient capital market all over the globe (Girard and Hassan, 2008).

Investor protection is the prime aim of any country's stock exchange, where the investor should have wider choice to select financial products and matching derivative products to protect his/her investments from market risks. To augment liquidity and also to reduce the risks in financial assets governments allow mutual funds to issue units to the public. Conventional mutual funds invest funds collected in all types of financial products without classifying the shares as halal or haram, while Islamic mutual funds restricts their investment only with the Shariah compliant shares (Nilsson, 2008). This reduces their flexibility and also to some extent they reduce the earning potential (Walkshäusl and Lobe, 2012). The interest bearing financial products, companies which deal in entertainment, alcohol, gambling and pork businesses have more income potential and their share prices are normally high in the market (Bauer, Koedijk and Otten, 2005). But Islamic finance prevents all the above companies' shares in their portfolios as they are not Shariah compliant (Leahy, 2008).

To compete with the conventional mutual funds the Shariah compliant mutual funds must construct efficient portfolios and they should give the same dividend as the conventional counterpart or they should exceed them (Samad and Hassan, 1999) not only to attract the Muslim investors but also to spread the Islamic finance efficiently all over the globe (Hussein and Omran, 2005; Moscowitz, 1972).

Conventional mutual funds evaluate individual company's shares in terms of return and standard deviation to be included in a portfolio. Then based on expectations funds are allocated to buy them. Finally the portfolio performance is evaluated either in Markowitz Model or in Capital Asset Pricing Model (CAPM). In the absence of any specific model for allocation of funds hitherto the Islamic funds also followed the same methods to design, implement and measure their portfolio performance in terms of return and risk (Abdullah, Hassan& Mohamed, 2007). The fund allocation is mostly based on the heuristic method by human judgement of future return and risk. A number of alternative methods of fund allocation exist which may result in higher return and lower risk especially in Islamic equity funds. These alternate methods are rarely tested by researchers

for their efficiency. To address this gap we propose few alternate mathematical fund allocation methods for Islamic finance to design and implement Shariah compliant equity portfolios.

With the above ideas we have organised this article into five sections. The first section introduces the research problem, section two reviews the existing literature in this area, methodology and data are explained in the third section, while the fourth section presents the results and the fifth section concludes this paper.

In recent times, investment in financial assets becomes more interesting and challenging as the human knowledge improved a lot after the arrival of softwares, algorithms, and high speed data processors. The international community especially the Islamic investors look for Shariah compliant financial assets whichprovide high return and at the same time fulfil the religious sentiments. All types of investors can benefit from sound portfoliosand confidently invest if they certainly know how to diversify their investment risk without adversely affecting the return. It also can foster economic growth, create well paid jobs by attracting household savings which would ultimately provide a good standard of living.

What are Shariah-Compliant Securities?

The Shariah Advisory Council uses three standards or benchmarks in identifying the Shariah-compliant Securities. They are 5%, 20% activity benchmarks and financial ratio benchmarks. Only the shares which match Shariah rules will be included in Shariah Compliant equity portfolios (Securities Commission Malaysia, 2004).

Business Activity Benchmarks

Based on Bursa Malaysia (2014) report, in order to be approved as a Shariah security, any company's share traded or issued in Malaysia, should have less than 5% sales revenue earned in the following activities. In other words the revenue generated from these activities should be less than 5% of total revenue or 5% profit before taxation in total profit before taxation.

5% (Sales Revenue or EBIT) Benchmarks

1. Conventional banking
2. Conventional insurance
3. Gambling

4. Liquor-liquor-related activities
5. Pork and pork-related activities
6. Non-halal food and beverages
7. Shariah non-compliant securities
8. Interest income from conventional accounts and instruments
9. Tobacco and tobacco-related activities

20% (Sales Revenue or EBIT) Benchmarks

1. Hotel and resort operations
2. Share trading
3. Stock broking business
4. Rental received from nonShariah compliant activities

Financial Ratio Benchmarks

In this benchmark, there are two core ratios. They are:

1. ***Cash over total assets:*** Here cash meanscash and cash equivalents invested in conventional financial products.
2. *Debt over total assets:* Here debt means only the interest-bearing conventional debt, any Islamic financeand sukuksare excluded.

Both of these ratios are proposed to calculate the riba' or ribabased activities. These ratios must be less than 33 percent of total assets of a company to become eligible for Shariah compliant share.

METHODOLOGY

Evaluation of each share present in portfolio is important as the results decide buy, hold and sell decisions. Portfolio turnover is an important evaluation measure which is necessary to get capital gains which mostly depend on the timing of buying and selling. Net assets value (NAV) is one of the measures to be evaluated at the beginning and theend of the year to measure growth in funds invested. This growth percentage is important to initiate rewarding or penalising the portfolio manager depending on the growth of NAV. The return and risk of each share present in a portfolio is important as these parameters decide the Sharpe Ratio as it standardises the return in terms of portfolio standard deviation.

PORTFOLIO DIVERSIFICATION

As the share prices are dynamic and ever changing the portfolio value is also dynamic. Portfolio risk assessment and management is one of the principal duties of any fund manager. The amount collected by selling units to the investing public is to be invested in right proportion in different companies' shares achieve the objectives of the specific fund (DeMiguel, Garlappi and Uppal, 2009). The amount collected cannot be invested as per the wishes of any individual or the board of directors as the regulators tightly regulate the mutual funds to avoid excessive risk takingand also to protect investors. Compliance, safety and liquidity are the key issues in deciding the investments (Bello, 2005). Keeping the above in mind the board decides to select the industries and companies in each industry in which the funds are to be invested (Garlappi, Uppal and Wang, 2007). The selected shares should be Shariah compliant for Islamic portfolios as such additional care is to be taken to select the right companies. Over diversification will bring risk down but the return also will be lower and vice versa for lesser diversification. Striking a balance between over and under diversification is yet another challenge to be met by the fund managers (Karen, Brailsford and Humphery, 2006).

FUND ALLOCATION

The fund allocation function is one of the challenging activitiesof any portfolio manager due to three reasons. Firstly it is not a onetime decision as the manager has to turn over the portfolio several times in a year to get maximum capital gains by buying lower priced and selling higher priced shares. Secondly the portfolio manager has to constantly monitor which shares are falling and raising in prices and assets the fall or rise whether it is sufficient to warrant the buying and selling. Thirdly he has to decide what amount to park in a particular company's share to maximise the portfolio Sharpe Ratio.

The fund allocationand turnover decisions are challenging as there is no fixed formula or strategy to execute them. It is a continuous process which involves identification ofpotential shares assessment of return, risk and action. This article attempts several strategies of fund allocation at the beginning of the year given the Shariah compliant shares and ignores the portfolio turnover during the year, assuming that portfolio manager is in hibernation. This assumption can be relaxed in later studies to improve the modelling and results.

Firstly the heuristic method of fund allocation by a portfolio manager is retained for finding the weights. Here weight means the proportion of funds invested in a company's share. Secondly, if the average share return is high for consecutive two years then it will get higher allocation than the share which is not. The average returns computed from the share prices of 2012 and 2013 are

considered and theiraverage is taken as the basis. Thirdly, if 2012 average returns are high and if the 2013 average returns are less, then the allocation will be lower. This is based on the trend assumption. If thedecreasing trend continues the share will not perform better in 2014. Hence to determine the weight, 2012 returns are subtracted from 2013 returns and average is taken in computing weights. In the above method some shares show minus average return. While determining weight the minus and the plus returns cannot be added, just like any ordinary weight determination algorithm, as the minus and plus returns reduce the total and in finding proportion this reduced total will not help. To overcome this problem the returns are squared after adding one, $(1+r)^2$,which will not only eliminate the minus sign, but also in allocating more funds to positive return shares than the negative return shares.

In statistics the first moment is the mean, the second is the standard deviation, the third is the skewness and the fourth moment is the kurtosis. Most of the previous research studies stop with the second moment and largely ignore the third and fourth moments in allocating funds (Hansen, 1982). These moments generate useful information about the frequencies of returns generated by the shares in directions and peakedness (spread and convergence near mean). The variance (up and down), directions (right and left) and peakedness (peak and flat) are considered for determining weights, in the fourth, fifth and sixth methods.

The Eigen values and Eigen vectors play a central role in principal component analysis. Eigen value identifies the natural frequencies and the principal orthogonal orientation of any data and gives a vector of values (Eigen vector) which are critical in shaping or determining the significance of those involved in the data set. With the same analogy the covariance matrix of share returns considered as input and the resultant Eigen values and Eigen vectors are used to allocate the funds among shares.

Both the highest and the lowest Eigen valuesproduce Eigen vectors with extreme values and results in distorted fund allocation among the shares. This was observed while testingthe MATLAB algorithm with the data. Hence in this article the second dominantEigen vector and the second weakest Eigen vector are used to allocate funds. This is to avoid the extreme values in both the directions.

Portfolio Return and Risk (Markowitz Variance-Covariance Framework)

Computing portfolio return is straightforward.It is the linear combination of returns of selected individual shares and the proportion of funds invested in each share. The computation of risk is complex in Markowitz model as the number of shares increase in portfolio the number of correlations increasesin ${}_nC_r$ combinations of two. For each correlation, a line of calculation is needed and it becomes tedious and cumbersome when the shares exceed 20 (Ledoit and Wolf,

2003). This is the prime reason for the restricted application of Markowitz model. But after the arrival of software programs Markowitz portfolio model gained popularity.The return and risk of individual shares are computed as follows.

GEOMETRIC RETURN

The share prices are non-stationary and therefore they are to be de-trended before any analysis could be done. Normally first differences will make the data stationery. The share prices are to be differentiated in geometrical term as the share returns follow geometrical Brownian motion. The daily share geometrical return could be computed as follows.

$$r_{i,j} = Ln\left(\frac{P_{1i}}{P_{0i}}\right) \tag{1}$$

i = (1, ... m) number of days approximately 256 days (rows)

j = (1, ... n) number of companies included in a portfolio (columns)

Ln = natural logarithm to compute continuously compounded rate of return

r = compounded return

p_1 = current price of a share

The share returns will produce a matrix of returns as follows. First row will be the base numbers for all shares. Hence the first row returns will not be available

$$R_{i-1,j} = \begin{bmatrix} r_{2,1} & \cdots & r_{2,n} \\ \vdots & \ddots & \vdots \\ r_{m,1} & \cdots & r_{m,n} \end{bmatrix} \tag{2}$$

$R_{i,j}$ = Return matrix of shares included in the portfolio

Out of 256 share prices only 255 returns could be computed as one degree of freedom will be lost. The daily average of geometrical returns will produce a row vector of returns as follows.

$$\overline{R} = [\overline{r}_1 ... \overline{r}_n] \tag{3}$$

$\overline{r}$ = average return of each share

Risk is measured in terms of standard deviation of share returns. The square root of variance is standard deviation, which is computed as follows.

$$\sigma_{i,i}^2 = \frac{\sum (X_i - \overline{X}_l)^2}{n-1} \tag{4}$$

σ^2 = variance of each share return

$$\sigma = \sqrt{\frac{\sum (X_i - \bar{X}_l)^2}{n-1}} \tag{5}$$

σ = standard deviation of each share return

The covariance is the joint variance produced by any pair of share returns. Markowitz model plays a central role in bringing this covariance in estimating the portfolio variance. In investment management the contribution of covariance is central as the portfolio risk may go up or come down depending on the size and direction of covariance. This is a well researched area in general finance and investments but in Islamic finance this covariance application is emerging slowly.

$$\sigma_{i,j}^2 = \frac{[(X_i - \bar{X}_l)(X_j - \bar{X}_j)]}{(n-1)} \tag{6}$$

$\sigma_{i,j}^2$ = covariance of each share return

The covariance matrix given below is a semi definite matrix meaning that the upper triangle results will be exactly equal to lower triangle results. This covariance matrix has nice properties to compute Eigen value and Eigen vectors which is important in principal component analysis and in factor analysis.

$$C = \begin{bmatrix} \sigma_{11}^2 & \cdots & \sigma_{1n}^2 \\ \vdots & \sigma_{ii}^2 & \vdots \\ \sigma_{n1}^2 & \cdots & \sigma_{nn}^2 \end{bmatrix} \tag{7}$$

C = Covariance of returns matrix

When this covariance matrix is standardised with pairs of standard deviations they produce correlations which is also a semi definite matrix.

$$\rho = \begin{bmatrix} 1 & \cdots & \rho_{1n} \\ \vdots & 1 & \vdots \\ \rho_{n1} & \cdots & 1 \end{bmatrix} \tag{8}$$

ρ = Correlation matrix

EIGEN VALUE AND VECTOR

The Eigen values are the natural frequencies whereas the Eigen vectors are the orthogonal (independent values) derived by an iterative procedure and could be compared with the principal component structures. These Eigen vector values give the importance of each share to be included in a portfolio which could

easily be transformed into the proportion of funds to be invested while constructing a portfolio. We select Shariah compliant shares by judgemental sampling and measure their returns' natural frequency by Eigen value. The Eigen values produce another vector of numbers equal to shares present in a portfolio which is known as Eigen vector. For each Eigen value there is one Eigen vector. These Eigen value and vector are twins, computed from the covariance matrix, will always go hand in hand. Their computation and relationships are as follows.

$$C = \begin{bmatrix} \sigma_{11}^2 & \cdots & \sigma_{1n}^2 \\ \vdots & \sigma_{ii}^2 & \vdots \\ \sigma_{n1}^2 & \cdots & \sigma_{nn}^2 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ \vdots \\ x_n \end{bmatrix} = \lambda \begin{bmatrix} x_1 \\ x_2 \\ \vdots \\ x_n \end{bmatrix} \tag{9}$$

where

λ = Eigen values

$\begin{bmatrix} x_1 \\ x_2 \\ \vdots \\ x_n \end{bmatrix}$ = Eigen Vectors

The compact mathematical equation for Eigen value and Eigen vector is as follows. It is also known as characteristic equation of A.

$$(A - \lambda I)X = 0 \tag{10}$$

where

A = Covariance matrix

I = Identity Matrix

PORTFOLIO RETURN

Markowitz return in portfolio context is computed as follows. Allocation of funds among the shares selected is the only activity a manager can control. As per investor's wishes he/she can allocate any proportion of the fund in his/herpossession to a company's share. This proportion of funds invested in each company's share is the weight. The weights will form a row vector which if added should be equal to one.

$$W = [w_1 \ldots w_n] \tag{11}$$

$$\sum_{j=1}^{n} w = 1 \tag{12}$$

The portfolio return is the linear combination of weights and returns of individual shares. The capital gains earned due to buy and sell of shares is omitted here as it is assumed that the portfolio turnover is absent.

Portfolio Return

$$P_r = \langle \overline{r}, W \rangle = \overline{r}^T W = \sum_{j=1}^{n} \overline{r}_j * w_j \tag{13}$$

PORTFOLIO RISK

Portfolio risk is the other side of the portfolio evaluation. The objective is to maximise the return and minimise the risk. This twin but diagonally opposite objectives are to be balanced and optimised (Brown, 1979) to get higher return at a lower risk which is evaluated by Sharpe Ratio (Dowd, 2000; Kan and Zhou, 2007). The risk computation process is given below with covariance instead of correlation. In a way both covariances and correlations are similar. The covariances are to be reduced by weights in two ways, one for within and other for between shares. Hence two weight matrices are generated to form the row and column vector weights.

$$W_r = \begin{bmatrix} w_1 & w_2 \cdots & w_n \\ \vdots & \vdots & \vdots \\ w_1 & w_2 \cdots & w_n \end{bmatrix} \tag{14}$$

W_r = row vector weights.

$$W_c = \begin{bmatrix} w_1 & w_1 \cdots & w_1 \\ \vdots & \vdots & \vdots \\ w_n & w_n \cdots & w_n \end{bmatrix} \tag{15}$$

w_c = column vector weights.

The total variance of a portfolio could be computed by multiplying the covariance matrix C by the two weight matrices and adding $n - 2$ variances with it. The process is given in equation 13. The dots before multiplication indicate the dot product of matrix algebra.

Finally if square root is taken to the total variance, the standard deviation could be arrived for a portfolio.

$$TV_p = \sum C \cdot * W_1 \cdot * W_2 + (n-2) * \begin{bmatrix} \sigma_{11}^2 & \cdots & 0 \\ \vdots & \sigma_{ii}^2 & \vdots \\ 0 & \cdots & \sigma_{nn}^2 \end{bmatrix} \tag{16}$$

$$P_{\sigma} = \sqrt{TV_p} \tag{17}$$

The same risk could be computed through correlation also as follows.

Portfolio Risk by correlation

$$P_{\sigma} = \sqrt{\sigma_i^2 w_i^2 + \sigma_j^2 w_j^2 + 2\rho_{i,j}\sigma_i\sigma_j w_i w_j} \tag{18}$$

where

R_i = Return of each security

var = Variance of share returns

n = Number of shares in portfolio

$cov_{i,j}$ = Covariance between share returns

$r_{i,j}$ = Correlation coefficient between pair of share returns

w_i = Weight (Investment amount in each share)

P_r = Portfolio Return

P_{σ} = Portfolio Standard Deviation

Sharpe Ratio

Finally in the portfolio evaluation process the Sharpe Ratio (SR) is computed. This ratio is used to calculate the return per unit of risk for the shares as well as the portfolio.

$$SR = \frac{P_r}{P_{\sigma}} \tag{19}$$

where

P_r = Portfolio Return

P_{σ} = Portfolio Risk

For a fund manager the challenging activity is the fund allocation to maximise portfolio SR at any point of time. Normally there is no systematic method and managers apply heuristic method to apportion the funds among shares without violating the regulatory constraints imposed by various agencies. As discussed earlier we allocate the funds among the shares included in a Shariah compliant equity portfolio and compare the resultant Sharpe ratio to identify any method which is consistently appearing superior to the managers' heuristic method.

SAMPLING AND DATA

To assess the effectiveness of the funds allocated among the Shariah compliant shares we selected four real Shariah compliant portfolios, Aberdeen, Amanaraya, AmIttikal and Kenanga from fund supermart.com. The profiles of these four portfolios are given in table 1 below.

Table 1
Profiles of Portfolios Chosen

	Inception	*Size in RM (m)*	*Invested in Companies*	*Year ending*	*Current NAV RM*	*Units (million)*	*PTO Ratio*	*Mgt Exp ratio %*
Aberdeen	2013	8.50	20	June	1.2395	2.80	0.60	NA
Amanaraya	2009	26.00	30	June	0.6965	34.50	0.52	0.84
AmIttikal	1992	236.00	36	Sept	0.7089	325.48	0.62	2.61
Kenanga	2004	8.60	51	Feb	0.4612	18.67	0.12	1.11

NAV = Net Asset Value; PTO = Portfolio Turnover Ratio; Mgt Exp = Management Expense

AmIttikal fund is in existence for the last 23 years, followed by Kenanga (11 years) and Amanaraya (6 years). The Aberdeen is the youngest fund existing only for two years. In size of investment also AmIttikal stands first with RM 236 million. Amanararya is with RM 26 million and the other two funds Kenanga and Aberdeen are almost equal with RM 8.6 million and RM 8.5 million respectively. Though Kenanga is a small fund it is invested in 51 companies' shares. It may be considered as well diversified or may be over diversified when compared to other funds. Although AmIttikal is the largest fund it is diversified only in 36 companies' shares. Aberdeen is the smallest of all diversified in 20 companies' shares. The year ending is not uniform for these funds. For easy computation and understanding we have taken the preceding 24 months share price data of diversified companies and named it as 2012 and 2013 for all funds.

Current NAVs are given in RM as published without standardising. It seems Aberdeen has the highest NAV. It is due to the par value of the unit which is RM1. For other funds the par value is RM 0.50. AmIttikal has the highest NAV of RM 0.7089 and the lowest NAV is for Kenanga (0.4612). The units in circulation, is another indicator of the size of the portfolio. AmIttikal has the largest number of units in circulation with 325.48 million followed by Amanaraya with 34.5 million. Though Aberdeen and Kenanga are equal in size of RM the units are far less for Aberdeen as the unit par value is half when compared with Kenanga. The portfolio turnover ratio indicates the speed at which the shares are sold and reinvested in the portfolio. If the ratio is high the manager is active in selling and reinvesting the shares present in the portfolio frequently. Except for Kenanga the other three funds show a turnover ratio of more than 0.5, while

Kenanga shows only 0.12. It could be interpreted other way also. The slow turnover may be attributed to the cautious move whereby only strong moves which bring substantial capital gains only are attempted.

The small moves if attempted the profit margin will be thin which would be insufficient to offset the transaction costs and hence not worth the transaction. Management expense ratio percentage is another indicator which shows how much is the agency cost. AmIttikal and Kenanga are in existent for long and their expenses are relatively higher when compared to Amanaraya. For Aberdeen the data is not available.

RESULTS AND DISCUSSION

With the above methodology and data, four real Shariah compliant equity portfolios are subjected to the eight methods of fund allocation and their return, risk and Sharpe ratio are computed. The results are given below.

Table 2
Aberdeen Portfolio's Return, Risk and Sharpe ratio at different allocations

Allocation Method	*Return*	*Risk*	*SR*
Heuristic	0.13	0.21	0.59
Consistently Up	0.20	0.35	0.56
Consistently Down	–0.06	0.26	–0.23
Standard Deviation	0.18	0.41	0.45
Skewness	0.29	1.71	0.17
Kurtosis	0.19	0.66	0.28
Dominant Eigen vector	0.11	0.30	0.36
Weak Eigen vector	0.01	0.28	0.05

Table 2 above gives the return, risk and SRs of Aberdeen portfolio which is the youngest of all. Funds are allocated by applyingeight fund allocation methods to identify which allocation method maximises the SR. The Sharpe Ratio optimises the two objectives of portfolio management of maximising the return and minimising the risk simultaneously. When return is divided by risk the SR emerges which shows the return earned per unit of risk. The heuristic method, though earns a lesser return of 13%, the risk is also less with 21%. In terms of SR this method is superior to all the other methods as it shows RM 0.59 per unit of risk. Consistently down method shows a negative return of 6% and ends up in negative SR of RM 0.23. The skewness, consistently up and kurtosis methods produce high returns of 29%, 20% and 19% and also they show higher risks of 1.71, 0.35 and 0.66 respectively. The higher return and higher risk combination bring down their corresponding SRs thus they are lesser attractive.

Table 3
Amanaraya Portfolio's Return, Risk and Sharpe Ratio at different allocations

Allocation Method	*Return*	*Risk*	*SR*
Heuristic	0.23	2.37	0.09
Consistently Up	0.34	0.57	0.60
Consistently Down	–0.09	1.93	–0.05
Standard Deviation	0.32	2.35	0.14
Skewness	0.49	1.33	0.37
Kurtosis	0.23	1.16	0.20
Dominant Eigen vector	0.51	2.19	0.23
Weak Eigen vector	0.11	0.53	0.21

Amanaraya's return, risk and SRs are given above in table 3. Dominant Eigen vector allocation method produces a return of 51% with a risk of 219%. In terms of SR it falls to RM 0.23, which means for every unit of risk under this method the portfolio earns only 23 cents. The skewness method of allocation in this portfolio produces the second highest return of 49% and again because of higher risk of 133%, it goes to second place with a SR of RM 0.37. The consistently up method though produces the third highest return, it becomes first in terms of SR because of return of 34% and moderate risk of 57%, thus ending up in a good SRof RM 0.60, standing first in rank. In this portfolio also the consistently down method of allocation produces negative return like Aberdeen portfolio. The skewness method of allocation in both portfolios produce high return, but due to higher risk they lose the chance of superiority.

Table 4
AmIttikal Portfolio's Return, Risk and Sharpe Ratio at different allocations

Allocation Method	*Return*	*Risk*	*SR*
Heuristic	0.28	1.45	0.19
Consistently Up	–0.48	39.74	–0.01
Consistently Down	1.45	41.15	0.04
Standard Deviation	0.49	2.26	0.22
Skewness	0.17	3.74	0.05
Kurtosis	0.37	0.87	0.42
Dominant Eigen vector	0.72	4.11	0.18
Weak Eigen vector	0.23	0.37	0.61

The results of AmIttikal portfolio are given above in table 4. The portfolio returns are displayed in second column, followed by portfolio risk and portfolio SR in third and fourth columns respectively. The consistently down method produces 145% return but the risk is also abnormally high at 4115%. These two larger numbers reduce the SR to a negligible level of RM 0.04. The second highest

return is produced by the dominant Eigen vector 0.72 and again due to higher risk of 4.11 the SR reduces to RM 0.18.Weak Eigen vector and kurtosis allotments produce higher SRs of 0.61 and 0.42 respectively, though their returns are not so high because of lower risk. Surprisingly the consistently up method produces minus return in this portfolio hence minus SR of 0.01. The portfolio standard deviations of consistently up and down methods are very abnormal and this needs further investigation of data. Extreme values in returns may arise due to stock split etc sometimes cause such high standard deviations.

Table 5
KenangaPortfolio's Return, Risk and Sharpe Ratio at different allocations

Allocation Method	*Return*	*Risk*	*SR*
Heuristic	0.12	0.25	0.47
Consistently Up	0.23	0.48	0.47
Consistently Down	–0.09	0.44	–0.21
Standard Deviation	0.29	0.45	0.66
Skewness	–0.64	14.26	–0.04
Kurtosis	0.22	0.62	0.35
Dominant Eigen vector	0.27	1.05	0.25
Weak Eigen vector	0.67	1.11	0.60

The results of Kenanga portfolio are given above in table 5. This is a well-diversified portfolio with 51companies' shares. The standard deviation based allocation produces the highest SR of 0.66 followed by weak Eigen vector allocation which produces SR of 0.60. The standard deviation allocation produces only 29% as return while the weak Eigen vector allocation produces a very high return of 67%. But due to larger portfolio risk in the later, the SR fell drastically. Consistently down and skewness method allocations produce negative returns. skewness, dominant and weak methods produce portfolio risks of more than 100%.

The above results indicate no single method is consistent in maximising the SR. This could be attributed to three basic underlying assumptions such as absence of turnover, taking historical data for computing standard deviations and returns under the assumption the stock market is perfect. These assumptions are to be relaxed to get the true status of SR maximisation.

INTER PORTFOLIO COMPARISON

After comparing the returns and risks within the portfolios the next approach is to compare the returns and risks across the portfolios. Though the results are not different a rearrangement will highlight on the sensitivity of the parameters such as return, risk and Sharpe Ratio.

Figure 1: Portfolio Returns at different allocation methods

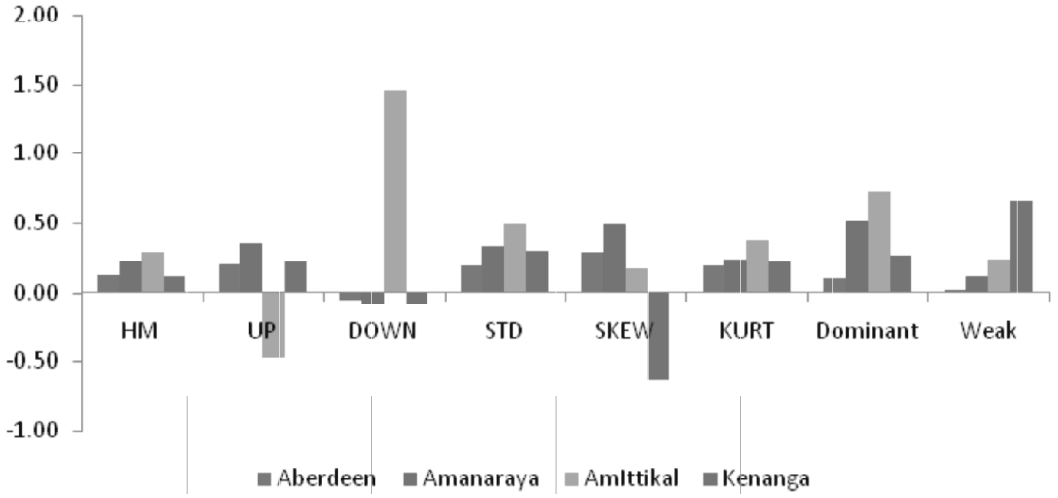

Table 6
Portfolio Returns at different allocation methods

Allocation Method	*Aberdeen*	*Amanaraya*	*AmIttikal*	*Kenanga*
Heuristic	0.13	0.23	0.28	0.12
Consistently Up	0.20	0.34	–0.48	0.23
Consistently Down	–0.06	-0.09	1.45	–0.09
Standard Deviation	0.18	0.32	0.49	0.29
Skewness	0.29	0.49	0.17	–0.64
Kurtosis	0.19	0.23	0.37	0.22
Dominant Eigen vector	0.11	0.51	0.72	0.27
Weak Eigen vector	0.01	0.11	0.23	0.67

Table 6 above exhibits the returns of various portfolios computed by assigning various weights based on eight totally unconnected independent methods. Observation of highest and lowest rates isdifficult through the numbers. The bar graph below conveys this information effectively and quickly. Anyone needs more details in minute form can refer the above table.Figure 1Portfolio Returns at different allocation methods

Figure 1 above shows the returns of the selected four portfoliosunder various methods of fund allocation. The returns are consistent in heuristic, standard deviation, kurtosis and dominant methods. With slight variation these methods of fund allocation show the portfolio returns in the positive direction. The consistently up and skewness methods of allocation estimate negative returns for AmIttikal and Kenanga portfolios. Consistently down method is the worst estimator of returns as it displays three negative returns and one very high positive return of 145%.Therefore this method is the highly undependable method. The

weak Eigen vector allocation shows a step ladder pattern of increasing returns for the four selected portfolios.

Table 7
Portfolio Risks at different allocation methods

Allocation Method	*Aberdeen*	*Amanaraya*	*AmIttikal*	*Kenanga*
Heuristic	0.21	2.37	1.45	0.25
Consistently Up	0.35	0.57	39.74	0.48
Consistently Down	0.26	1.93	41.15	0.44
Standard Deviation	0.41	2.35	2.26	0.45
Skewness	1.71	1.33	3.74	14.26
Kurtosis	0.66	1.16	0.87	0.62
Dominant Eigen vector	0.30	2.19	4.11	1.05
Weak Eigen vector	0.28	0.53	0.37	1.11

The risks in terms of standard deviationsof the selected portfolios in all types fund of allocations are given in table 7 above. These portfolio standard deviations are computed in two step process, first from returns the standard deviations of individualshares are computed. Later with covariances in pairs are combined in Markowitz framework as a single standard deviation for each portfolio under different fund allocations. AmIttikal portfolio the consistently up and down methods show very large standard deviationsof 39.74 and 41.15 respectively.

The inter portfolio standard deviations of the four portfolios are shown by the figure 2 above. The AmIttikal portfolio shows very high standard deviations in consistently up and down methods. The skewness allocation shows moderately high standard deviation for Kenanga portfolio. Even in the returns these three

Figure 2: Portfolio Risks at different allocation methods

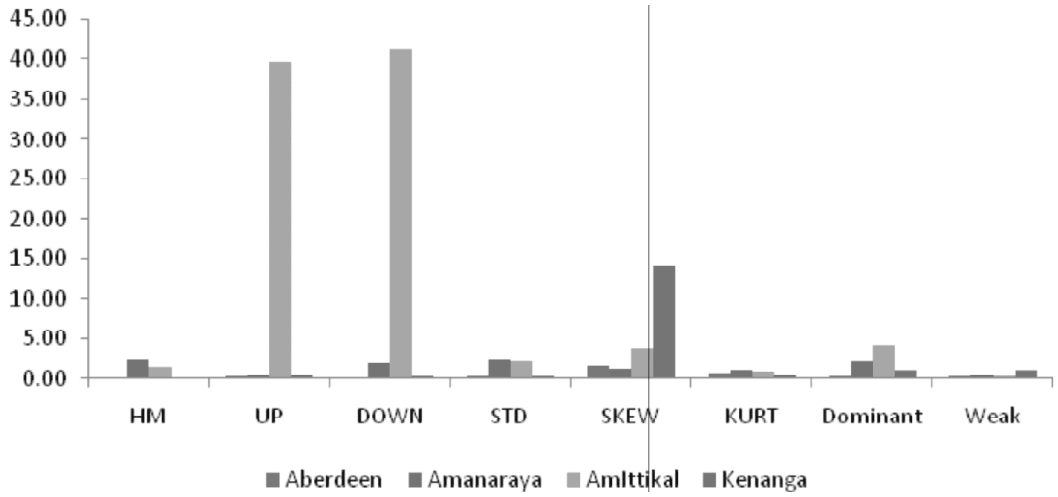

Table 8
Inter-Portfolio SRs at different allocations

Allocation Method	*Aberdeen*	*Amanaraya*	*AmIttikal*	*Kenanga*
Heuristic	0.59	0.09	0.19	0.47
Consistently Up	0.56	0.60	–0.01	0.47
Consistently Down	–0.23	–0.05	0.04	–0.21
Standard Deviation	0.45	0.14	0.22	0.66
Skewness	0.17	0.37	0.05	–0.04
Kurtosis	0.28	0.20	0.42	0.35
Dominant Eigen vector	0.36	0.23	0.18	0.25
Weak Eigen vector	0.05	0.21	0.61	0.60

methods show inconsistent returns of negative and high positive returns. Some of the shares present in these AmIttikal and Kenanga portfolios might have been sold completely in the year 2013 halfway through and reinvested in some other shares which have high volatility. These sudden changes in portfolios could cause this type of abnormal standard deviations. Another reason could be the methods them selves. The consistently up and down methods may not be suitable to capture risks.

Table 8 above shows the Sharpe ratio of different portfolios under different allocation methods. Since the return is divided by the risk to arrive SR it normalises the return for one standard deviation. If the ratio is high, the better the performance is, as it optimises both return and risk.

Figure 3: Inter-Portfolio SRs at different allocations

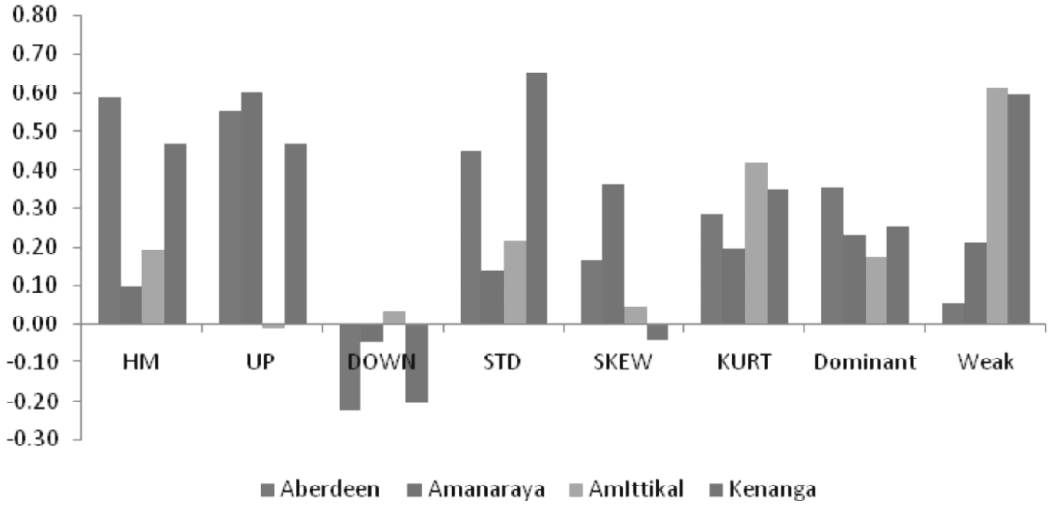

Table 8 numerical data is captured in graph form in figure 3 above.The heuristic, standard deviation, kurtosis and dominant methods show consistent results of portfolio SR while the consistently up, downand skewness methods of allocation show inconsistentSRs. The weak Eigen value method shows a step ladder pattern in SR.

The above dissimilar patterns shown by Sharpe ratios prove that the share market and share pricesfollow random walk.No stable method exists to predict the proportion of funds to be invested in a particular share to be included ina portfolio which will maximise the Sharpe ratio.

CONCLUSION

In the four selected Shariah compliant Islamic portfolios none of the eight methods of allocation of funds produce consistent higher Sharpe ratios. The results are highly inconsistent. This inconsistency yet again proves that the share market even for Shariah compliant equity shares behaves as a random variable. The chaotic movement of share prices and the resultant returns are also chaotic. No useful prediction could be made relying on the past data. The results are consistent with the efficient market hypothesis that all information available in the form of historical, current and even insider information are all already reflected in share prices. In addition, in statistical terms, the mixed results of these models are attributed to the fixed nature of standard deviation and covariances applied here. One year prices are converted to returns and the daily returns' standard deviation is computed and the same returns are used for the covariances, which is a weakness in deciding allotment of funds. To overcome this weakness either a moving window standard deviation and covariances approach orthe implied standard deviation and implied covariances method could be applied to get consistent results.

LIMITATIONS

The fund allocation methods, though take covariances among returns as the basis,still they fail to accommodate the dynamic nature of portfolio management. The fund allocation methods are to be executed at frequent intervals to assess and rebalance the portfolio but this article assumes that the portfolios are stable throughout the year. Assessing at frequent intervals will reveal the true return and risk along the path of progression. Secondly it fails to accommodate time value of money (though in Shariah Compliant portfolios they are challenged). Thirdly, all the shares present in the portfolio are treated as 'Fair Value Through Profit and Loss' accounting classification which will affect the portfolio value as there is no reserve treatment. The 'Available for sale (equity)' treatment will

show a better position as the losses are kept in a reserve account until the share is sold. The hedging instruments like the derivative contracts bought for protecting the values of portfoliosare also ignored in this study.

IMPLICATIONS

Though many limitations are pointed out above still these fund allocation methods are relevant as a starting point for the fund managers to allocate funds. In any model building approach the basic model will be developed initially and later the assumptions and limitations will be relaxed to assess the impact of these assumptions. Allocation of funds initially is very important which provides a sound basis for the later build up and growth. Initial mess-up of any event will demotivate the managers and investors. Most of the financial assets are mere papers and their value always depends upon the confidence and faith the investors pose in them. These models have a lot of information to the managers and to the investors to depend on before investing in units of mutual funds, especially in the growing area of Shariah compliant equity portfolios. As such our methods of fund allocation are useful not only to the fund managers but also to the Islamic scholars, Islamic investors, regulators and academics.

SCOPE FOR FURTHER STUDY

Taking more Shariah compliant equity portfolios these eight methods of fund allocation could be applied at every turnover date and assess the impact on Sharpe Ratio. This will highlight really which method performs well, if assessed at end of the year. Adding more portfolios and studying their SR at regular intervals, say, at every quarter will be another direction of research. Financial reporting standards classify the financial assets as fair value through profit and loss, held to maturity, available for sale and financial receivables and payables. These classifications, whether they have any impact on the overall performance, NAV and Sharpe Ratio of these Shariah compliant equity portfolios could be another research study. A number of research studies can emerge with the above ideas.

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